Arms & Explosives

A TECHNICAL AND TRADE JOURNAL.

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CONTENTS.

CURRENT TOPICS.

The Problem of the Ordnance Factories.—In connection with the present vacancy in the post of Director-General of Ordnance Factories, the *Times* has raised an important discussion as to the policy which should be adopted in future with regard to the management of these factories. Unfortunately, in a leading article on the subject, it has failed to take an unprejudiced survey of the whole question, and its views must, therefore, be regarded more in the light of special pleading than of judicial consideration. It plumps for the appointment of a military chief of ordnance factories, and treats as supporting its contentions various faults of administration which are patent to all. While we are quite in agreement as to the existence of these faults, we do not see that their remedy is necessarily to be found in the direction of appointing a military man to the position which is now vacant. It is frankly admitted that if a private firm were conducted in the manner of the Woolwich factory, even with its advantages of no capital on which to pay interest, the firm would be ruined in a very short time. Members of contracting firms, who have observed the leisurely way in which the work is carried out, fully realise these facts. The question is as to what should be the qualifications of the man placed in charge of this and other ordnance factories. The *Times* takes the line that the chief should be an engineer and a man knowing the requirements of military supplies. It seems to make no mention of any requirement in the way of business experience. Although the designs for military equipment come up for consideration by the Chief of factories, and also engineering matters connected with their manufacture, it is quite clear that there can be little time for the detailed consideration of these points by the Chief of the factories, whose days must be mainly occupied in dealing with administrative matters. It seems quite clear to us that the chief work of the head of ordnance factories must consist of the routine work of administration and organisation, and that the real decision of technical matters must rest with his subordinates, who have the necessary time and specialised knowledge to weigh and consider the numerous details concerned. No doubt these decisions would come before the Chief of the factories in the form of reports; but it is clear that this is more a matter of form than anything else, because no single man would have the time to go over the ground covered by the enquiries in such a way as to enable him to act with full knowledge of everything involved in the giving of a final decision. Let us take, for instance, the question of a new form of gun carriage. In order to arrive at a practical decision with regard to removing certain defects which may be proved in actual practice to exist in a certain type of gun carriage, a large number of experiments would require to be made in order to arrive at a modified design, overcoming these objections, and at the same time introducing no fresh difficulties. This would be the work of a small committee of practical soldiers and engineers, and the result of their work would be made known in the form of a report containing the necessary suggestions for future work. The business of the Chief of the factories would be to see that the committee of experts contained the right elements, and that their report, when issued, would be a reliable document. It would then remain for the Chief of the factories to see that the suggested

improvements were authorised at head-quarters, and put into immediate use. In the same way the Chief of one of the subsidiary factories might desire to make changes which he had satisfied himself would work to the advantage of the country. It would again be the business of the Chief of the Ordnance Factories to see that every facility was given for putting these changes into practice. The Chief of Ordnance Factories should also see that trivial matters, which might well be decided by his subordinates, should be dealt with at once, and not require to go through the hands of War Office clerks and officials, who have no concern with them, and whose action in such matters is chiefly governed by the desire to glorify their own importance, unfortunately at the expense of the taxpayer. All these considerations go to show that the chief qualification of the Director-General of Ordnance Factories should be administrative ability, of course coupled with as much practical military and engineering knowledge as is possible. Administrators do not necessarily belong to any particular class of the community, whether military or civil. The centralisation of authority, and the small opening for individual action, makes it more difficult for a good administrator in a military position to make his fame known, than would be the case with a man employed in private enterprises. This suggests that it would be easier to find a suitable man in the private ranks of life than among military men; but against this choice are two objections—one, that it would require a very strong man to overcome the passive resistance of the somewhat clannish military element, which would obstruct him in nearly everything he might try to carry through; the other difficulty is that a man of proved ability in the administration of commercial enterprises is not likely to be tempted by the price paid even for the Director-Generalship of Ordnance Factories. There are, of course, many who would value the social and other benefits of such a position, but in these commercial days such a benefit, for anything it might be worth, is not so vastly superior to a good commercial position. The problem is, therefore, one of great difficulty, and we trust that, whether the future chief be military or civil, he will have the strength of mind to deal strongly with the existing abuses. All agree that these must be removed, and the country would back up a man who offered to sacrifice his position rather than give way on a vital point involving the efficiency of the service factories.

The Carrying of Pistols.—The Howard Association has recently placed itself in communication with the Home Office suggesting a re-introduction of legislation to deal with the improper carrying of pistols, and the following reply was received:—"I am desired by Sir Matthew Ridley to acknowledge the receipt of your letter of the 7th inst., urging legislation on the subject of pistols, and to say that he has the evil of the existing state of things clearly before his mind, and agrees with his predecessors in the office of Home Secretary that some remedy is desirable, but that he is unable to make any promises as to the Government being able to take the matter up." The Home Office has evidently retained a keen remembrance of the difficulties of pistol legislation, and it apparently shirks risking another futile effort in that direction. The large number of practical difficulties in the way of effective legislation are well recognised by those who have examined the question, and the Home Office realises that it is of no use to make a pretence of dealing with the nuisance of pistol carrying by means which are palpably ineffective. The Home Office appears to have the strongest objection to give any additional powers to the police authorities, and yet it is only in this direction that anything can be done. The gun licence regulations only applies to the carrying of arms, and any suggestion to force purchasers of pistols to show a gun licence would be a useless extension of the Act, since no licence is necessary for the carrying of a pistol in one's house or curtilage; and consequently a person would be acting within the law in obtaining the services of a friend in possession of a licence to effect its purchase. The improper carrying of the pistol is the chief cause of the present nuisance, and it is only by aiming directly at those who carry pistols that anything can be done. There are practical objections to almost every form of registration and control of purchase. In the end, therefore, we are reduced to certain slight extensions of the present prohibitions, with such modifications of the penalties and their means of enforcement, as will allow for making healthy examples of those who are caught.

The late Sir William Anderson.—Sir William Anderson, K.C.B., the Director-General of Ordnance Factories, died on the 11th ult., after a year of illness. With him passes away the first of the civil chiefs of the Ordnance Department, and he was, therefore, the embodiment of the new policy of placing commercial men of technical ability in charge of the producing departments of service munitions. Sir William Anderson was a decidedly able man. He was a first-rate linguist, and throughout his life he had maintained an alert knowledge of modern engineering developments, his familiarity with languages enabling him to follow technical developments as published in foreign reports and periodicals. As an engineer his record has been one of early success and continued prosperity. As quite a young man he was partner in a Dublin firm of engineers engaged in the construction of various fittings for railways. Before the age of thirty he was made President of the Institution of Civil Engineers of Ireland. Soon after this he joined the firm of Easton & Amos, and eventually he became head of the concern, under the name of Easton & Anderson. This firm was engaged in very important engineering work, and during the period of his active connection with it, it attained a very high position in the engineering world. It is quite a question whether Dr. Anderson, by which title he was then known, did not make a mistake in severing his connection with the old firm for the purpose of accepting, in 1889, the position of Director-General of Ordnance Factories. On the one hand, he withdrew from the strife of commercial enterprise and accepted a high position under the Government, which secured him a good income and freedom from the worries of carrying on a large business; but, on the other hand, the new position was no bed of roses, and as his interest in the firm was transferred to members of his family, he was, no doubt, left with much of its cares upon his mind. The fact that the Company has not prospered since his retirement from its active management was, no doubt, a source of constant worry and anxiety. This, coupled with the responsibilities attached to his new position, meant that the last years of his life were not such as most of us would wish to live. As an administrator, Sir William Anderson has been subjected probably to more hostile criticism than any other highly placed official connected

with the War Office, though, we believe, many of these criticisms were due to a state of affairs over which he had no control. The centralization of authority, and the consequently large number of trivial matters connected with the ordnance factories which had to pass through his department, were largely the work of ambitious members of the War Office staff in Pall Mall. Promotion among such is somewhat hard to achieve, unless something can be done to draw the attention of the chiefs. The only way in which pens and ink may produce this result is by the multiplication of special reports emanating from Pall Mall; and to provide an excuse for these it is necessary that the business of the departments should be concentrated in that quarter. Dr. Anderson made the chief mistake of his War Office career when he failed to make a stand against these abuses. He attempted to be on good terms with Pall Mall, and at the same time with his subordinates, which included the chiefs of the various service factories. In this way, in failing to back up his subordinates and strengthen their authority, he failed to give them satisfaction; while, on the other hand, his methods were not sufficiently those of Pall Mall to satisfy his own chiefs in that quarter. Had he made a firm stand at the commencement, the evils, against which a fight is now being carried on, would not have existed. In saying this it is somewhat difficult to do justice to Sir William Anderson without knowing the forces against which he had to contend. It is well known that the military element at the War Office and ordnance departments is very jealous of the incursion of civilians into what it regards as its own department; and these tactics went to the extent of doing all that was possible to render civil appointments a failure by harassing the work of a civil chief wherever the opportunity occurred. This has led to a somewhat mixed condition of affairs, which we discuss elsewhere in this issue. As an engineer and a man, Sir William Anderson has always been pre-eminent for the wide range of his knowledge and the interest he has taken in the advancement of scientific enquiry into engineering practice. In this way he has occupied prominent positions in the leading engineering societies; and the papers which he has read, together with the discussion in which he has taken part, have shown him to be at home in the most advanced theory and practice of a large number of specialised subjects.

The late Mr. E. W. Findlay.—We regret to hear of the sudden death of Mr. E. W. Findlay, who has for a number of years occupied a responsible position at the Ardeer works of Nobel's Explosives Co., Ltd. As assistant-manager, charged with the erection of buildings and with the superintendence of the general engineering work on the factory, his loss will be keenly felt. The high esteem in which he was held by the staff and employees at the factory is shown by the proposal to organise a subscription to be applied to the erection of a memorial in recognition of his many good qualities.

COL. F. W. J. BARKER, R.A.—With reference to the large number of paragraphs which have recently been going the rounds of the daily press to the effect that Colonel Barker has retired from the position of Superintendent of the Birmingham Royal Small Arms Factory at Sparkbrook through having reached the age of retirement, we wish to point out that a mistake has been made. Last April Colonel Barker reached the age of retirement from the active list of the army, but this does not necessarily affect his position as Superintendent for some years to come.

SAFETY EXPLOSIVES.

The *Colliery Guardian* reproduces in a recent issue the following translation of an interesting article, which has appeared in the *Annales des Mines de Belgique*, on safety explosives and the proper use of this term as applied to practical coal-mining work. The authors of the article are M. Victor Watteyne, Ingénieur Principal, Directeur des Mines, and M. Lucien Denoel, Ingénieur au Corps des Mines.

What is a "safety explosive?" This question is very much controverted; and, indeed, no definite and irrefutable answer has yet been given to it. The reason is very simple. There are no explosives that entirely merit the appellation of "safety," and, if such an explosive existed, it might well be defined as "one that can without danger deflagrate or detonate in any quantity, whatever be the tamping used and the conditions of the explosion, in an atmosphere charged with fire-damp or coal-dust having any degree of inflammability"; but as no product satisfying all these conditions has yet been discovered, and certain theoretical considerations even lead to the belief that such an ideal cannot be realised, safety with blasting in the presence of fire-damp or coal-dust can only be comparative, and therefore difficult to define.

It would appear, however, that an explosive claiming to be a safety one may be expected to practically show itself free from danger under the usual conditions of its employment, and also any that may accidentally subvene in mine working; but, if opinions be approximately agreed in restricting the question within these limits, they are far from being so when it becomes necessary to determine whether a given explosive really does or does not afford the degree of safety thus understood.

The French adhere to the formula which they have stated once for all, after scientific investigations backed up by numerous experimental trials, and in this they have been followed by the Russians. In Germany and Austria reliance is chiefly placed, as it is in England, on the results of repeated experiments carried out by permanent official commissions. In Belgium many experiments have also been made; but they have only been carried out by manufacturers of explosives, so that they have no official character.

Considering that there is more than a speculative interest in exactly establishing the distinctive characteristics of various explosives, the authors have endeavoured in the present paper to arrive at a classification that shall have the greatest probability of being correct; and in presence of the importance of the subject and the serious difficulties it raises, especially divergencies in methods of investigation and their results, often contradictory in appearance, they have thought well to group together (in the original paper) the most interesting facts already acquired, and to draw from them the following conclusions, on which may be founded practical teachings and also a theory as correct as possible:—

From a Theoretical Point of View.—The criterion as to the greater or less degree of safety possessed by explosives in the presence of fire-damp and coal-dust consists in variation of the space of time between the delay before ignition and the complete cooling down of the explosion products. The chief influences on which depend (owing to the nature of the explosive) the extent of this variation, are the rapidity of the explosion and the temperature of detonation; but they are too

imperfectly defined, and their interdependence is too complex for permitting their limits compatible with safety to be determined with any degree of certainty. For a given explosive the measure of safety cannot but be relative, depending upon external circumstances and the weight of the detonating substance; and there exists for every explosive a limit of charge, beyond which the ignition of fire-damp or coal-dust must inevitably occur.

From a Practical Point of View.—The limit of charge constitutes the most rational standard for measuring the degree of safety possessed by various explosives; and it must be determined empirically, under conditions of danger as identical as possible with those of fiery and dusty mines. A safety explosive is characterised by a sufficiently high limit of charge, that may be compared with those required in the normal use for which the explosive is intended; and the most economical explosive is that which, in addition to a maximum of safety, possesses the greatest explosive force and shattering power, as well as that most appropriate to its destination. These conditions, not absolutely contradictory, may be realised by a suitable combination of the detonation temperature and the shattering power.

The above conclusions should be rigorously maintained if it be desired to arrive at an exact classification, and also to ascertain the comparative value of the numerous products furnished by industry under the name of "safety explosives"; but if one is content with a mere approximate separation, having no other object than dividing the explosives into two categories, according as their dangerous character appears more or less pronounced, such an end may be attained by proceeding from the numerous experimental facts and the theoretical principles deduced from them.

Anti-grisou Favier No. II., grisoutite and dahmenite A are considered by those who use them as safety explosives; and opinions are tolerably well agreed in giving this title to the various grisoutines which have in their favour the authority of the French Fire-damp Commission. As regards the classification of the other explosives, the dangerous character of which is disputed, the authors have classified them, in the absence of direct experiment, according to (1) the resemblance in their chemical composition with that of those which have formed the subject of searching tests; (2) the detonation temperature; and (3) the fact that mixtures with ammonium nitrate base are so much the less safe as the proportion is higher of the carburising or explosive substance added.

PERRANPORTH RIGHTS OF WAY.—Nobel's Explosives Co., Ltd., are at the present time experiencing some trouble with regard to the rights of way over a piece of ground which they have recently acquired for extending their factory in Cornwall. The local residents claim the right to use a path over the cliffs which passes through the land, and the dispute has been brought into Court by a prosecution for trespass. It seems to be a matter open for friendly negotiation, and even if this would entail a certain amount of sacrifice on the part of the public, such a course might be justified by the fact that the explosives company provided employment to the inhabitants of a region where factories are somewhat few and far between. It seems a pity that anything should be done to hamper the enlargement of a factory which brings money into the district, particularly as the proposed extension of output might be transferred elsewhere.

NOTES.

STRANGE DISAPPEARANCE OF AMMUNITION.—There are elements of comedy about the disappearance of some 50,000 rounds of ammunition from the Hounslow Barracks. All the circumstances make the disappearance exceptionally strange, since the store is situated at the top of a building in the Barrack Square, to which the ordinary means of entry is by three flights of narrow stairs. Altogether the theory of theft suggests so many difficulties that the disappearance may more plausibly be attributed to bungling—such, for instance, as a mistake in the store books and entries of delivery—so that the missing ammunition may never have been put into store. Should it, however, be a real case of theft, it is quite possible that someone having a market for these goods will sooner or later be offered a job lot of ·303 ammunition on the grounds that the vendor has no further use for the same, his contemplated hunting tour having been indefinitely postponed.

CANNONITE SMOKELESS POWDERS.—We understand that the directors of the War and Sporting Smokeless Powder Co., Ltd., recently had under consideration a proposal from Messrs. Curtis's & Harvey, Ltd., for the purchase of their business, and that a contract was signed subject to the confirmation of the shareholders. This arises from the fact that Messrs. John Hall & Son, Ltd., who form part of the new gunpowder trade combination under the name of Curtis's & Harvey, Ltd., have for some years had the selling rights of the Cannonite smokeless sporting and rifle powders, and that the present arrangement aims at placing the manufacture and sale of these powders upon a permanent basis. We hear that last year the sales of the coarse grain sporting powder were treble those of the previous year, so there is doubtless a very good future for Cannonite smokeless powder, and Messrs. Curtis's & Harvey are, therefore, to be congratulated on having acquired the patents of the War and Sporting Co.

BIG QUARRY BLAST.—Under the superintendence of Mr. George Farren, a monster blast took place in the quarries of the Welsh Granite Co., Ltd., at Trevor, Carnarvon, last month. The reason for this blast was that the rock was getting very high and extremely difficult to get at. There have been no blasts of this character in such quarries in Wales before. There were two large blasts recently, one at Bethesda and the other at Dinorwic Slate Quarries, for the purpose of removing a quantity of rubbish, but there have been none for the purpose of getting good rock. The calculations for this blast were made with the greatest care and forethought. The quarry is situate at 600 ft. above sea level, and the bank to be operated on was 100 ft. high. The plans of operation consisted in driving in 15 ft. above the level of the bank. This heading was 53 ft. long. Another heading 23 ft. long was driven to the left from this, and a chamber formed there. A further tunnel was driven to the right, but nearer to the mouth of the first heading; this one was 29 ft. long, and a chamber formed at the end; this was the state of things when the powder boat arrived on a Saturday. The powder was stored over the Sunday, and on the Monday the whole of it, amounting to 6¼ tons, was got into place. Immediately this was done, two high-tension fuses were placed one in

each chamber, for communicating with a cable; but a further precaution was taken of placing duplicate fuses, and another connection with the cable, in case of missfire by the first. For in the case of a total missfire there would have been nothing for it but untamping the whole of the work. No sooner was some turf placed in front of the powder than the work of tamping began. This was done with Portland cement, mortar, and large stones, and the whole made up as tight and strong as could be. This operation took up all Monday night, all Tuesday, and Tuesday night, and by eight o'clock on Wednesday morning the whole thing was ready for firing. At 2 p.m. the steam whistle sounded as usual to fire, and immediately afterwards a 400 volt battery was applied. There was very little report, and by measurement it was found that about 80,000 tons of rock was displaced, and fell on the bank exactly as prepared to receive it. A further quantity of 20,000 tons had been loosened. There is another heading on the second bank which will take a charge larger than this, but this will not be exploded till the summer weather comes on.

THE HOTCHKISS ORDNANCE CO., LTD.—The manner in which the affairs of this Company have been mismanaged during recent years, as a consequence of internal bickerings and disputes, is fast becoming a grave scandal. The shareholders' money and interests are frittered away by negotiations which in the end have no results, and are harmful to the reputation and trading prospects of the Company. The latest arrangement for reconstruction has been upset by some legal difficulty. It is a great pity that those who refuse to fall in with schemes propounded in the interests of the shareholders at large cannot be bought out on fair terms, which would leave the shareholders, who are really anxious to see the Company in a prosperous position, free to carry out a suitable scheme for reconstruction.

THE REPAUTRAP.—Under this mysterious name, which somehow suggest matters antediluvian, a new inanimate bird trap has been put upon the market in this country. The trap is known in the States under the equally mysterious title of the Magautrap, and the Cleveland Target Co. of Cleveland, Ohio, are responsible for its manufacture. The trap consists of an iron tripod working in connection with bicycle cranks and pedals. These operate a trap fixed on the stand, and set the arm of the throwing lever each time that it is released. A supply of birds is fed automatically into the trap, and in this way birds may be thrown to the number of something like eighty to the minute. This, therefore, substantiates the claim that the trap will replace five ordinary ones, and further that instead of requiring five trappers the same work may be done by a single person. The trap is fitted in a sort of sunk shed, which is more economical to construct than the more complicated trench. The working of the trap was demonstrated at the grounds of Mr. W. P. Jones, of Birmingham, and the satisfactory nature of the results lead us to anticipate that there are many cases where its special features will lead to its adoption. Of course it is somewhat early to suggest that it will replace the present system of throwing inanimate birds at clubs, as more experience will be required in order to demonstrate whether the required variation in the direction and position of the birds thrown can be obtained. In any case, however, its introduction is an interesting event in the clay-bird shooting world, and the future developments of the trap will no doubt be followed attentively.

NORMAL POWDER REPORT.—The following is the report of the Normal Powder and Ammunition Co., Ltd., as submitted to the shareholders, and signed on behalf of the Board by Mr. A. W. Franke, the Secretary:—"The directors beg to submit their report of the working and progress of the Company since its registration on the 11th March, 1897. The bulk of the business being transacted in the shooting season, your directors have considered it advisable to defer issuing this statement until some particulars as to the trading of the second year of the Company's existence could be placed before you. From the following comparative statement it will be seen that the sales of cartridges and equivalent in powder, during five months of the shooting season of 1898, are about 80 per cent. in excess of those of the same period last year:—

	July	Aug.	Sept.	Oct.	Nov.		Total.
1897..	145,000	276,500	368,935	275,510	368,225	..	1,434,215
1898..	425,000	542,015	456,410	511,920	550,710	..	2,486,055

The constantly increasing number of shareholders is also a further proof of the popularity of Normal Powder. On the 31st of March, 1897, the number of shareholders was 214; at the present date there are no less than 1,282, the majority of these being sportsmen using this powder. Your directors, having succeeded in obtaining a name for Normal Powder among English sportsmen, turned their attention to the foreign trade, and the powder is now well known in India, Ceylon and Burmah, and has been introduced in Australia, New Zealand, the Straits Settlements, China, South Africa, Canada, Italy, Morocco and Belgium. The shareholders can, therefore, rest assured that all that could be done has been done, and that a good foundation has been laid for a profitable business. The directors regret that the results up to date do not permit of a dividend. This is owing to the following unforeseen circumstances. The Company commenced by loading all ammunition at Erith, but finding this inconvenient, they decided to build a factory at Hendon, as being a more convenient locality in every respect. Meantime, early in November, 1897, while the materials were being removed, a disastrous flood occurred, and a great loss was suffered at Erith, hundreds of thousands of cartridges, cases, shot, boxes, and five tons of powder being destroyed or damaged. In consequence, work had to be started at Hendon before things were ready, thus much confusion and unsatisfactory results ensued. The heavy losses under these heads are all charged against the trading account. During the first year it has been necessary to spend very large sums on advertisements, both in the United Kingdom, India, and the Colonies, and free samples have been distributed to all enquiring sportsmen in the kingdom. As the powder is now so well known, a very considerable reduction in expenses will be made in the future, and the merits of the powder, together with the assistance of the shareholders in recommending it to their friends, will assist very materially in the future development of the business. As a further economy, the offices have been removed to 2, Bank Buildings, Cricklewood, whereby a saving of £200 in office rent is effected, and the great convenience of having the offices within a mile of the factory will enable correspondence to be curtailed, and a reduction of the staff in the offices can therefore be made. The

directors have also decided to make a considerable reduction in their salaries for the coming year, and, should it be found necessary in the future, will be prepared to forego them altogether till more prosperous times. To obviate any inconvenience to customers caused by there being no London offices, it has been arranged with the Military Equipment Stores, Ltd., 7, Waterloo Place, S.W., to be our London representatives, and to receive orders for our ammunition, supply price lists, testimonials, etc., and, in fact, to give all necessary particulars. In order that the shareholders may at the same time have the opportunity of inspecting our ammunition works, it has been decided to hold the ordinary general meeting at our new offices, and those shareholders who are willing to avail themselves of this opportunity are requested to communicate with the secretary, who will then arrange for conveyances to be ready immediately after the meeting to take them to the works. The retiring directors are the Right Hon. the Earl of Westmorland and Major-General Alex. A. A. Kinloch, C.B., who, being eligible, offer themselves for re-election."

CALIBRE OF U.S. RIFLES.—The board of officers of the United States Army, Navy, and Marine Corps, which was appointed to consider the desirability of adopting a uniform calibre for rifles and machine guns used by the different services, has reported in favour of a uniform calibre, and has recommended that of the ·300 calibre now in use in their army rifles. It will be understood that this enquiry is chiefly brought about by the fact that, while the army has adopted the above bore of ·300 of an inch, the navy uses a rifle of ·236 calibre. The conclusions of the board are given in the following terms, and they appear in the columns of our contemporary *Shooting and Fishing*:—(1.) The board is of opinion that there are no conditions in the nature of the service peculiar to the army, navy, and marine corps, which require a different calibre for their small-arms and machine guns. (2.) Since the board finds no sufficient reason for a different calibre of small-arms and machine guns for the army, navy, and marine corps, the board is of opinion that the same calibre should be adopted for these services, and since interchangeability of ammunition is the special advantage to be gained by the use of a single calibre, a standard and uniform cartridge to the extent of insuring interchangeability should be adopted. (3.) As the board is of opinion that there should be but one calibre of small-arms and machine guns for the army, navy, and marine corps, and as great numbers of satisfactory calibre ·300 rifles are now in service in the army, and are being manufactured at a considerable daily rate, after large preliminary expenditures for plant, and as under the prospective enlarged sphere of the army's action and possible increase in its numbers, it will require an immediate additional supply of such arms, the board is further of the opinion that the calibre now in use is at present imperative for the army, and therefore, under their previous conclusions, it should also be adopted for the navy and marine corps. The board, however, while recognising the desirability of a uniform calibre for both services, does not deem it of vital importance, and is of opinion that the change of navy calibre might well be postponed until it has been definitely settled whether or not it is advantageous to modify the army cartridge by the use of a cannelured instead of a rimmed case. (4.) In considering a standard cartridge the board recognises that the cannelured case is a suitable one for small-arms and machine guns, and that its use in the naval weapon of these classes has been satisfactory; it is further of opinion that it found practicable at moderate cost to adapt the present army rifle to the use of such a case, a cartridge conforming in other external form and dimensions to the present army cartridge should be adopted as the standard and uniform small-arm cartridge for the army, navy, and marine corps.

A NEW EXPLOSIVES ORDER IN COUNCIL.

THE Home Secretary issued a new Order in Council, dated the 23rd ult., which is supplementary to the one dated July 11th last, which was referred to at length in our August issue. The new Order contains a clause repealing that portion of the old dealing with Oxalate Blasting Powder, a slightly modified composition for which, viz., the addition of sulphur, is sanctioned in the new definition of this explosive. Three other explosives, viz., Argus powder, Earthquake powder, and Elephant brand gunpowder No. 2, are specified as follows:—

Argus Powder, consisting in every 100 parts by weight of the finished explosive of not more than 82 parts, and not less than 79 parts of pure saltpetre, with not more than 20 parts and not less than 17 parts of charcoal, and not more than one part and not less than ½ part of pure distilled sulphur, and with no other ingredient, the whole being thoroughly well incorporated, and to be of such strength as, when exploded in a lead cylinder as used at the Home Office Testing Station, will give a result not inferior to that obtained with an equal weight of R.F.G.² gunpowder, and to be in the form of grains of a size to pass through a sieve of 16 meshes to the linear inch, and to be retained on a sieve of 40 meshes to the linear inch.

Earthquake Powder, consisting in every 100 parts of the finished explosive of not more than 81 parts and not less than 78 parts of pure saltpetre, with not more than 22 parts and not less than 19 parts of charcoal, and with or without the addition of ⅛th per cent. of pure sulphur, and with no other ingredient, the whole being thoroughly well incorporated, and to be of such strength as, when exploded in a lead cylinder as used at the Home Office Testing Station, will give a result not inferior to that obtained with an equal weight of R.F.G.² gunpowder, and to be in the form of grains of a size to pass through a sieve of 11 meshes to the linear inch, and to be retained by a sieve of 40 meshes to the linear inch.

Elephant Brand Gunpowder, No. 2, consisting in every 100 parts by weight of the finished explosive of not more than 76 parts and not less than 74 parts of pure saltpetre, with not more than 15⅛ parts and not less than 14⅛ parts of charcoal, and not more than 11 parts and not less than 9 parts of pure distilled sulphur, and with no other ingredient, the whole to be thoroughly well incorporated, and to be of such strength as when exploded in a lead cylinder, as used at the Home Office Testing Station, will give a result not inferior to that obtained with an equal weight of R.G.F.² gunpowder, and to be in the form of grains of a size to pass through a sieve of 11 meshes to the linear inch.

MESSRS. CURTIS'S AND HARVEY, LIMITED

WE gave in our last issue a preliminary announcement relating to the formation of the above Company, stating at the same time that the prospectus would be issued about the middle of the month. It appeared in due course, and now that we are at liberty to go into greater detail, we propose to place on record a more exact account of the financial organisation of the Company.

The share capital consists of £600,000 in £1 ordinary shares, and £400,000 of first mortgage debenture stock, bearing 4½ per cent. interest. £450,000 of the ordinary shares have been taken by the vendors, and the balance provides for the future enlargement of the Company by the taking over of other companies or firms which it may be desirable to acquire. The Articles of Association provide that the aggregate amount of debenture stock shall not at any time exceed the issued share capital for the time being. The debentures are redeemable at the option of the Company on or after the 1st January, 1918, at 105, or before that date at a premium of £10 per cent. In the event of the liquidation of the Company, a similar premium will be paid according to the date of liquidation. The interest will be paid on the 1st May and 1st November of each year. The debenture stock was issued at the price of 103 per cent.

We will not repeat the list of directors and other officers of the Company which were given in our last issue. It will be seen that the total issued capital of the Company, including both classes of stock, comes to £850,000. This will be dealt with as follows:—The £450,000 of ordinary shares will be allotted to the vendors in part payment of the businesses acquired. This leaves a balance of £350,000 still due to the vendors, £800,000 having been arranged on the basis of a valuation as the purchase consideration. The above balance of £350,000 will be paid to the vendors, either in the form of cash or of debenture stock; but it has been arranged that a first call on the amount subscribed for the debenture stock shall provide a fund of £50,000, which is to be added to the cash balances and working capital already taken over as part of the businesses to be acquired.

The agreed price of £800,000, which is to be the purchase price of the companies entering into the amalgamation, is arrived at on the basis of the following valuations:—

	£	s.	d.
Land, Buildings, Fixed Plant, &c.	501,688	14	11
Stock in Trade and Book Debts, Cash in hand and at Bankers, less Liabilities ...	318,453	7	6
Total ...	£820,142	2	5

It will be seen that this valuation does not include any allowance for goodwill, and that the purchase price has been written down to the round sum of £800,000, so removing the odd sum of £20,142 2s. 5d.

Summarising the prospectus as a whole, it will be apparent that, however the payment to the vendors is arranged, £800,000 of the capital represents the purchase consideration, and that £50,000 remains with the new Company for providing additional working capital. This takes no account of the 3 per cent. premium on the debentures, which, supposing the whole will have been subscribed for by the public, would amount to a sum of £12,000. Possibly any sum available in this way will be applied to the expenses of forming the Company, and advertising the prospectus, any balance of course remaining in the hands of the new Company. The sum of £17,000 will be required to pay the interest on the debenture stock, so that any balance after making suitable provision for directors' fees, reserves, depreciation, and sundry expenses of management, will be available for dividends on the ordinary shares. Roughly we may take it that a gross profit of something over £50,000 will provide a fair return on the capital of the Company. At the moment of going to press we are informed that the above debenture issue was largely over subscribed.

THE PIEPER SEMI-AUTOMATIC PISTOL.

LAST month we were invited to attend a demonstration of a new automatic pistol which is being manufactured by the well-known gunmaking firm of Pieper, in Liége. The demonstration was held at the Haymarket premises of the Morris Tube, Ammunition, and Safety Range Co., Ltd., Major-General Wardell, Chairman of the Company, and Mr. W. C. Luff, Secretary, being present.

The various special points of the pistol were explained by M. Nicolas Pieper, who had come over from Liége for the purpose. The view held by M. Pieper's firm is that inventors of automatic pistols have been too ingenious by just about one-half, their error consisting in applying automatic action to parts which should be under the control of the shooter. As is well known, after the first shot from an automatic pistol has been fired, the mechanism is instantly re-loaded ready for the firing of the next shot, and the trigger has only to be pulled to fire another cartridge. If the shooter does not wish to fire another shot, his arm is in such a condition that it has either to be put away loaded and at full cock, or it must be put into a safe condition, either by the working of a safety bolt, or by releasing those parts which are drawn back against the compression of springs. This, we are assured by M. Pieper, has been considered a grave defect by several military commissions and experts who have exhaustively examined this type of pistol, as they consider that it would be objectionable in the excitement of action to require those armed with pistols to have to bear in mind this special source of danger to themselves and their comrades.

The present pistol has met these objections by having an ordinary double-acting hammer and trigger mechanism, combined with an automatic recoil-operated system of extracting the fired cases, and re-loading from the supply of cartridges contained in the magazine. In this way the cocking of the hammer is a voluntary act, which is performed by the user only when he actually wishes to put the pistol into firing condition. This cocking of the pistol may be effected either by pulling the trigger or by separately drawing back the hammer to full cock with the thumb. This, of course, is a system which has been known for many years in its application to revolvers; and experience has shown that in most cases the small amount of time lost by separately cocking the hammer is more than compensated for by the increased steadiness of aim, due to the shorter travel of the trigger necessary to fire

the arm; though, of course, the double-acting movement of the trigger always provides for those cases where superior rapidity of firing is of greater advantage than the maximum accuracy of aim.

It will be seen that the advantages presented by this pistol are that, while possessing the same safety in use as an ordinary double-acting revolver, the operations corresponding to the turning of the cylinder are performed automatically; and, therefore, the work of cocking the hammer is reduced to the effort represented by the turning the cylinder of of a revolver. The pistol possesses the further advantage having a continuous bore, so that the full effect of the powder within the available length of barrel is applied to the projectile without the loss occasioned in revolvers by the interruption between the cylinder and the barrel.

The pistol we examined fired a bullet corresponding in diameter to one of the Continental small-bore service rifles. The bullets were jacketted with a nickel composition, and the ammunition was, therefore, of a similar character to that of other automatic pistols. The magazine is contained inside the handle, and is filled by means of a metal clip holding the number of cartridges required for filling the magazine. So far as it was possible to test the working of the pistol, it seemed to operate with great smoothness, and there were no misfires nor failures to reload, in the twenty or thirty rounds that were tried. It was not possible to make a test of the accuracy of the pistol, but there appeared no reason from its general construction to suppose that it would be in any way defective. We shall look with interest to any future developments of this arm

SECRET PATENT SPECIFICATIONS.

It may be noticed that both in our November and our current issues patents have been taken out and specifications lodged by Col. Bainbridge, of Woolwich, but that their contents have not been published, as they have been declared secret documents. The following is the wording of Section 44 of the Patents Act, 1883, which provides for this state of affairs:—

(1.) The inventor of any improvement in instruments or munitions of war, his executors, administrators, or assigns, (who are in this section comprised in the expression the inventor) may (either for or without valuable consideration) assign to Her Majesty's Principal Secretary of State for the War Department (hereinafter referred to as the Secretary of State), on behalf of Her Majesty, all the benefit of the invention and of any patent obtained or to be obtained for the same; and the Secretary of State may be a party to the assignment.

(2). The assignment shall effectually vest the benefit of the invention and patent in the Secretary of State for the time being on behalf of Her Majesty, and all covenants and agreements therein contained for keeping the invention secret and otherwise shall be valid and effectual (notwithstanding any want of valuable consideration), and may be enforced accordingly by the Secretary of State for the time being.

(3). Where any such assignment has been made to the Secretary of State, he may at any time before the application for a patent for the invention, or before publication of the specification or specifications, certify to the comptroller his opinion that, in the interest of the public service, the particulars of the invention and of the manner in which it is to be performed should be kept secret.

(4.) If the Secretary of State so certifies, the application and specification or specifications with the drawings (if any), and any amendment of the specification or specifications, and any copies of such documents and drawings, shall, instead of being left in the ordinary manner at the Patent Office, be delivered to the comptroller in a packet sealed by authority of the Secretary of State.

(5). Such packet shall, until the expiration of the term or extended term during which a patent for the invention may be in force, be kept sealed by the comptroller, and shall not be opened save under the authority of an order of the Secretary of State, or of the law officers.

(6). Such sealed packet shall be delivered at any time during the continuance of the patent to any person authorized by writing under the hand of the Secretary of State to receive the same, and shall, if returned to the comptroller, be again kept sealed by him.

(7). On the expiration of the term or extended term of the patent, such sealed packet shall be delivered to any person authorized by writing under the hand of the Secretary of State to receive it.

(8). Where the Secretary of State certifies, as aforesaid, after an application for a patent has been left at the Patent Office, but before the publication of the specification or specifications, the application, specification or specifications, with the drawings (if any), shall be forthwith placed in a packet sealed by authority of the comptroller, and such packet shall be subject to the foregoing provisions respecting a packet sealed by authority of the Secretary of State.

(9). No proceeding by petition or otherwise shall lie for revocation of a patent granted for an invention in relation to which the Secretary of State has certified as aforesaid.

(10). No copy of any specification or other document or drawing, by this section required to be placed in a sealed packet, shall in any manner whatever be published or open to the inspection of the public, but save as in this section otherwise directed, the provisions of this part of this Act shall apply in respect of any such invention and patent as aforesaid.

(11.) The Secretary of State may, at any time by writing under his hand, waive the benefit of this section with respect to any particular invention, and the specifications, documents and drawings shall be thenceforth kept and dealt with in the ordinary way.

(12.) The communication of any invention for any improvement in instruments or munitions of war to the Secretary of State, or to any person or persons authorized by him to investigate the same or the merits thereof, shall not, nor shall anything done for the purposes of investigation, be deemed use or publication of such invention so as to prejudice the grant or validity of any patent for the same.

NORMAL POWDER CO., LTD.—This Company have, as is mentioned in the annual report, moved their offices from 38 and 39, Parliament Street, to 2, Bank Buildings, Cricklewood, which is within short carriage distance of their ammunition loading shops, which are situated on a portion of the London Sporting Park Company's land.

PERSIAN FIRE-ARMS LITIGATION.

Two further cases have been heard during the past month in connection with the liability as between merchants and manufacturers, due to the seizure of arms in the Persian Gulf, and the resulting stoppage of trade in that quarter. The cases dealt with the question as to who should bear the loss of arms manufactured for this trade, when the opportunity of delivering the consignments had been removed.

In one action, the plaintiff was Mr. D. V. Johnstone, trading as J. P. Clabrough and Johnstone, gunmakers, of Birmingham, and the defendants, Malcolm Brunker & Co., merchants, of London, the damages claimed amounting to £703. Mr. Hugo Young and Mr. Parfitt (instructed by Messrs. Mason & Son, Birmingham) appeared for the plaintiff, and Mr. Jelf, Q.C. (instructed by Messrs. Baker & Nairne, London) was leading counsel for the defendant company.—During August, October, and December, 1897, defendants gave several orders to the plaintiff for the supply of sporting guns and ammunition, these to be delivered f.o.b. at Manchester, for shipment within two months. Plaintiff was willing to deliver the goods so ordered, and asked the defendants to take delivery of the same, and to name the vessel for the shipment of the goods. Defendants, however, refused to take the delivery of any of them, and at the end of January last year the orders were cancelled. The defendants held that the goods were not to be delivered until they were in a position to ship to Bushire. The Government's determination to enforce their prohibition of 1881, a determination emphasised by the seizure of the *Beluchistan* by H.M.S. *Lapwing*, rendered it useless, and indeed impossible, for them to attempt to send the arms.—Mr. Jelf submitted that the main question was the conduct of the British Government, and how far that action relieved the parties from the contract. If the contract was illegal when it was made, it could not be enforced, and if it became illegal before it was fulfilled, it had been clearly laid down that it could not be enforced. If, from political exigencies, the Government, by a definite and strong exhibition of force, prevented a certain class of contracts being carried out, to resist such authority by any private citizen would be on his part a failure in his duty to the State to which he owed allegiance. Consequently, if the alternative of failure in this duty was the breaking of the contract, he must break the contract.—His lordship said that the party certainly ought not to disobey. It would be like a declaration of war. Defendants' manager, in his evidence, said that the rifles in question were made specially for Bushire, and with the contingency that arose the contract was at an end.—Mr. Johnstone, on the other hand, denied that when the contract was made anything was said as to it being inoperative under any circumstances.—In delivering judgment, his lordship said that he was satisfied that neither plaintiff nor defendant had any knowledge whatever of the supposed prohibition. As a matter of fact, there had been a prohibition as far back as 1881, and that appeared to be renewed from time to time until 1895. He was also of opinion that the prohibition was merely fiscal in its character and operations, and only meant that before goods of this description could be imported, liberal payment of customs must be made to the individual fortunate enough to farm the customs from the Persian Government. Judgment must be for the plaintiff. He understood that an arrangement had been come to that the goods should be taken by the defendants and paid for according to the contract. Mr. Hugo Young, for the plaintiff, said that he understood judgment would be for the amount claimed, to be reduced on payment for the goods when delivered. Leave was given to appeal.

Mr. Justice Ridley heard a case covering slightly different ground, in which Messrs. C. H. Laubenburg and C. B. Engels, trading together as C. H. Laubenburg & Co., were plaintiffs, and C. W. Andrews, Ltd., 13, Bath Street, Birmingham, the defendants, the action being for breach of contract. Mr. Hugo Young, Q.C., and Mr. J. J. Parfitt (instructed by Messrs. Mason & Son) appeared for the plaintiffs; and Mr. M. Shearman and Mr. E. G. M. Carmichael (instructed by Messrs. Stackpole & Co., London) were for the defendants. Plaintiffs claimed £365 damages on account of the defendants having refused to accept 200 carbines, the balance of an order for 400 Martini carbines agreed to between the parties in August, 1897. The first lot were delivered. The defendants contended that by agreement the carbines should have been delivered not later than October of that year, the time being afterwards extended to the middle of December; but they were not so delivered, so the defendants at the end of the latter period declined to accept delivery of the remainder of the order. Other contracts being incompleted in consequence, the defendants counter-claimed £81 5s. as loss of profit on the 200 carbines. The evidence showed that the carbines were intended for shipment to the Persian Gulf, and Mr. Engels mentioned that it was a good thing after all that they were not delivered in time for shipment in the *Beluchistan*, which was seized by Government.—The jury found for the defendants on the claim, and for the plaintiffs on the counter-claim.

KRUPP BARREL STEEL.—Mr. Aug. Reichwald, the London agent of the firm of Fried. Krupp, has issued a notice to the effect that gun and rifle barrels made of Krupp's "Flussstahl" are not the same as those made of "Krupp's Special Gun Barrel Steel," of which Mr. Reichwald has the sole representation for the United Kingdom and the Colonies. We understand that gunmakers have for some time past been perplexed by the widely different prices of these two kinds of barrel, particularly as the distinction between them has not been over clear, emanating as they do from the same manufacturer.

CORRESPONDENCE.

RE NEW GUNPOWDER CARTRIDGE.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—No good purpose is served, we think, by entering into a long correspondence with Mr. James Macnab, but it is inadvisable to allow his letter appearing in your December issue to go entirely unanswered, particularly as he makes some statements which to an ordinary reader would be very misleading. Mr. Macnab purports to write in an "impartial spirit," with a desire that the truth should be told. Mr. Macnab has thought it right to make such a statement as the following:—"I now find that Gunpowder makers have at last recognised 'my' valuable principle of keeping the quick-burning gunpowder separate from the cooling agent and not mixed; for the fine-grain or quick-burning powder cartridges,

combined with my recently improved pellet or case of ammonium salts of 1893 and 1897 (oxalates and carbonates, &c.,) has passed the Woolwich test as 'Elephant Gunpowder.'"

The "Elephant" gunpowder, which has passed the Woolwich tests, is a powder manufactured by our Company, and is a powder with which Mr. Macnab has not, and never had, anything whatever to do. The idea of putting Oxalate of Ammonium as a cooling substance in a cartridge and keeping it separate from the gunpowder is not Mr. Macnab's idea, but is an invention forming the subject of our patent of 1898.

Mr. Macnab, in a complete specification, filed long after our 1898 provisional specification, made an attempt to protect a a combination in a cartridge with gunpowder of a cooling substance; but we are pleased to say we successfully opposed his patent so far as it attempted to include gunpowder, on the ground that the invention was the subject of our prior patent. Mr. Macnab has for some time past been trying to interest the trade in the use of a safety cartridge containing ammonia in sealed tubes, and any credit which may attach to that invention belongs to Mr. Macnab; but the trade up to the present time do not appear to have found that cartridge a commercially useful one, nor has it passed the Woolwich tests. The credit of having invented a cartridge which has passed the Woolwich tests, containing gunpowder and a cooling substance, such as Oxalate of Ammonia, kept separate from one another, belongs to us.

CURTIS'S & HARVEY, LIMITED,
Per H. BALDWIN, Secretary.

London, Dec. 29, 1898.

REVIEWS.

An Illustrated Treatise on the Art of Shooting. By Charles Lancaster. Sixth and Popular Edition. Published by the Author at 151, New Bond Street, London, W. Price 2s. 6d.

We are very pleased to notice that the excellent reception which has been accorded to the previous editions of this work has tempted the author to try the experiment of bringing out the book in a popular form at a much reduced price. The work is far too well known for us to require to go into any detail as to the manner in which the author has dealt with the "Art of Shooting." Very excellent pen and ink illustrations are given throughout the book to show the particular alignment required to make successful shots at the varying classes of moving objects which may be brought down by the shot gun. Dotted lines show the precise line of aim which should be taken in order that the travel of the shot should intersect the line of flight of the bird, whether it be crossing, rising, descending, or in any other of the various positions which need special treatment.

A large amount of information is also given in the book as to the general behaviour of the shooter, both in the interests of his own safety, and in that of his friends and the beaters. Towards the end of the book the information given is of a somewhat more technical nature, but this is not at the expense of the readableness of the volume, as nothing has been included which is not well within the understanding of the sportsman, and which has not some special bearing upon practical questions of shooting.

"The Sportsman's Year-Book." Edited by C. H. Colman and A. H. Windsor. Published by Lawrence and Bullen, Ltd., London.

The enterprise of Messrs. Lawrence and Bullen in the issue of sporting publications has nowhere found a more useful or more congenial field than in the preparation of this handbook. They have set themselves to follow in sporting matters the high standard attained by Whitaker's Almanac on general subjects. They challenged a unique comparison, and it is to their credit that they have produced a book which will be to the sportsman what Whitaker is in a more general way.

In the shooting section of the work they have dealt with general matters under the headings of "Game Shooting" and "Guns and Powders." Under the former they have discussed the records of the past season's work with each class of game, and it is regrettable to notice that we receive a further confirmation of the unfavourable reports as to partridges, which, throughout the country, have with but slight exception been almost a missing quantity, anyhow as regards young birds. A table of game-shooting seasons over the three sections of the country will be useful for reference purposes, as in the same way will be the column of standard weights of various kinds of game. Other general particulars include some record bags, most of which, we regret to see, have not been made within recent years.

Mr. Henry Sharp, who is the chief author of the shooting section of the book, deals, we are very pleased to note, in the most fair-minded and unbiassed way with the developments in the past year of guns and ammunition. In no case does he give the impression of puffing some favourite product at the expense of truth and of other rival products. He refers to the increasing use of single-trigger guns, and also to the introduction of selective single-trigger mechanisms, providing for the use of either barrel at the option of the shooter. He also puts in a word of well-deserved praise for the Westley Richards, double ·256 hunting rifle, which is without doubt a clever piece of arm construction of undoubted benefit to the shooter. The page dealing with automatic pistols causes us regret in so far that every arm of this class bears a foreign name, and it suggests the query as to what our own manufacturers have been doing to leave this department of work entirely to the foreigner. Under the heading of powders, a concise record is given of the changes during the past year, which includes the introduction of E. C. No. 3, the advance in popularity of the new Cannonite coarse-grain powder, and the Kynoch smokeless powder. Under the heading of "Inanimate Bird Shooting" we see a reference to some of the best scores which have been made during the past season, and these are followed by the official rules of the Inanimate Bird Shooting Association. Target shooting comes in for a well-deserved position of prominence, and we find a record of the Annual Meeting of the N.R.A. at Bisley, which includes a useful summary of the particular features of the Meeting, among which we observe a reference to the excellent shooting done with our service rifle. After giving the winners of some of the chief events, the definitions of each type of rifle used in the competitions are reproduced, and these are followed by the conditions of a few of the main events of the annual meeting.

The utility of this book lies, not so much in the amount of attention given to any individual department of sport, as in the fact that all departments are proportionately represented, so that the sportsman may verify matters connected with any

particular pastime in which a query has arisen or a record requires to be authenticated. Of course it will be in the annual re-appearances of this book that its utility will be established, for the experience of each subsequent year will enable the editors to introduce fresh factors of interest, and revise others where changing conditions have altered what was correct in the previous year. The care with which the editing has been done is well shown by the great accuracy of the information, so that while it is usual for reviewers to find fault with various items, we are on this occasion in the happy position of being able to confine our comments to congratulations of the able manner in which the work has been produced.

APPLICATIONS FOR PATENTS.

NOVEMBER 14th—DECEMBER 17th, 1898.

23,928 Sights for Ordnance. T. G. Russell.
24,001 Measuring Recoil of Small-arms. H. F. Phillips.
24,066* Machines for Cutting Cartridge Wads. H. H. Lake, *(Agent for Austin Cartridge Co., U.S.A.)*
24,468 Explosives. E. A. G. Street.
24,544* Breech-loading Guns. J. F. Meigs and S. A. S. Hammar.
24,554 Breech-loading Ordnance S. Pitt. *(Agent for F. F. Fletcher, U.S.A.)*
24,555 Gunpowder. A. G. Bell.
24,662 Explosives. A. Luck.
24,948 Ammunition Hoists. A. T. Dawson, T. Thackeray, and J. Horne.
25,059 Flying Torpedo Gun. J. O'Kelly, M.P.
25,151* Projectile of Malleable Tungsten Alloy. G. Roth and C. Krnka.
25,176 Breech Mechanism for Ordnance. A. Reichwald *(Agent for Fried. Krupp, Germany.)*
25,177 Breech Mechanism for Ordnance, A. Reichwald *(Agent for Fried. Krupp, Germany.)*
25,212 Projectiles. S. V. Buskirk.
25,222 Firing Mechanism for Small-arms. W. and A. Cashmore.
25,364 Gun Carriages. A. Reichwald. *(Agent for Fried. Krupp, Germany)*
25,365 Gun Carriages. A. Reichwald *(Agent for Fried. Krupp, Germany.)*
25,440 Martini Fire-arms. C. H. Laubenberg, C. B. Engels, and W. Field.
25,515 Attaching Sights to Fire-arms. L. B. Taylor.
25,568* Explosives. Count von Geldern-Edgmond.
25,607 Guns. G. H. Laxton.
25,757 Steadying Guns on Ship-board. B. Tower.
25,745 Revolvers. F. E. Chilton and H. W. Roberts.
25,824 Preparing Cartridge Cases. D. Scase.
25,838* Explosives. J. E. Evans-Jackson *(Agent for W. Alvisi, Italy.)*
25,864 Gun Mountings. A. T. Dawson and J. Horne
26,081 Shells for High Explosives. L. Gathmann.
26,149* Regulating the Direction of Projectiles. Norddeutsche Munitionsfabrik and A. Totte.
26,249 Manufacture of Multi-perforated Powders. H. Maxim.
26,263 Preventing Erosion in Guns. H. Maxim.
26,287 Modification of the Mauser Rifle. R. M. Ramirez.
26,358 Sporting Guns. F. A. Adcock.
26,493 Single-trigger Gun. C. O. Ellis and E. W. Wilkinson, trading as Charles Osborne & Co., and W. Jerman
26,529* Smokeless Powder. F. A. Halsey.
26,708 Explosive Shells. D. M. Mefford.

*These Applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

NOV. 26th—DEC. 17th, 1898.

18,642* (Aug. 11, 1897). F. M. Hale, J. Deas, and J. B. Reavil, London. The Hale Fuse for Projectiles.
26,248* (Nov. 11, 1897). R. W. Howe, London, and G. H. Smith, Birmingham. The Howe-Smith Single trigger Gun.
29,488 (Dec. 13, 1897). Sir A. Noble and C. H. Murray, Newcastle-on-Tyne. An arrangement for serving ammunition hoists with projectiles in such a way as to obviate the necessity of stopping the movement of the hoist while the projectile is being placed therein. Accepted Nov. 5, 1898.
30,416 (Dec. 23, 1897). J. J. Garrard, South Africa. A range finder constructed on the principle of a series of hairs, forming a screen through which objects may be viewed. The finder may be placed near the foresight of a rifle, and the object be viewed with the eye in the position of firing. The range is determined by the space occupied on the screen of an object of known dimensions at the distance to be estimated, tables being constructed on the basis of average heights of men on foot, men on horseback, etc. Accepted Nov. 23, 1898.
30,735 (Dec. 29, 1897). L. Silverman, Crayford. A machine for loading such explosives as rifle Cordite, so arranged as to be automatically brought to a stop should one of the threads of explosive forming the stranded cords be broken. In this way is obviated the danger that the machine will go on cutting off the charges of Cordite after the number of cords in the strand has been reduced by the breakage of a cord unobserved by the attendant. Accepted Nov. 12, 1898.
88 (Jan. 1, 1898). A. Vickers, L. Silverman, and C. A. Larsson, London. A new mounting for the Maxim automatic gun, in which the tripod stand is replaced by two rods dividing forkwise so as to provide four feet for the support of the gun. The two rods are so mounted on hinges that the mount may be opened out into the form of an ambulance stretcher, with the gun in the middle, the four legs forming the handles. Accepted Nov. 26, 1898.
232* (Jan. 4, 1898). C. H. Curtis, D. J. Metcalfe, C. L. Watson-Smith, A. F. Hargreaves, and A. C. Pearcy, London. A Gunpowder Safety Blasting Cartridge.
370* (Jan. 6, 1898) J. de Ugarte, Manchester. A means of fastening a bayonet to a rifle by means of a hinge near the muzzle, so arranged that the bayonet may be retained on the rifle in two positions, one when set and ready for use, and in the other folded back and lying underneath the barrel and adjoining the wooden stock. By releasing the hinge joint the bayonet may be entirely removed from the rifle. Accepted Nov. 12, 1898.
4,361 (Feb. 22, 1898). H. Fiedeler, Germany. A gun without a stock, which is shot while lying upon the shoulder. The description is hardly in such detail as to show in what manner the various requirements of a gun are met. Accepted Nov. 12, 1898.
8,122 (April, 5, 1898). R. Dinsmore, U.S.A. A repeating rifle, described in the course of 13 pages of specification and numerous drawings, for which 36 claims are made. The gun has a longitudinal magazine passing along the interior of the stock. The centre of the stock is hollowed out to receive a vertical magazine, which supplies the longitudinal magazine with cartridges. The object of the patent is to produce various improvements and simplifications as compared with existing types of repeating rifles. Accepted Nov. 5, 1898.
17,249 (Aug. 10, 1898). A. J. Boult *(Agent for T. J. Lovett, U.S.A.)* A big gun so built up in sections as to be readily taken apart for repair or transport. Accepted Nov. 12, 1898.
18,415 (Aug. 27, 1898) J. Johnstone, Rosshire. A trap for throwing glass balls or similar objects for shooting practice. The trap is fed from a sort of magazine, and the balls are thrown by an overarm movement of the throwing lever. Accepted Nov. 5, 1898.
18,570 (Aug. 30, 1898). W. P. Ferguson, New York. An electric fuse-head and detonator constructed with the general external appearance of a revolver cartridge, the object of pointing it at the nose being to allow for forcing the detonator into the blasting charge without the necessity for clearing a hole first. Accepted Nov. 12, 1898.
20,990 (Oct. 5, 1898). G. P. Bickford-Smith, Cornwall. An electric fuse consisting of a piece of wood of semi-circular section, with the two wires on the flat side. Their ends are bent over the piece of wood, and a cardboard tube is drawn over and extends a short distance beyond the wire ends. This portion of the tube is filled with priming composition, and the whole is then ready for crimping into a metal tube containing fulminate of mercury. Accepted Nov. 26, 1898.
21,845 (Oct. 17, 1898). E. Bainbridge, Woolwich. This specification has been declared a secret document under Section 44 of the Patents, etc., Act, 1883. Accepted Dec. 17, 1898.

*These specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

A SAFETY GUNPOWDER BLASTING CARTRIDGE.

232. (Jan. 4, 1898). C. H. Curtis, D. J. Metcalfe, C. L. Watson-Smith, A. F. Hargreaves, and A. C. Pearcey. This patent evidently refers to the system of blasting with gunpowder which was described at some length in our last July issue. Correspondence which appeared in subsequent issues showed that doubts were entertained as to the existence of such originality in the idea as would justify a patent. The specification has evidently been drawn up with considerable care, so that its scope shall be limited to the precise ground which is considered to be original. In view of the interest attaching to this patent, we give the following exact reproduction of the whole of the descriptive matter, and of the subsequent disclaimers, together with the precise claims.

According to this invention we provide in front of the gunpowder or other explosive blasting charge suitable means for extinguishing

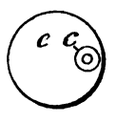


Fig. 2.

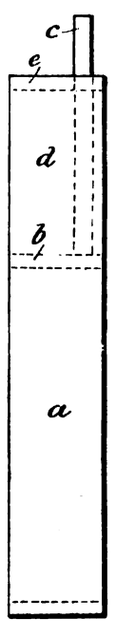


Fig. 1.

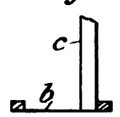


Fig. 4.

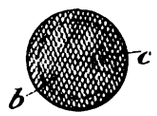


Fig. 3.

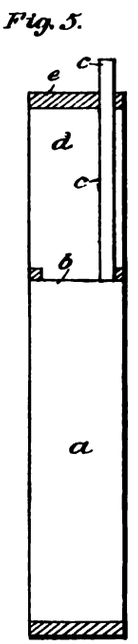


Fig. 5.

the flame or incandescent particles of the said explosive charge, or for lowering the temperature of the same when fired for blasting purposes in localities such as dangerous coal and other mines. We combine in one cartridge the explosive with the aforesaid means for exerting an extinguishing or cooling action when the explosive is fired, so as to be readily available for transport storing and immediate application when wanted, but so that the explosive and the cooling means are not formed into a mixture but kept separate or intact from each other by a paper diaphragm or the like.

As cooling means we may use any such that may be found suitable for the purpose. We may, however, particularly mention the ingredients hereinafter named, which are used separately or mixed two or more or all of them in a granular form and enclosed in a paper or other receptacle, which is made up in one cartridge with the powder or other explosive, but separated therefrom by a paper diaphragm or the like. We may thus make a cartridge in which the powder is first run into the paper or other case, and then a paper, cardboard or other disc provided with a tube (for the passage of the fuse or other igniting device) is placed on the top of the powder whereupon the granular cooling ingredients are filled in upon the disc. The cartridge case is then closed on it, and the cooling ingredients kept separate from the explosive.

The cooling ingredients are sulphate of alumina, potash, alum ammonia, alum oxalate of ammonium, borax, and sulphate of ammonium, separately or combined. We have found that oxalate of ammonium in a granular condition, as hereinafter more particularly described, is especially suitable for our purpose.

We are aware that the salts of oxalic acid have been proposed to be used as a cooler or for the reduction of flame in conjunction with various high explosives requiring detonation, also that attempts have been made to cool and extinguish the flame of an explosive by the liberation of carbonic acid provided under pressure in a suitable receptacle adjacent to the explosive.

Also that it has been attempted to use salts containing quantities of water of crystallization, such as carbonate of soda (soda crystal) as a coating or receptacle for the explosive.

Also that it has been proposed to provide a stemming or tamping to be rammed into the bore-hole with the explosive consisting of various flame-quenching substances.

Also that it has been proposed to intermix or incorporate with high explosives requiring detonation containing nitro-glycerine or other nitro-compound salts, such as soda crystals, sodium carbonate, potash, alum ammonia, alum sodium sulphate, magnesium sulphate, iron sulphate, copper sulphate, sodium phosphate and magnesium phosphate and sodium phosphate.

Also that various attempts have been made to surround the explosive with water or with water held by other substances.

Also that oxalate of ammonium, sulphate of alumina, potash, alum ammonia, alum borax, and sulphate of ammonium have been proposed to be used incorporated or intermixed so as to form part of the explosive charge.

But from experience it has been found that none of these contrivances succeed, and that they fail for the following reasons amongst others:—

Either the cooling or flame-extinguishing materials have only been used with or as part of the explosive charge, and generally with a charge of some high explosive requiring to be exploded by detonation. Gunpowder differing in its character from the high explosives leaves after explosion a considerable percentage of solid particles which become incandescent, and which it has hitherto been impossible to cool down or extinguish sufficiently rapidly to render them safe in the presence of coal-dust or inflammable gas. In the cases where such materials as we employ have been contemplated for use with or as part of gunpowder, they have been either incorporated with the gunpowder, and have become an adulteration and reduced the disruptive power of the explosive and rendered it of little value, or where other substances of a somewhat similar character have been used, they have been of such a nature that they could not be kept as part of or in close proximity to the gunpowder without causing deterioration thereof either from their efflorescent or deliquescent nature.

Our intention has been to provide, as we claim to have successfully done in connection with gunpowder, a means of combining in one cartridge (so that the explosive cannot be used without the cooling means) a substance which will act as a cooler and extinguisher of flame or incandescent particles, whilst at the same time it leaves the gunpowder intact and free to exert its proper disruptive action, the cooler being of stable character and neither likely to change itself nor bring about any change in the gunpowder, and so placed in a cartridge case as to be in the closest proximity to the gunpowder and yet separate therefrom.

From experience we have found that one part by weight of the cooling agent to two parts by weight of gunpowder is a good pro-

portion, but we do not restrict ourselves to these proportions, and either greater or less proportions may be used.

In order that the said invention so far as the same consists in the use of the cartridge may be more fully uuderstood, we will describe the same by means of the accompanying drawings:—Fig. 1 shows a drawing of the cartridge; Fig. 2 is a drawing of the end piece through which the fuse passes; Fig. 3 is a drawing of the diaphragm; Fig. 4 is a sectional view of the same; Fig. 5 is a sectional view of the cartridge. *A* is the portion of the cartridge which contains the powder. *B* is the disc or diaphragm constructed as shown in the form of a cardboard ring supporting a membrane of muslin paper or other suitable separating material. In place of a diaphragm constructed as shown, we might use a disc of paper or other easily disrupted fabric supported and retained in place in any suitable manner. *C* is the channel or passage for the reception of the fuse. *D* is the receptacle for the cooling material charged with crystals of oxalate of ammonium or equivalent salt as above mentioned in a coarsely granulated condition, so as to leave a large proportion of interstitial space. *E* is the end piece placed on the top of the cooling material to complete the cartridge.

The cartridge may be made of paper or any other suitable material usually employed for the purpose of making cartridges.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In a blasting cartridge the combination with gunpowder in the manner hereinbefore described and without intermixture therewith of a cooling agent consisting of granulated oxalate of ammonium, sulphate of alumina, potash, alum ammonia, alum borax or sulphate of ammonium separately or combined as hereinbefore described.

2. The hereinbefore described blasting cartridge charged with gunpowder and with a cooling agent for extinguishing the flame and incandescent particles of the gunpowder, which cooling agent consists of the materials hereinbefore enumerated for that purpose or of some or of one of them granulated and placed in the cartridge substantially as hereinbefore described and shown.

3. The use in a blasting cartridge in which gunpowder is employed as the blasting agent of granulated oxalate of ammonium treated and disposed as hereinbefore described and shown.

4. A blasting cartridge containing the materials hereinbefore mentioned and constructed and arranged as hereinbefore described and shown by the accompanying drawing. Accepted Nov. 5th.

THE HALE FUZE FOR PROJECTILES.

18,642 (Aug. 11, 1897). F. M. Hale, Manager New Explosives Co., Ltd., London; J. Deas, Plumpstead; and J. B. Reavil, Blackheath. This patent relates to percussion fuzes of the kind in which a firing point or needle and a percussion pellet having a detonator, are so arranged that the said detonator at first lies out of alignment with the firing point or needle, and only comes into alignment therewith by the rotation of the shell during its flight from the gun. The fuze is so constructed that a rotative detonator pellet, which is excentrically disposed within the fuze body, will be normally retained out of alignment with the firing needle until released by centrifugal force acting on locking bolts during the flight of the shell, the pellet, by reason of its excentricity, then changing its position angularly until it brings its detonator in alignment with the firing needle. In this position the pellet is restrained from further angular movement, but is free to shift longitudinally on impact, and cause its detonator to strike the needle and explode the shell.

In the illustrations Fig. 1 is a central longitudinal section with the parts in an inactive position, that is to say, in the position they occupy before discharge of the shell from the gun; Fig. 2 is a similar section taken at right angles to Fig. 1; Figs. 3 and 4 are sectional views corresponding to Figs. 1 and 2, and illustrating the parts in the position they occupy after discharge of the shell from the gun; Fig. 5 is a sectional view similar to Fig. 3, but showing the parts in the position they occupy immediately after impact; Fig. 6 is a transverse section of Fig. 1; Fig. 7 is a plan of a screw plug forming part of the fuze, as hereinafter described.

a is the body of the fuze within a cavity *b*, of which is located the pellet *c*, having pivots or axles *d d* co-axial with the longitudinal axis of the fuze. The shape of the pellet is such that its centre of gravity is excentric to the axis of the pivots or axles. It is furnished with one or more laterally disposed bolts *e*, the heads *f* of which are, by means of springs *g*, kept in engagement with recesses *h* formed for their reception in the body *a* of the fuze. The pellet is, by means of such bolts, held locked to the fuze body, and rendered incapable of performing any independent movement. In this position of the

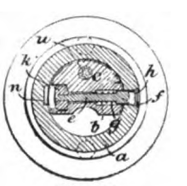


Fig. 6.

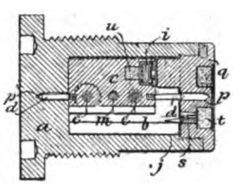


Fig. 1.

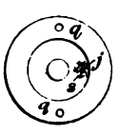


Fig. 7.

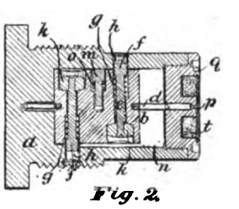


Fig. 2.

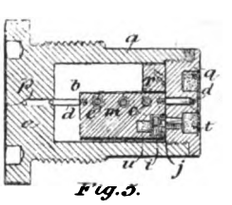


Fig. 5.

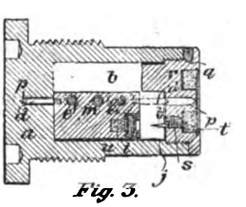


Fig. 3.

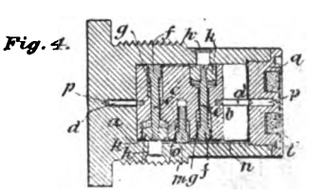


Fig. 4.

pellet, the detonator *i* which it carries, is out of alignment with the firing needle *j*. The tails *k* of the bolts are weighted, and occupy such a position relatively to the longitudinal axle of the fuze that during the flight and spin of the shell to which the fuze is applied, the heads *f* of the bolts are caused by centrifugal force acting on the weighted tails *k* to be withdrawn from their recesses in the fuze body, and thereby release the pellet from its locked position. The rotation of the pellet about its pivot pins *d d* then becomes independent of the rotation of the fuze, and by reason of the excentric position of the centre of gravity of the said pellet, the speed of its rotation is diminished while the speed of rotation of the fuze body remains unchanged. The position of the detonator *i* with respect to the firing needle *j* is thereby altered, and continues to alter until the detonator comes into alignment with the firing needle. Immediately this alignment occurs, a bolt *m* carried by the pellet is caused to be

thrust into a longitudinal slot *n* in the fuze body by a spring *o*, whereby the pellet is locked to the fuze body in its new angular position (Figs. 3 and 4). But the above longitudinal slot *n* leaves the pellet free to move forward on impact of the shell, and consequently when such impact takes place the pellet will, by its own momentum, fly forward and cause its detonator *i* to strike the firing needle *j*. The resulting "flash" explodes the shell, as is well understood. In order to permit of this longitudinal forward movement of the pellet, its pivots and their bearings *p p* are made so long that the pivots can slide longitudinally without any liability of the pellet to become disengaged from the bearings.

The forward end of the fuze body is provided with a screw plug *q* for closing the cavity *b*, and this plug is furnished with a projection *r*, which is so arranged that it will lie contiguous to the end of the pellet (Fig. 1), and restrain the latter from longitudinal movement until the detonator has assumed its position of alignment with the firing needle. This projection *r* also reduces the transverse stress that would otherwise come upon the lateral bolts *e e* carried by the pellet, and enables them readily to shift when subjected to the action of centrifugal force during the flight of the shell.

The plug *q* has a series of flash holes *s* contiguous to the firing needle *j*, such holes opening into a cavity *t* containing an explosive mixture which is fired by the flash on impact of the shell. In order to ensure that the flash shall be effectually projected through the holes *s*, it is preferable to provide a cavity *u* containing an explosive mixture immediately at the rear of the detonator *i*, so that on explosion of the detonator this explosive mixture will likewise be fired and give rise to a flame that will extend completely through the flash holes.

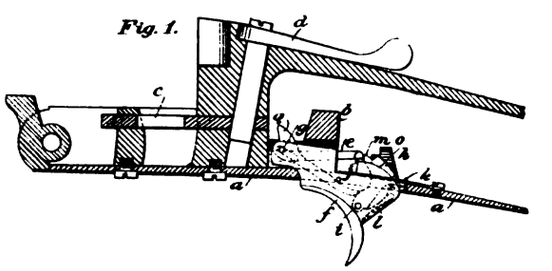
THE HOWE-SMITH SINGLE-TRIGGER GUN.

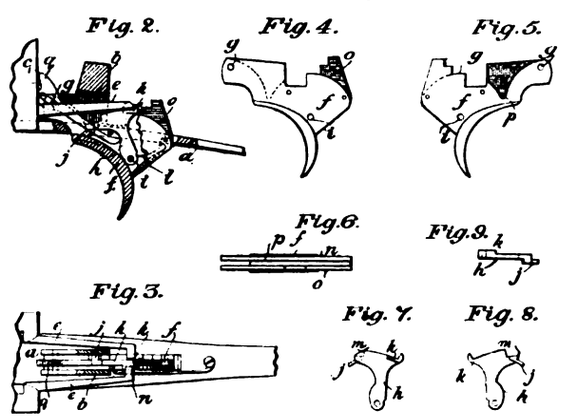
26,248 (Nov. 11, 1897). R. W. Howe, Dulwich, and G. H. Smith, Birmingham. This single-trigger gun mechanism is of the two-pull variety. The trigger blade is slotted longitudinally, and inside this slot an arm is pivotted, so that its upper part is capable of a longitudinal to-and-fro movement. At the two extreme positions the arm engages with one or other of the two sears, and the time occupied in passing from one position to the other is such as to cover the period during which the involuntary pull takes place. Fig. 1 is a longitudinal sectional elevation of so much of an action as is necessary to show the single-trigger mechanism; Fig. 2 is a similar view with the parts in another position, and Fig. 3 is a plan view of the trigger plate and part of the firing mechanism; Figs. 4 and 5 are elevations of opposite sides of the trigger, and Fig. 6 is a plan view of the same; Figs 7 and 8 are elevations of opposite sides of the sear operating device; and Fig. 9 is a plan view of the same.

a is the trigger plate, and *b* the lump or box, as usual; *c* is the locking bolt, and *d* the locking bolt lever, which operate the trigger mechanism in the usual way; *e* are the sears; *f* is the trigger, which is formed as shown at Figs. 4 and 5, and is pivotted at its fore-end *g* to the lump or box *b*, as usual. The trigger is slotted out or recessed longitudinally, as shown at Fig. 6, to receive a tumbler *h*, which may be termed a vertical swinging piece (Figs. 7 to 9), and which constitutes the sear operating device. This piece is pivotted in the trigger recess at the point *i*, which, when the parts are assembled, is situated outside and below the trigger plate *a* (Figs. 1 and 2). It is important to get this pivot as low down as possible, in order to obtain the requisite amount of movement in the piece *h*.

This piece *h* is formed with two blocks or lateral projections *j k* (Figs. 7 to 9), that on the right forward edge, *j*, underlying, when the gun has been closed, and serving to operate the right-hand sear *k*, and that on the left rear edge, *k*, coming under at the right moment, and serving to actuate the left-hand sear. A light spring *l* is placed in the recess of the trigger behind the swinging piece *h*, the object of which is constantly to urge the piece in a forward direction, or towards the muzzle end of the gun, to bring it into its proper operative positions. The blocks *j k* are formed to correspond, on their undersides, to the arc of a circle struck from the pivot *i*, and the block *j* has an upward projection or catch *m*, which strikes against the end of the right sear *e*, and thereby retains the piece *h* in position to operate the sear. When the discharge of the first barrel has taken place, the right sear is held up above the path of the catch, so that when the pressure of the finger on the trigger is released, the piece *h* can go forward, and take up the position necessary to actuate the left sear, when the trigger is again pulled.

The projections *j k* will rest on the edges of the sides of the recess in the trigger, so that there will be no strain on the projections, when the trigger is pulled, to discharge the barrels. Thus, the projection *j*, in the firing position, will rest on the ledge *n*, and be supported thereby, while the projection *k*, in the firing position, will rest on the ledge *o* on the other side of the trigger, and both these ledges will be curved to correspond to the curve of the projections, the circle being





struck from the point *i*, as before. To enable the nose *j* of the piece *h* to go forward to the full extent, a V-shaped recess *p* in the side of the trigger *f* is formed, the rear face of the recess being curved at the same radius as the projection *j*. *q* is a rod or slide contained within the trigger, and intended to throw back the piece *h* when the locking bolt *c* is drawn back by the action of the lever *d*.

The operation of the parts is as follows:—On opening the gun, the piece *h* is forced back by the action of the rod *q*, and the hammers are cocked. The catch *m* of the block *j* passes behind the tail of the right-hand sear, with the block *j* underneath. To discharge the right barrel, the trigger is pulled, and the tail of the right sear is raised clear of the point of the catch, and it is held in this raised position, so that the piece *h* can swing forward to bring the block *k* under the tail of the left sear, so that the second barrel can be discharged. The pivot of the swinging piece *h* must be as low down as possible, and the distance between the two blocks must be as long as possible, in order to give a sufficient length of movement to the piece *h*, to prevent the block *k* arriving under the second sear before the involuntary pull has taken place. Accepted November 11th, 1898.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

New Explosives O. in C.—Those gunpowder manufacturers who handle smokeless powder, will accord a hearty welcome to the new Order in Council, which makes it lawful to pack within the same outer cover both black and smokeless powder, so reducing the freight charges which would be incurred by making separate consignments. It is rather a wonder that this privilege has not been granted earlier, but still it has followed sufficiently soon after the representations made by the trade to show that H. M. Inspectors of Explosives have not stood in the way of this reform. The fact that the combined weight of the explosives so carried in one outer package is limited to 50 lbs., shows that it is only intended that this concession shall apply to quantities of powder so small that their separate carriage would materially increase the cost to the purchaser. Still, the amount will be all that a gunmaker who stores under Mode B will be entitled to receive at one time, according to the powder allowed on his premises. In the case of the gunmaker who is fortunate enough to possess a Mode B store for his powder, we may assume that if he wanted more than the amount of assorted powders represented by the above 50 lbs. limit, his storage facilities would enable him to take in enough powder at a time of each sort to bring down the all-round rate of carriage to that of the 50 lb. lot. The section of the new order dealing with the carriage of pin-fire cartridges has already been anticipated by what was known to be the probable outcome of the recent explosion of pin-fire cartridges at Euston. It will be noticed that the provisions are strictly limited in all cases to pin-fire cartridges for pistols. The first clause states that such cartridges shall be packed by the use of perforated millboard or similar material. It is, of course, quite clear that the system referred to is the one described in our December issue, and patented by Messrs. Eley Bros. We may, of course, assume that H. M. Inspectors of Explosives have purchased the said Letters Patent, in order to place it in the power of other manufacturers to comply with the new rule. The next clause requires that where the number of cartridges exceeds 50, they shall be packed in an inner and an outer package. The final clause requires that the words "Pin-fire Cartridges" shall be conspicuously displayed on the outside of the packing case. Of course, it would have been equally easy to have prohibited the carriage of these cartridges altogether. We do not complain of the new regulations, because we have referred to the danger of such ammunition. All we can say is that in future those who want pin-fire cartridges for pistols will have to pay for them, or else order them as pin-fire cartridges for saloon rifles.

The National Rifle Association.—The Annual Report of the National Rifle Association has recently been issued, and it is interesting to note how cordially the Council have met the wishes of those members who considered it was not in sufficiently good touch with the ordinary shooting competitor. The changes which have been made give every promise of a successful issue, and though their results will probably be felt gradually, it is sufficient to know that increased representation of the right kind has been secured. The accounts of the Association are not such pleasant reading as they might be,

unless perhaps they take note of the rule that too flourishing a state of affairs might check the flow of voluntary subscriptions. On a turnover of £20,811, there is a deficit of £501, or practically 5 per cent. The result is partly accounted for by a heavy bill for repairs during the past year, and also by the fact that it has been considered advisable to write off for depreciation £882 from the plant account. This amount comes to about 10 per cent., since the plant now stands at £8,320. From the nature of the plant owned by the Association, it is clear that repairs will always be heavy, and therefore that liberal provision must be made for depreciation. Conspicuous among the tabulated list showing a comparison of the amounts given in prizes during the past two years, are the names of those manufacturers of rifle powders who mutually agreed last year not to continue their support in the way of giving prizes for special competitions where their powder would be used. This decision was arrived at since it had become clear that the value of the advertisement did not justify the outlay involved. The Association could not meet the manufacturers, so that it is some £200 the poorer On the other hand, various new supporters in the gun and allied trades appear freshly in the list, so that the net contribution of the trade, regarded as a whole, shows but a slight diminution. One of the most regrettable paragraphs in the report is the statement that Col. Mackinnon has been obliged, through severe illness, to resign the duties of Secretary. This news will be generally received with regret, for the gallant Colonel has always performed the arduous duties of his position with an exactitude and courtesy which have endeared him to all.

BALLING OF SHOT.

THE gun trade is a good deal interested at the present time in the question of the balling of shot guns. The problem has arisen by virtue of a controversy, which may be considered as quite apart from the scientific issues involved, and it is the latter point of view to which we propose to pay attention.

Mr. R. W. S. Griffith, in his lecture on "Shot Gun Patterns," dealt with the subject of balling, and his remarks have deservedly been quoted as those of a standard authority. The large amount of ground covered by his lecture naturally left him but little space to deal with a question which alone would provide the material for a long discourse.

The following is practically all that appeared in his lecture on this important subject beyond references to the different conditions under which balling is likely to occur:—

"Now a word as to BALLING or CLUSTERING. This arises "from one or two causes.

"1. By *welding* of the shot. This is caused either by "violent impact against the wad, or the turnover, or the cone, "or from violent powder, or from an over load. When "arising from these causes it may often be cured by using a "softer wad, so as to provide a kind of spring to break the "blow. It is also caused by using too long a case in the "chamber, the shot being jammed together.

"2. By *fusion* of the shot itself. This is caused by the "hot gases of the powder combustion getting past the wad "and among the pellets of the shot, either from too loose a "wad, or from too long a chamber. A tighter wad will often "cure this in the first case, and a more elastic wad in the "other case. The elastic wad swells out, as is shown here, "and stops the passage of the gases.

"This balling is more found with the cylinder guns than "with the chokes, the constriction in the latter breaking up "the mass of shot somewhat, and producing clustering rather "than balling. I have traced it sometimes to the fact that the "actual bore of the cylinder is larger than that of the choke, "though of the same nominal figure."

What we propose to consider are the conditions under which the pellets of shot are formed into more or less compact masses. Balls or discs consisting of welded shot naturally fly further than individual pellets, owing to the fact that the proportion between weight and air surface gives the balls an advantage by virtue of their increased capacity to overcome air resistance. The two-fold object of preventing balling is, therefore, to limit the danger zone of the shot gun to the range that individual pellets will fly, and to get rid of the inevitable bad patterns which are associated with balling.

It will be seen that Mr. Griffith draws a distinction between *welding* and *fusion* of the shot. The result is, of course, the same. By welding we presume that Mr. Griffith refers to a state of affairs in which the shot are pressed together with such force that the most intimate contact is established between the particles of the previously separate pellets, and that the two become one. That lead may unite in this way is well-known. It is a favourite experiment in metallurgical lectures to press two smooth, clean surfaces of lead together, so that it requires some considerable force to overcome the adhesion so established. The conditions of this laboratory experiment preclude the introduction of heat as an element in the welding of the lead; but in the case of a charge of shot fired from a gun this condition cannot be considered as excluded, even in the cases where the heat of the powder gases is insulated from the shot.

The deformation of the shot pellets to the extent necessary to bring their adjoining surfaces into contact necessitates a large amount of rearrangement of the particles of metal forming the mass of each pellet. This deformation progressively effected over 24 hours would not create an appreciable amount of heat, but concentrated as it is over say the two-hundreth part of a second, there is no time for the dissipation of the heat produced by the friction, and consequently the heat accumulates throughout the mass of each pellet. The friction is set up between the atoms forming each pellet of shot as well as on the surfaces of the separate pellets due to the friction of one against the other. In this form of friction we, therefore, have a condition under which heat is produced throughout the mass of the pellets, and consequently the friction has only to produce a sufficient quantity of heat in order to cause partial or complete liquefaction of the shot pellets. If a piece of flat elastic is suddenly stretched, its rise of temperature, due to internal friction, is apparent on pressing the elastic to the face. If the elastic is stretched slowly the heat is less apparent. In the same way any sudden alteration in the form of a mass of shot creates heat, varying in intensity with the force applied, and with the suddenness with which the force acts.

That lead will melt when subjected to sudden impact may easily be proved by firing a ·303 bullet through a piece of boiler plate. This experiment should, of course, be carried out with proper safeguards for the protection of the shooter

from the backwardly-flying jacket of the bullet. One frequently finds in this experiment lumps of freshly melted lead, which no one attempts to pick up in the fingers after a first experience. This experiment conclusively proves, if proof be needed for such an obvious fact, that a suitably violent impact of lead against a resisting surface will produce sufficient heat to raise the lead in a fractional period of time to melting temperature.

We cannot investigate with any exactitude the precise amount of friction set up in the deformation of shot in the act of being expelled from a gun, nor the amount of heat generated by that friction. But certainly, on the other hand, neither do we know enough to exclude it as a contributory cause to the welding of shot in the gun. Rather do the circumstances point to the heat set up by friction as a very important factor in the balling of the shot.

With regard to the fusion of the shot itself by the action of the powder gases which have got past the wad, we have again a set of circumstances where exact enquiry is difficult, if not impossible, and where intelligent theory must work hand in hand with practical experiments. Again, taking the two-hundredth part of a second as the time that the shot is subjected to the conditions bringing about balling, we may proceed to consider the effect of a high temperature rush of gas among the shot for such a period, although, as a matter of fact, the time is probably far less.

A pellet of shot will melt in an ordinary Bunsen flame in a few seconds. An ordinary rule-of three calculation will show that the heat of the powder gases cannot by simple contact with the shot effect their fusion in the limited time during which their influence is exerted, even if allowance be made for the greater heat of the powder gases as compared with that of the Bunsen burner. We know that when powder gases pass between two surfaces of metal, as in the case of a bullet in a rifle barrel, they tear or burn away the metal at a pace corresponding, relatively to the duration of their action, with the effect of a jet of boiling water on ice. This effect is largely mechanical, and hardly fulfils the conditions of gas rushing among a charge of shot.

For shot to be raised in temperature by the application of hot gases, the outer layers must first be heated, and the heat must be conveyed by conduction to the interior of the pellet. Metal only conveys heat at a given pace, and the pace cannot be forced. If the gas flame were to tear away the outer surface of the pellet, then it might heat the interior of the pellet, but by so doing the pellet would no longer be intact.

One may overcome the inertia of a mass of given weight so as to set it in motion at various speeds; the greater the force which is applied, the quicker the resulting displacement. But heat travels along metals at its own pace, and there is no forcing this pace by the use of high temperatures. Consequently, unless we can show that gas of a given temperature is in contact with the pellets of shot a sufficient time to raise them to the melting point through an appreciable distance from their surface to their interior, we must look with a certain amount of suspicion on the theory of gases melting shot. What may be the mechanical effect of the gases among the shot is more difficult to establish, beyond the fact that a plausible theory to account for balling is unlikely to be the result.

Dr. Dupré recently attended a lecture where the testing of blasting explosives was discussed. It had been suggested that a cannon, in imitation of a bore hole, would absorb the heat of the gases, and so reduce their temperature, and consequently their capacity to ignite a coal gas mixture of air. Dr. Dupré is one of our most talented and most cautious investigators of explosive phenomena, and yet in the most unmeasured terms he condemned the above theory as absolutely untenable. He quoted Major Holden as having proved "that no appreciable cooling took place, and the supposition might be dismissed, for it took several seconds before the metal could have any such reducing effect." It is but a short step to apply this rule to the melting of lead pellets by the contact of powder gases, and to be equally clear that the time is not sufficient for the lead to be fused.

To those who wish to conduct investigations into the balling of shot charges, we would recommend the firing of charges of shot vertically downwards into water. A vertical range of ten yards, and a tub of water some three feet across, is all the apparatus required, beyond a sieve some twelve inches under the surface to collect the pellets. With cartridges specially loaded to ball we have obtained the most interesting results. Plenty of pellets fused together was the result of firing some fifty shots, and an amount of deformation of individual pellets, which would presumably account for the wildest of patterns. It seems unlikely that the impact with the water causes this deformation, since the pellets, in most cases, show some six or so depressions fairly evenly distributed over their surface, and these could not all have been caused by contact with the water. They indicate a compression of the pellets against one another, the roundness of the cavities supporting this theory. Without pretending to have carried out any but the most superficial of tests, we think that sufficient has been shown to indicate a more scientific way of testing for balls than firing against iron plates, a form of experiment which precludes all examination of the shot in the condition in which it flies in the air.

In the earlier part of this article we have referred to Mr. Griffith, and, considering that he has recovered shot fired vertically in the air up a tube, and has also fired into slabs of paraffin wax of low melting point, and afterwards extracted the shot, it would be interesting to hear a more detailed exposition of his views than those quoted above. We fear that our contemporary, the *Field*, is a little prone in these matters to jump to conclusions. For instance, it may be right or it may be wrong in assuming that a splash on the target is caused by several stringing pellets happening to strike at about the same place. Proof would be more satisfactory than dubious assumptions in such matters, and the leading authority should be more painstaking where proofs are so easily obtainable.

Summarizing our own observations, and also those of others whom we have consulted, we may indicate that there is a good deal of evidence that balling is due to the violent concussion of the charge of shot against itself, and that this concussion or impact can be promoted in a variety of ways, and that it may also be counteracted in a variety of ways. The harder the shot, and the more gradual and free from concussion its transition from a state of rest to one of rapid motion, the less likely is balling. Stated in this form, the conclusions read like axioms, but the ultimate lines of all experiments must be based on careful examination of the shot pellets in the condition in which they leave the muzzle of the gun, and the determination of those conditions of powder, wadding, shot,

and gun, etc., which reduce the tendency to balling to a minimum.

As regards the more theoretical question as to the actual cause of balling, it should be remembered that the shortness of the time during which the shot is being expelled from the barrel is all in favour of assigning the existence of the heat which contributes to balling being due to friction, and all against its arising from a leakage of hot powder gases among the shot.

NOTES.

CO-OPERATIVE GUNPOWDER.—The action of what we may now term Messrs. Curtis's & Harvey, Ltd., late the gunpowder amalgamation, in raising the price of gunpowder, has brought up the question of starting a co-operative gunpowder factory in Northumberland. This county, owing to the character of its coal mines, uses an exceptionally large proportion of gunpowder, as compared with other explosives. Further, the system of co-operative stores for retailing the powder has grown up, and consequently its distribution is largely controlled by the miners themselves. At the present time, there appears to be a difficulty in getting the various powder funds, as these co-operative stores are called, to agree as to a scheme for starting a factory. Naturally, the difficulties of the scheme have been fully set forth in the local press; but the miners hold to the view that, if the consumption of powder in Northumberland could be turned over to the proposed factory, its success would be assured. We hardly think that the miners have yet realised what the existing trade could do in the way of opposition. When a rival in trade starts business in the United States, the older firms who wish to crush the new-comer adopt a policy which is known as giving him a run for his money. Over here we have the system, but not the phrase. It consists in starving out the new-comer by local reductions of price. This latter may be what the miners desire; but, when all things are taken into consideration, it may appear that the unprofitable running of a gunpowder factory may be an expensive way of reducing the cost of a barrel of powder by three shillings.

KYNOCH ESTATE CO., LTD.—The opening up by Messrs. Kynoch, Ltd., of land in the neighbourhood of Stanford-le-Hope, Essex, by the erection of their new factory, has naturally led to an enhancement of the value of property in the district. The Company have had the good sense to reserve for their shareholders a portion of the benefits resulting from their enterprise, and they have accordingly purchased building sites in the neighbourhood of their works, which could be developed with advantage by way of erecting houses and cottages for the accommodation of their staff and employés. In order to do this the more effectively, a company, with £30,000 capital, has been formed to develop these estates, particulars of which are given in the prospectus which has been issued. It appears that the Company will also take over a brick works capable, not only of supplying the bricks required for building the necessary property, but of producing a surplus which, at the present high prices bricks are now fetching, should find a ready market, particularly when the advantage of proximity to the river is taken into account. We understand that the capital of the Company was subscribed for several times over by the shareholders of the parent concern.

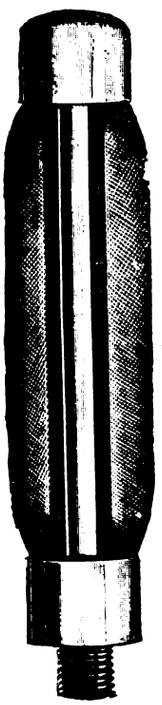
A NEW COLT REVOLVER.—We understand that the Colt's Patent Fire-arms Manufacturing Company have recently introduced a new double-action revolver of ·455 calibre for taking the English Government cartridge. The construction adopted is the well-known Colt jointless frame with side-swinging cylinder, which allows for the simultaneous ejection of the cartridges. It has been specially designed to meet the wants of officers and others requiring a reliable weapon for use at close quarters. The mechanism only contains three springs. A great feature in the design of the weapon is the special locking of the cylinder in its place at the moment of firing, so insuring the perfect alignment of the cylinder chamber with the barrels. The entire arm consists of thirty-four parts, and these have been manufactured on the interchangeable system, so that spare parts may be purchased to replace those injured or broken by rough usage. For a long time the Colt Company have been urged to apply their system of revolver to the English service cartridge, and we are very pleased to note that they have finally decided to take the advice of their customers.

THE WESTLEY RICHARDS ANNUAL DINNER.—The employees of Messrs. Westley Richards & Co., Ltd., held their 86th annual dinner at the Midland Hotel, Birmingham, on Saturday, the 21st ult. There was a large attendance, and Mr. Leslie B. Taylor, secretary and manager of the Company, occupied the chair. The toast of the firm was suitably proposed by a veteran worker, Mr. J. J. Newham, who has been in the employ of the Company for over half a century. Mr. Leslie B. Taylor, in replying, referred to the fact that by this time next year they would have left the old premises at 82, High Street, since it had been decided to quit the scene of the foundation of the firm's fortunes, in order to take up the work in larger and more commodious premises at Bournbrook, near Selly Oak. These works had been fully equipped with the latest appliances in the way of modern machinery and so forth, all of which had been designed to facilitate the production of the high-class work associated with the name of the firm. During the course of the evening other toasts were duly honoured, and an excellent musical programme assisted in passing a very pleasant evening.

AMMUNITION LEAKAGE IN INDIA.—With a view to preventing the loss of ammunition issued to the troops in India for target shooting, the following regulations have been put into force, the idea being to prevent the theft of cartridges and empty shells by natives, from whom they may pass into the hands of unfriendly tribes on the frontier:—"(*a*) A British officer will always be present at the issue of ammunition from the magazine; (*b*) the exact number of rounds issued and the surplus returned, with the empty cases, are to be checked by an officer on each day of issue; (*c*) 'missfires' are never to be thrown away, but returned for the purpose of being forwarded to the Ordnance Department, and to enable the expenditure of ammunition to be checked; (*d*) no ball ammunition is to be issued to the men in the lines or barracks. The ammunition is to be taken out in bulk and issued on the range or ground where practice is to take place; (*e*) after all

practices each man will return unfired cartridges or empty cases equivalent to the number of rounds originally issued to him, and the officer responsible for the issue will invariably note on the ammunition indent, or make a written report, that he has received back either cartridges or empty cases equal in number to the total rounds issued; (*f*) officers superintending practice are held responsible for any deficiency in the number of cases and unfired rounds returned. At some practices, field-firing, for instance, there may be some little difficulty in collecting cases, but if the men are cautioned beforehand, and the officers insist on it, there is no doubt that every case or unfired round can be collected."

THE TOMLINSON CLEANER.—We give an illustration herewith of the Tomlinson cleaner for shot guns, the sole European agency for which has been granted to Messrs. McCarthy, Buck & Co., who trade as the Wholesale Arms and Ammunition Trading Company, of 40, St. Andrew's Hill, London, E.C. The cleaner is made in all gauges from 8 to 20 bore. The principle which has been adopted in the construction of this cleaner is one that enables it to clean any gun, no matter what system of choking has been adopted. It consists of two pieces of wood wrapped over with wire gauze, the surface of the gauze being pressed into close contact with the barrel by springs underneath. The gauze positively removes all accumulations of fouling and leading in the barrel, but at the same time it is not sufficiently hard to injure the bore. The cleaner should be inserted at the breach, and should not be allowed entirely to leave the barrels at the muzzle. A little oil on the cleaner assists in the removal of the dirt, and after use the accumulations on the wire gauze may be shaken out by giving it a slight jar. The complete cleaner is sold retail at 4s. 6d. each, including two extra slides, and spare slides for renewing the worn gauze may be purchased at 6d. a pair, all subject to a liberal wholesale discount.



THE GAUGING OF SHOT GUNS.—Recently we thought it would be of interest if we could ascertain whether there was any system of placing a gauge inside a gun barrel and reading off the diameter in thousands of an inch on the ordinary system of the screw micrometer. We know, of course, of the Allport gun barrel gauge, but unfortunately these gauges are no longer made, while those in use have become so worn as to require a special calculation to translate their nominal measurements into actual readings. The principle adopted is that of a tube which is passed inside the barrel, having two steel pins, which project from holes on opposite sides of the tube. These pins are advanced outwards by the working of a screw at one end of the tube; and the inside diameter of the barrel at the place where the measurement is being made is shown on a scale outside the barrel in much the same way as with the ordinary micrometer. We explained these facts in a letter which we wrote to the Brown and Sharp Manufacturing Co U.S.A., the well-known makers of the best type of outside measuring micrometers. We asked them whether they had any gauge which would serve the required purpose, and if not whether it would be worth while for them to construct one specially suited to the requirements laid down. Unfortunately they replied to us that after a careful consideration of the matter they did not feel themselves in a position to recommend anything which they could undertake to manufacture either in large or small quantities. This suggests that the production of such an appliance is one of considerable difficulty, and it looks as though nothing but plug gauges will be of any avail, and even here difficulties occur. A certain number of plugs hardened, ground, and manufactured exactly to size, will no doubt determine whether a gun barrel is larger or smaller than a certain plug; and though a number of different plugs, all exactly made to a series standard sizes, would serve many useful purposes, it still seems that there is a good opening for a screw having a larger range of work. Of course an ordinary pair of callipers slid inside the gun, and reading outside by means of an indicator arm working over a scale, allows rough measurements to be taken, but there is no comparison between this and a really finely constructed screw micrometer, which would give direct readings in thousandths of an inch. There is a limited demand for some such appliance, but we wish the demand were sufficient to justify some manufacturer in tackling the problem. We know of one case where a leading gunmaker paid a large sum of money simply for the drawings of a gauge which he had satisfied himself fulfilled the necessary requirements, but we have not heard the result of his outlay.

PERRANPORTH RIGHTS OF WAY.—In reference to the right of way dispute as to the right of the public to the unrestricted use of certain land, which Nobel's Explosives Co., Ltd., sought to enclose for the extension of their explosives factory at that place, a note referring to which appeared in our last issue, his Honour, Judge Granger, delivered an important judgment, which has a strong bearing on the interpretation of the Explosives Act in relation to the enclosure of ground. In opening, he stated that the defendant and one or two of the witnesses acknowledged that they signed the petition to the local authority asking them to allow the establishment of the factory. It was clear, therefore, that the plaintiffs had the right to protest against the change of front on their part, but he could only deal with the case under its legal aspect. Certainly in 1892 it was welcomed by the Perranporth people as affording well-paid work, which, owing to the shutting up of the mines and the decline of the fishing, was much wanted. He had come to the conclusion that there was sufficient evidence of use to justify him in reasonably inferring that it was the intention of the owners of the land to dedicate a path from Perranporth to Cliggar Head, and a path from Perranporth to St. Agnes. The defendant also claimed, as an inhabitant of Perranporth, the right, by custom from time immemorial, to walk on the land for exercise. Even if the evidence satisfied him, which it did not, that all the population of Perranporth had been in the habit of strolling generally about this cliff, that would confer no right of user. He had to consider whether the highway

was still in existence. It was a maxim, "Once a highway, always a highway." For the defence, Mr. Terrill argued that the right was saved by Section 102 of the Explosives Act, even if he, the judge, came to the conclusion that it was taken away by implication by earlier section. If he concluded that the right of way was saved by that clause, it was quite clear that such clause was entirely repugnant to the body of the Act, and therefore void. The whole intention of the Act was to keep people from trespassing in a factory, and nothing could well be more repugnant to such an intention than a public right of way. He thought that when the Legislature clearly and distinctly authorised the doing of a thing which was physically inconsistent with the continuance of an existing right, the right was gone. Though in this case there was no special Act of Parliament, he had come to the conclusion that by the licence granted upon the terms of the Explosives Act, the right of way from Perranporth to Cliggar Head and to St. Agnes had been taken away by implication. The inhabitants of Perranporth made no objection in 1892, when the greater portion of the footway was enclosed, and in 1897 they could, had they cared to do so, have objected, and saved what was left of the footpath. He gave judgment for plaintiffs, but stayed execution for one month, as he thought, considering the important questions of public interest raised by the case, there should be an appeal, and if asked he would grant leave. It will be an interesting case should the defendants elect to carry their claims to a higher court.

HEAVENITE.—Among prejudiced persons in this country there is a feeling that exaggerated narratives mostly hail from America. As a matter of fact, one need not go beyond the quasi-scientific paragraph writers of our daily press to find examples of tall stories, which would not disgrace the author of "Gulliver's Travels." That America does not universally endorse the tall stories of local production is shown in the manly criticisms by our New York contemporary, *Shooting and Fishing*, with reference to a supposed new explosive known as "Hellite." A paragraph went the rounds of the press to the effect that "several persons, wishing to test 'Hellite,' repaired to a stone quarry near New York, and finding a place where dozens of holes had been drilled in the solid rock to receive the sticks of giant powder, gave the drillers two dollars for the privilege of exploding a charge of 'hellite' in one of the holes. The foreman assented, the charge was placed, and an electric fulminate fuse inserted; spectators and workmen retired to a safe distance. The button was pressed, and this one charge of 'Hellite' sent fifty tons of rock from the cliff to the quarry bed with not noise enough to frighten a rabbit, a few ounces of 'Hellite' doing the work of twenty sticks of giant powder." Then continues the writer:—"By way of contrast, 'Hellite' was fired from a Winchester repeating rifle and a Winchester six-shot shot-gun at prepared targets. One-sixth of the quantity of 'Hellite' nearly doubled the maximum service of black powder in all three of the tests made. There is no resultant smoke, and even the guns built for the lighter explosives were not strained. Perhaps it is not necessary for us to follow our contemporary in proving the fallacies of the supposed powers of this explosive. Perhaps, relying upon its name, the author thought fit to consider it endowed with miraculous properties.

NEW EXPLOSIVES ORDER.

The *London Gazette* of the 6th ult. contains the following Order of the Home Secretary relating to the carriage of black and nitro-powders in the same outer packing case, and also to the packing of pin-fire cartridges, etc. :—

ORDER OF SECRETARY OF STATE modifying the General Rules as to the Packing for Conveyance of Gunpowder, and of Explosives other than Gunpowder.

WHEREAS by Part 1. (section 33) of the Explosive Act, 1875 (in this Order referred to as the Act), General Rules are set forth to be observed with respect to the packing of gunpowder for conveyance:

And, whereas by the said section 33 it is enacted that the Secretary of State may from time to time make, and when made repeal, alter, and add to, rules for the purpose of rescinding, altering, or adding to the General Rules contained in this section, and the rules so made by the Secretary of State shall have the same effect as if they were enacted in this section:

And, whereas, in pursuance of the Explosives Act, 1875, an Order of the Secretary of State (known as Order of Secretary of State No. 3) was made on the 27th day of November, 1875, adapting the General Rules relating to the packing of gunpowder contained in Part 1. of the Act, to the packing of explosives other than gunpowder; and, whereas by section 83 of the Act, it is provided that a Secretary of State may by Order, from time to time revoke, add to, or alter any previous Order of Secretary of State:

Now, therefore, in pursuance of the powers aforesaid, I, one of Her Majesty's Principal Secretaries of State, hereby order as follows:—

I. Notwithstanding anything in the said section 33, and the said Order of Secretary of State No. 3, contained, it shall be lawful to enclose inner packages containing authorised small arm nitro-compound with inner packages containing gunpowder, or with inner packages containing another authorised small arm nitro-compound in the same outer package, provided

(*a*) That the total amount of such gunpowder and small arm nitro-compound contained in any one outer package shall not exceed 50 lbs.; and

(*b*) That every such outer package shall be marked as required by the said Act and Order of Secretary of State separately, in respect of such explosive contained therein.

In this Order, the words "Authorised Small Arm Nitro-compound" shall be deemed to mean nitro-compound adapted and intended exclusively for use with small arms, authorized to be manufactured for general sale for the time being.

II. Notwithstanding anything in the said Order of Secretary of State No. 3, contained, the amount of guncotton, when mixed with sufficient water to be absolutely uninflammable, contained in any one inner or outer package, may be unlimited.

III. There shall be appended to part E, Rule 1, of the said Order of Secretary No. 3, the following provisos:—

Provided—

(*a*) That in the case of pin-fire cartridges for pistols, the said cartridges shall be so packed that the bases lie alternately in opposite directions, and the bases and pins shall be so fitted into perforations in mill board, or other suitable material, as to prevent the firing of any one of

the said cartridges by an explosion of any other of the said cartridges.

(*b*) That when the number of the said cartridges exceeds 50, they shall be packed in an inner and outer package, the inner package containing not more than 50 of the said cartridges; and

(*c*) That in addition to the marking required by the said Order of Secretary of State, No. 3, every outer package containing the said cartridges, there shall be affixed in conspicuous characters the words "Pin-fire Cartridges."

MATTHEW WHITE RIDLEY.

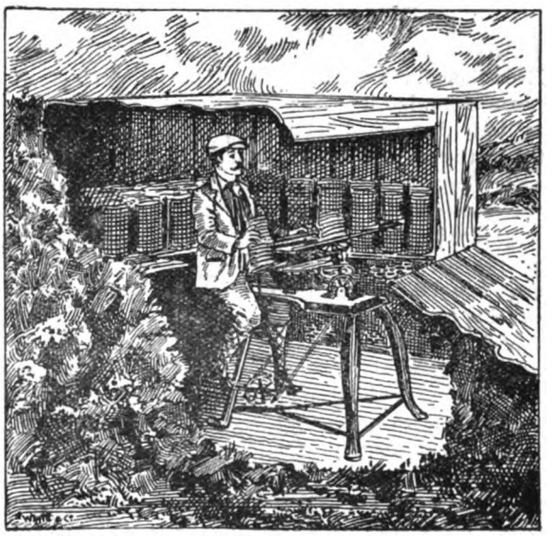
THE REPAUTRAP.

WE referred in our last issue to the demonstrations of the Repautrap, which had previously been given in Birmingham, and we are pleased to say that, since then, this repeating automatic trap has been exhaustively tested in London, with the result that it has earned golden opinions from all practical shooters. It looks as though this trap will revolutionise clay-bird shooting in this country, in much the same way as the Magautrap has done in the United States. The Magautrap works on a different principle from the Repautrap. The impulse for throwing the birds from the Magautrap is directly obtained from the working of the bicycle pedals, so that the speed of the birds depends upon the pace of pedalling. This is open to the objection, from the point of view of inanimate bird shooting clubs, that birds can be rendered easier or more difficult at the will of the operator. The Repautrap gets rid of this objection by throwing the birds by the impulse of a spring, so that it is the strength of the spring, and not the speed of pedalling, which regulates the flight of the bird.

The Repautrap promises to make an incalculable difference to the development of clay-bird shooting in this country. At the present time, enjoyment to be derived from club shooting is largely dependent upon the expenditure of a large amount of money in the equipment of the ground, and those clubs which elect to do the thing on a more economical basis are greatly hampered by the slowness of the shooting, and the general lack of interest in competitions conducted at slow measure.

The best equipped clubs, of which the Middlesex Gun Club is the premier example, have got over these difficulties by building a trench from which fifteen traps may be filled as soon as they have been discharged. In this way the shooting goes on at a pace which is untouched by installations where there is no trench, even in cases where there is a boy for filling each trap, and a proper system of relief enabling the work to be continued at high pressure. But even in the case of a trench there is sometimes undue delay if broken birds are at all prevalent. It may, for instance, happen that a shooter fails to get a proper bird, and the shooting has continued down the line while the faulty traps are being refilled, so that after the round has been finished, the shooters are kept waiting until a proper bird has been thrown. The instant reloading of the Repautrap enables a broken bird, if such occur, to be instantly followed by a good bird.

The Repautrap replaces the whole of an ordinary installation of fifteen single traps, and as there is every prospect that these traps may be obtained on hire for £5 the first year, and £2 for ever year after, it is evident that a considerable reduction in the first cost of a club equipment will be possible. The Repautrap admittedly entails a certain amount of expense in fitting up, but there is hardly any comparison between the cost of a 25 yard trench and a hole some 7 feet square and 3 feet deep. This latter serves for the accommodation of the Repautrap, and no further expense is entailed beyond the building of a little house over the hole, so as to protect the trap from the weather. Roughly speaking, an expenditure of some £10 or £15 would be sufficient to pay the first year's hire, and also to instal a Repautrap, as compared with the £50 or £60 necessary for the erection of a trench, and the purchase of a set of traps. Further than this, it should be remembered that many landlords, who would object to the cutting of a trench on their ground, would not have any objection to a compact little house, which would not endanger their cattle in those cases where land were used between times for grazing purposes. In the same way it would be easier to get permission to erect a repautrap on ground hired for a short term than to cut a trench. Another convenience arising from the use of a Repautrap would be



THE REPAUTRAP AT WORK.

that the house could be fitted with shelves so as to contain a stock of some 5,000 birds. Also the time and expense of maintaining fifteen traps in order, together with the even more complicated adjustment of the pulling apparatus, would all be saved, since the Repautrap, properly housed and fixed, would not be likely to get out of order, and would be at all times instantly ready for use, so much so, that there would be no difficulty in throwing the first bird thirty seconds after the door had been opened. In the working of the trap, equally important economies would result. At present it requires at least three boys to keep an ordinary set of traps refilled, while one alone could work the Repautrap. Shooting also would be more quickly carried through, so that whatever profit accrued to the club on the birds would be increased by the greater consumption.

Coupled with the introduction of the trap, we understand that there is a prospect of getting birds in this country which will sell at prices considerably lower than those at present on the market. Taking, therefore, the birds as in future purchasable by clubs, and delivered on their ground at 28s.

per thousand, it looks as though the birds could be trapped at a very nearly equal profit to the club, on the charge of ½d. each, as compared with the present conditions at twice that amount. We have shown this comparison in a few figures which, we feel sure, do not exaggerate the case in favour of the new trap and birds.

700 Birds thrown from Ordinary Traps in one afternoon.

	£	s.	d.
Cost of Birds to Club, at 5s. per 100	1	15	0
Services of Puller	0	4	0
Services of three boys for trapping	0	10	6
PROFIT ON BASIS OF CHARGING 1d. PER BIRD..	**0**	**8**	**10**
	£2	18	4

1,000 Birds thrown from a Repautrap in one afternoon.

	£	s.	d.
Cost of Birds to Club at 28s. per 1,000	1	8	0
Services of Puller	0	4	0
Services of boy for trapping	0	4	0
PROFIT ON BASIS OF CHARGING ½d. PER BIRD..	**0**	**5**	**8**
	£2	1	8

Even though the actual profit on the afternoon's working appears somewhat less than in the case of birds at 1d. each, it is likely that the difference would be more than counteracted by the reduced initial charge in equipping the ground, since it is certain that in one form or another the equipment of the ground would be a permanent charge on the members. As regards the flight of the birds, the Repautrap admittedly gives just as good sport as the full equipment of ordinary traps. Instead of the shooters being arranged in a straight line facing the row of traps, they stand in a slight circle, so that each faces the centre trap, and the variety of angles is quite equal to anything obtainable on the ordinary system.

The working of the trap is extremely simple. Our illustration shows it to consist of a table on three legs. The operator sits on the bicycle saddle at one end of the table, and works the pedals continuously while the shooting is proceeding. The rotation of the pedal spindle is communicated to a horizontal shafting under the trap by means of a bicycle chain. This shafting is geared on to a toothed wheel, which is constantly revolving. When the trap is sprung, an automatic clutch locks the arm on the revolving toothed wheel, and the arm is carried back until it passes the pulling catch, which retains it in the set position. The clutch is then automatically thrown out of engagement, and the trap is ready for throwing another bird. In order to allow for constantly changing the angle of the birds thrown, the whole trap is constructed so as to oscillate in a horizontal plane. One end of the trap is connected to a crank gear, which is constantly in motion, and in consequence the trap is continuously changing the radial angle at which it throws the bird. A shelf above the trap serves to contain a supply of birds ready for feeding into the trap. The birds are laid on an inclined slide, from which they slip down into position for being picked up by the hand of the trap when the arm is automatically set. All, therefore, that the operator requires to do is to keep up a continuous rotation of the pedals, and at the same time keep the slide full of birds. The trap is capable of throwing birds at a great pace, amounting, if necessary, to eighty a minute. In this way it is possible to throw double-rise birds with such a short interval of time between their flight that both are in the air almost at the same moment. In the illustration there is also shown a section of the house in which the trap is installed, and from it a clear idea may be gained of the method of operating the trap for club shoots.

We believe that it is well known in the trade, and among shooters, that a Company is likely to be formed for the purpose of purchasing a number of these traps, and putting them out for use among clubs at favourable terms of hire as noted above. Of course, the arrangements of such a company are not at the present time so far advanced that it will be possible to go into details, but at the same time there is every reason to anticipate that the best interests of the sport would be served by such a Company, and that the interests of the trade would naturally be favourably affected by anything which promises to lead to increased business.

The trap has been introduced into this country by Mr. Paul North, of the Cleveland Target Co., U.S.A., who are the owners of the patent and the manufacturers of the trap.

MR. GUTTMANN ON SAFETY EXPLOSIVES.

MR. OSCAR GUTTMANN delivered a lecture, on the 2nd ult., dealing with safety explosives; and, as is usual with him in dealing with a burning question of the day, his work was characterised by deep research, and philosophical consideration of divergent results and views.

Unfortunately, one might as well try to make a digest of an encyclopædia as attempt to express in a limited space the material of one of Mr. Guttman's lectures. He is a man of concentrated essences, so that any general expression of his teachings is either not complete enough to be conclusive, or is so general as to be too obvious. To the text of the lecture itself we must, therefore, refer those of our readers whose daily work leads them to take an interest in safety explosives; and it will, in due course, be found among the printed transactions of the Society of Chemical Industry.

Mr. Guttman's lecture dealt chiefly with the steps which had been taken by our own and by foreign governments to determine certain conditions of testing which would enable them to select for use in coal mines such explosives as would combine with proper efficiency to perform their work a minimum risk to the miner. Even in defining the risks against which the test should provide, there is opening for serious difference of opinion. In some cases it is held sufficient if an explosive when properly tamped shall be unable to ignite explosive mixtures of air. Others hold that this is not sufficient, and that an explosive should also be safe when untamped. Then, as regards the quantity of explosive to be tested, some hold that the behaviour of a small charge provides sufficient analogy for determining the degree of safety of the same explosive in larger quantities.

The arrangement of the testing station or trial gallery is a problem providing openings for the most divergent of practices. Some have galleries with a comparatively large cross-section; others think a flue about a third the size is sufficient. The nature of the explosive mixture, whether coal gas or pit gas, has to be determined. And when all this has been settled, and a means provided for reducing explosives of different character to a common denominator of standard explosive

value, then it is necessary to decide what shall constitute a favourable and what an unfavourable result.

All these things Mr. Guttmann laid down with complete details as to the practice of the different testing authorities, and the considerations upon which the different tests had been established. The result is, that while coal mines are much the same all the world over—anyhow, their characteristics do not vary with nationality—the rules laid down by each country for the protection of the miner against the preventible risks of his calling are contradictory in the extreme. An explosive which is allowable in one country, would not be permitted in another, owing to some difference in the tests enforced. In the course of the discussion following the lecture, fresh suggestions were made for the further limitation of permitted lists, such, for instance, as that an explosive subject to explosion by shock should be disallowed. The new oxalate of ammonia cartridge was objected to because it gave the miners sore throats, while another cooling salt was objectionable because of the nasty smell of its fumes.

We must look upon this lecture as a careful sorting out of all available material on the subject of safety in the use of explosives in mines. In a sense, it is a gathering up of the limbs prior to another spring. So far a large amount of independent work has been done by experimentalists in different parts of Europe, and there is a want of concordance in their results, arising from their not having been in sufficiently close communication. Mr. Guttman has done good service in devoting his time and his linguistic knowledge to acquiring a proper understanding of what has been done, and further of applying his knowledge on these subjects to the indication of the lines in the direction in which future research should be concentrated.

The concluding paragraph of his lecture shows that he, at least, is under no misapprehension as to the inconclusive state of our present knowledge. We quote his words in full:—

"If I attempt to summarise my paper, you will be struck by the uncertainty that prevails on almost every question. An explosive that will not fire if used in large quantities, or under all conditions in the mine, has not yet been found. Opinions differ still as to the kind of gas mixture to be used for tests. The quantity of explosive that can be allowed as a maximum has in no case been found with anything like accuracy, nor are experts unanimous as to what is a safe quantity for a test. The questions whether the explosive should be tested freely exposed, or confined in the bore of a cannon, and whether stemmed or unstemmed, continue to be the object of discussion. The influence of coal dust in gas mixtures is still contested. The *rôle* played by "flame-extinguishing" additions is not sufficiently elucidated. Thus there are many more disputed points, and yet I have given you only some rough outlines of the present notions in this peculiarly complicated, because not always open, field of research."

In the course of the discussion some very interesting views were expressed, in some cases not so much connected with the scientific basis of the experiments as upon the light in which they should be regarded by users of explosives. Capt. J. H. Thomson, H. M. Inspector of Explosives, who was an interested member of the audience, was a case in point. In referring to the Woolwich testing station, he gave the following clear exposition as to the views of his department on the ground covered by the tests, as he desired to prevent exaggerated ideas as to their finality from being held:—

"He said that while avoiding controversial questions on which he could hardly expect that his own opinion would carry much weight, he thought it only right to say a few words about the Woolwich testing station, referred to by the author. The Coal Mines Act was passed in 1896, and the Secretary of State was empowered to prohibit certain explosives for use in coal mines. It was soon found that this was practically impossible, for if an explosive were put on the prohibited list, it was only necessary for somebody to alter the composition of that explosive, and it immediately became another body, called by another name, and could be used accordingly. A way out of the difficulty was found by first prohibiting all explosives, and then permitting the use of some of them. Thus they got a permitted list of explosives, of all of which the Secretary of State was required to know something, and so it became necessary to establish a testing station. In establishing it they followed the lines of a testing station used in Northumberland by an institution of mining engineers, but with certain modifications. They started on the assumption—confirmed in the paper before them—that an explosive mixture of coal gas and air would be more inflammable than any mixture of marsh gas and air, or coal dust and air. In testing, they did not attempt to imitate the conditions of a coal mine, for this was impracticable, but considered it of greater importance to have a test uniform in its action, and at the same time capable of distinguishing between the power of inflaming gaseous mixtures of various explosives. Then they determined to fix a line of inflammability above which explosives might be permitted, but the Secretary of State never attempted to certify that any particular explosive was a safe one; all that the permitted list implied was, that any explosive in it was safer than one which had failed to pass the test. They found, as anticipated, that no explosive was safe for a test of coal gas and air if fired without stemming, nor did he think that it should be expected to be. An explosion which was doing no work in many cases exploded in a different way to what it would in actual practice; some quick explosives might produce the same products whether fired with stemming or without, but the slower ones would not, and might be so imperfectly consumed in detonating without stemming, that the products would take fire on coming into contact with the air. Therefore, stemming should be used in every case. Then the question arose, what kind of stemming? At that period but little was known about the effects of stemming, and some of the results were surprising. They first tried wet clay, but they found that it was so difficult to obtain it always in the same condition, that it was an unsuitable body for the purpose, though all explosives were very safe if it were employed. They then tried dry clay, and got anomalous results, which led them to determine the moisture present in dry clay, with the result that they found it varied greatly, and that the amount of moisture, even when it did not exceed 5 or 6 per cent., had very remarkable effects on the test, and that even small quantities of moisture might render an explosive much less liable to inflame a gaseous mixture. There was also great difference in the binding power of the clay, owing to the presence of sand. They next tried an artificially dried pottery clay of fairly constant quality, and that was the clay

now employed. They always employed the same length of stemming recommended by the mines inspectors as the minimum to be permitted. Mr. Guttman had hinted that the Woolwich test was an easy one; he admitted that it was, for the Home Office did not want to confine mine-owners to the use of just a few explosives, lest manufacturers should form a ring and put the users in difficulties. Possibly, however, at a future date, it might be necessary to make the test somewhat more strict. The large number of explosives which got through it was partly due to the fact that much greater care was now taken in manufacture, and he was not afraid that that care would be relaxed because the explosive was on the permitted list, for they had a system of taking samples from time to time, and repeated the test of them. The Home Office had had a large number of suggestions from time to time, some of them neutralising each other, and although they had not yet found it necessary to adopt any of those suggestions, they preserved an open mind on the matter, and were quite ready to adopt any really practical suggestion which would add to the efficiency of the test.

Dr. Dupré, the chemical adviser of the Home Office, strongly supported Capt. Thomson in his statement that a permitted explosive must not necessarily be considered a safe one. Every precaution now deemed necessary should be kept up, and safety explosives should only be considered as an additional safeguard.

Mr. W. J. Orsman, of the Roburite Explosives Co., Ltd., also spoke in the discussion, and, with the permission of the chairman, he carried out an experiment which has frequently been shown at other lectures on explosives—notably, for instance, by Prof. V. B. Lewes, in his Cantor Lectures at the Society of Arts some few years ago. The experiment consists in firing a small charge of carbonite inside a closed iron bomb, and afterwards turning on a tap and igniting the gas which flows under pressure from the bomb. The gas is carbon monoxide, and Mr. Orsman's contention is that the proof of its existence in the products of combustion of Carbonite shows that the atmosphere of a mine where this explosive is used is not healthy for miners, and further, that the presence of this gas renders explosions of coal dust especially violent. This experiment has, as mentioned above, been frequently made, but we do not remember hearing the other side of the case so clearly expressed as by Mr. Guttmann in his reply to the discussion. Mr. Guttmann's views are especially important, owing to his independent position and expert knowledge.

Mr. Guttmann contended that "Mr. Orsman was wrong in his assumption that the presence of carbon monoxide was so great a danger in itself, or contributed in any measure to increase the danger from coal dust. He had mentioned that Eagler had shown the influence of coal dust upon mixtures of inflammable gas and air, but he did not think that the carbon monoxide from a shot would create more dangerous conditions. Could Mr. Orsman mention any practical blasting explosive that would not liberate carbon monoxide? If Mr. Orsman would look at the work of experimenters on this subject, he would find that carbon monoxide was always present; and, moreover, as Mr. Hehner reminded him, coal gas itself contained about 13 per cent. of carbon monoxide, so that, when the test is made in coal gas, that body is already present. But if he were wrong, and if carbonite were the only explosive that would form a large amount of carbon monoxide, yet he must contend that it was not the business of the miner to approach the working immediately after the shot. Whether the explosive used was carbonite or any other, it was far from pleasant to approach the neighbourhood of a charge after firing, and however efficient the ventilation proved in some cases (it was not everywhere the same, but sometimes very defective), time must be allowed for the gases evolved to be carried off by means of the ventilation. Moreover, as carbon monoxide would only be formed after the explosion, where should the flame come from to ignite it? Did Mr. Orsman contend that the force of impact of the gases was sufficient to cause ignition? That might be possible, but he would hardly expect that in the ordinary working of a mine it would constitute so great a danger as came from the presence of the ordinary pit gas. After all, the quantity of carbon monoxide developed from an ordinary borehole charge was so exceedingly small, compared with the volume of air in the workings, that at the most its presence might accentuate the danger, but could not cause it. Mr. Orsman had stated that nearly all the explosives tabulated contained nitroglycerine; on closer inspection, however, he would see that only about half of them contained it, some of the examples given being practically the same body. But, apart from that, it was difficult to see how any serious objection could be offered to an explosive like carbonite, which had been tried all over Europe, under the most dangerous conditions, and had been found, with one or two exceptions, a practically safe body. It was true that at the Home Office testing station the smallest quantity of explosive, without stemming, was found to fire the gas mixture. On the Continent, on the other hand, one found explosives like roburite suspended freely, and no explosion occurred; yet, when half an ounce of it was fired, without stemming, from the mortar at Woolwich, explosion did occur. He would not attempt to assign the cause; he merely said that the constituents of the gas would not account for what occurred. But he would like to draw Mr. Orsman's attention to one fact. Prof. Bischoff showed that pit gas contains 16 per cent. of ethylene, and Schondorff that it contains 37 per cent. of ethane. Obviously, therefore, the gas question requires further investigation. Mr. Orsman laid it down that an explosive should be safe against concussion; others required that it should be safe when exploded, lying freely. Under these circumstances none but ammonium nitrate explosives would pass as safe. Would that satisfy Mr. Orsman? Then, again, Mr. Orsman emphasised the fact that any blasting powder used in a mine must be rapid—the more rapid the better. He (the author) had shown conflicting views on that point. It was said, originally, by the Prussian Commission that a quick explosive was safe. It was now shown by Heise that a slower explosive was safer. He, himself, would not attempt to express a definite opinion, but was inclined to agree with Mr. Orsman with respect to certain explosives, but not with respect to others. It was not safe, however, to draw definite conclusions from the mere fact of having made a few experiments in a single district, with one kind of coal dust."

LITIGATION OVER CAPS.—Recently Mr. Justice North made an order transferring the case of F. Joyce & Co., Ltd., *v.* Kynoch, Ltd., from the non-witness to the witness list. It appears that the case had been brought in respect of an alleged infringement of trade mark, and it had previously been before the Court, but had been adjourned in the hope, since unfulfilled, of a compromise being affected.

MESSRS. J. AND W. TOLLEY, LIMITED.

The prospectus of this Company has recently been issued. The capital has been fixed at £15,000, £7,000 of which will consist of 6 per cent. cumulative preference shares, and the remainder in ordinary shares, both in £1 shares. The ordinary shares will be transferred as fully paid to the vendors as part payment for the business, while the preference shares have been issued for public subscription. Of the amount subscribed for the preference issue, £5,000 will be paid in cash to the vendors, making a total purchase consideration of £12,000, while the balance of £3,000 will be utilised as working capital. The directors are Mr. James Tolley, Mr. Wm. Tolley, and Col. G. C. Sartorius, C.B., and the offices will be at 59, New Bond Street.

The details are more fully set forth in the following passages in the prospectus:—

This Company has been formed for the purpose of acquiring and carrying on as a going concern the old-established and well-known business of J. and W. Tolly, Gun and Rifle Manufacturers, which is carried on at 59, New Bond Street, London, W., and Pioneer Works, St. Mary's Square, Birmingham, including goodwill, stock (finished and in course of manufacture), tenancies, fixtures, tools, appliances, and orders on the books.

The business of J. and W. Tolley was established in 1860, and their guns and rifles have a wide reputation, extending to every civilised country, for their shooting powers, accuracy, and high-class workmanship.

The vendors of the Company are James Tolley and William Tolley, the founders of the business, and the present issue is made to provide additional capital, necessary for working the increased business, and to give to the customers of the firm (of whom there are some thousands on the books), and also to the employés of the firm, an opportunity of taking a practical interest in the business.

The present manufactory was built by the firm in the year 1870, and has been occupied by them since that time. It has a shooting range on the premises, and all other conveniences to carry on the trade advantageously and economically, and is situated in the centre of the gun trade.

The London premises are also most favourably situated in New Bond Street, held on lease, and admirably calculated for the conduct of a large trade. The existing staffs at New Bond Street, and at the works in Birmingham, are fully equal to conducting a trade having twice the present turnover, without any appreciable increase in cost. Thus the gross profit on all increase over present turnover might be carried to net profit. This would have a considerable effect on the dividend on ordinary shares, which it is anticipated will pay at least 10 per cent. in addition to the 6 per cent. on the preference shares.

The business will be carried on in precisely the same way, and by the same managers and staff as heretofore, the vendors having agreed to take service in the Company without salary for the first three years (on the issue of 7000 Six per cent. Cumulative Preference Shares being subscribed) they depending on the return on the ordinary shares for their remuneration, unless further remuneration be at any time granted by the Company in general meeting.

An examination of the books of the firm has been made by Mr. George Shead (Fellow of the Institute of Chartered Accountants), who has given the following certificate:—

To the Directors of J. and W. Tolley, Limited.

Dec. 20, 1898.

Dear Sirs,—I have examined the books and accounts of Messrs. J. and W. Tolley, and hereby certify that without charging interest upon capital and cash advances, but after making what you deem a necessary provision for bad debts, the net profits for the three years ending March 31, 1898, show an average of 12½ per cent. per annum upon the partners' capital at present employed in the business, or sufficient to pay the dividend upon the proposed issue of preference shares more than twice over.

Yours etc.,

GEORGE SHEAD, Chartered Accountant.

The purchase price has been fixed by the vendors at £12,000 payable as to £8,000 in fully paid up ordinary shares of the Company, and the balance in cash, leaving £3,000, which, with the capital at present in the business, is considered by the directors ample to carry on a largely increased trade.

The assets to be taken over by the Company comprise:—

	£ s. d.	£ s. d.
1. Stock (finished and in course of manufacture), fixtures, tools, and appliances guaranteed by the vendors to be (at cost price) of the value of, at least	3,000 0 0	
2. Lease of New Bond Street premises, and tenancy of Birmingham Works	1,250 0 0	
3. Goodwill (including trade marks, trade names, &c.) ...	7,750 0 0	
		12,000 0 0
Add cash as above (working capital) ...		3,000 0 0
Total security for preference shares ...		£15,000 0 0

The business will be taken over by the Company as from Feb. 15, 1899, and the profits and liabilities from that date will belong to the Company, and all liabilities up to that date will be discharged by the vendors.

CORRESPONDENCE.

SEMI-AUTOMATIC PISTOLS.

TO THE EDITOR OF *Arms and Explosives*.

DEAR SIR,—In No. 76, Jan. 2, 1899, of your paper, of which I am an interested reader, I find an article headed "The Pieper Semi-Automatic Pistol," in which certain advantages are claimed as novel features in automatic pistols.

From these assertions it might be inferred that the Semi-Automatic Pistol had not before existed, but was just brought out by Mr. Pieper. In order to clear up such an error, should it exist, I beg to send you by book-post two copies of a pamphlet entitled "Semi-Automatic Repeating Pistol," and published in Vienna in 1894. This pamphlet contains a description and drawings of my Semi-Automatic Pistol, Model 1894, and shows, if not exactly in the same words, at least in almost the same terms, the so-called disadvantages of the

entirely automatic fire-arms, and the same means of overcoming these objections as the above article.

Moreover, you have, in your own paper, No. 41, Vol. IV., of February, 1896, given on page 84, beginning at line 14 from the bottom of the right-hand column, a description of my pistol, which exactly sets forth the features claimed now as novelties of the recent Pieper pistol.

But since then experience has shown that the advantages of an entirely automatic pistol are greater than the comparatively greater safety of a semi-automatic arm. In consequence, the automatic cocking of a pistol and the employment of a safety bolt or slide are not any more considered a grave defect by the military commissions, as Mr. Pieper asserts according to the above article.

Knowing your strict and absolute impartiality on all such questions, I beg to call your attention to the above facts, leaving it to you whether you think proper to mention them in the next, or one of the next, numbers of your paper.

FERDINAND RITTER VON MANNLICHER

Vienna, January 28th, 1899.

[Our correspondent has sent us copies of the pamphlet we referred to, and we are pleased to have an opportunity of recording his views and experiences. ED. *A. & E.*]

THE NEW GUNPOWDER CARTRIDGE.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—I certainly was surprised to read so many misleading statements made by Messrs. Curtis's and Harvey in your last issue. They ought to know better than to challenge the first inventor of the method of keeping the cooling agent separate from the gunpowder or other explosives, as the records of the Patent Office and journals since 1883 and 1884 will prove—in fact, since 1876, when I invented the flame-cooling water cartridge. Surely they can hardly accuse me of *mixing* the gunpowder with water! On several occasions I have experimented under their officials' auspices, notably, with my patent of 1893, with quick-burning gunpowder, including their E.S.M., containing about 76 per cent. of nitre, and similar to the powder employed at the Woolwich test with my new safety tamping pellet case of ammonium oxalate; the same having been secured by me six months before their application of 1898, which I am opposing. I did not think it was incumbent on me to again disclose in my provisional patent of 1897 my combination of quick-burning gunpowder with cooling salts already patented in 1893. They were defeated in their attempt to eliminate my claim to oxalate of ammonium salts and my new tamping pellet case. With regard to the liquid ammonia and gunpowder modification of my patent of 1893 not being "a commercially useful one," I may say that about three years ago it was proved to their satisfaction, after many experiments, that it would be a commercial success, seeing that half the usual charge of gunpowder was saved, and the cartridge weighs only 9 oz., as against 16 oz. for doing the same work, thus saving 45 per per cent. of costly freight, independent of additional profits on the cartridge materials. As to the cartridge not having passed the Woolwich test, the explanation is that the test had to be postponed on account of illness.

Yours &c.,

JAMES MACNAB.

London, January 10, 1899.

SAFETY EXPLOSIVES.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—The article upon "Safety Explosives and the Proper Use of this Term as applied to Practical Coal Mining Work," by MM. Victor Watteyne and Lucien Denoel, in your journal of January last, contains conclusions that are not in accord with mining experience.

It is suggested that "the rapidity of explosion and the temperature of detonation" are a "criterion to the greater or less degree of safety possessed by explosives in the presence of fire-damp and coal dust." It is well known that the "temperature of detonation" of the useful explosives is more than three times greater than the ignition temperature of fire-damp; consequently more than adequate to ignite this gas. The records of coal mining show that fire-damp and coal dust have been ignited, and colliery explosions caused by all these detonating explosives or their prototypes. Temperature developed by the detonating explosives cannot, therefore, be associated with the term "safety." The fact that explosions of fire-damp and coal dust have been produced in coal mines by the detonating explosives, indicates that "rapidity of explosion" is no criterion of safety in "practical coal mining work." The theory of "rapidity of explosion and temperature of detonation," as the basis of "safety explosive" for coal mining, has entirely broken down in mining experience with the detonating explosives.

It is also stated that "there exists for every explosive a limit of charge beyond which the ignition of fire-damp or coal dust must inevitably occur." Experience confirms this conclusion touching detonating explosives, to which the authors limit their remarks. The Permitted Elephant Brand Gunpowder Cartridge is not a detonating explosive. It is only permitted to be made with the contained high grade gunpowder and cooler in a fixed and invariable proportion. The safety factor is, therefore, *constant* whatever the size of the cartridge or charge. The Elephant Cartridge is consequently an exception to the authors' conclusion.

Again, it is remarked that "the limit of charge constitutes the most rational standard for measuring the degree of safety possessed by various explosives. . . . A safety explosive is characterised by a sufficiently high limit of charge that may be compared with those required in the normal use for which the explosive is intended." The Elephant Brand Cartridge possesses a constant safety factor by its nature, and therefore has no limit of charge, so that it perfectly satisfies the author's standard of safety.

It is also stated that "the most economical explosive is that which, in addition to a maximum safety, possesses the greatest explosive force and shattering power, as well as that most appropriate to its destination." The first and last conditions are axioms. The second—"shattering power"—constitutes a serious economical objection to the detonating explosives. It is this quality of detonating explosives that produces an abnormal quantity of slack in the coal faces, and so shakes the lumps that they break by shock and attrition in conveyance to the shaft, making still more slack. It is the same quality that shatters the stone to pieces, reducing its value for the face walls of the packs. As a blasting agent for coal mining, gunpowder acknowledgedly possesses an unequalled economic value in its yield of large coal, and in condition to stand conveyance without breakage. The high grade gunpowder exhibits this quality in a superior degree to the old

blasting powder, and its incorporation in the Elephant Cartridge provides a "safety explosive" which is certainly not surpassed, probably unequalled, in the author's standard of safety, economic effect, and appropriateness to coal-mining work. For these reasons, high grade and other gunpowders which have passed the Government tests at Woolwich, are now regaining the place in coal mining formerly held by blasting powder, and displacing the detonating explosives.

DONALD M. D. STUART.

Bristol, January 26th, 1899.

REVIEWS.

Explosive Materials: The Phenomena and Theories of Explosion. By Captain John W. Wisser, 7th Artillery. Published by the D. Van Nostrand Co., New York. Price 50 cents.

This book forms part of a pocket-book series of science hand-books, which, to the number of fifty-nine, seem to cover every imaginable branch of general engineering work. The first edition of this hand-book having become exhausted, it was decided, in producing a fresh edition, to re-write the contents throughout, and this responsible task was placed in the very able hands of Capt. Wisser, who is an instructor of military science in the United States Military School, and is also editor of the *Journal of the U.S. Artillery*.

In the production of a hand-book of this character, it is essential that the author should store up in his brain all the available information on his subject, and then draw forth an essence of his own entire knowledge, and convey it to the reader, so that the gist of his subject is presented in its main outline, but without such scrappiness of handling as will vitiate its interest for those who only require a general knowledge imparted in a pleasing form. In this task the author has acquitted himself with considerable credit. He takes us through the general considerations of explosive phenomena, then through the division of explosives into classes. After this the chemical questions involved in their decomposition are explained. The theory of the subject is thus laid out in a clear and continuous series of chapters, the one following on from the other until the groundwork is complete. From this point the hand-book becomes more of a chemical character. The various chemical constituents of explosives are dealt with from the point of view of their production and chemical construction. Then we pass on to the consideration of the explosives themselves, and the part which is played by the various elements in their formation; and finally we have a reference to the leading explosives in use, showing their general characteristics and special features. Altogether, the work is one which will form a worthy item of the interesting series to which it belongs.

Colliery Explosions. Forming the Seventh of a Course of Lectures of Mining delivered by Professor W. Galloway, of the University College, Cardiff. Published by the South Wales Institute of Engineers, Park Place, Cardiff. Price 1s.

Professor Galloway, although he does not go in for personal advertisement to the extent that is necessary in order to be recognised as a scientist of great public reputation, is still well known, among those who have studied the subject as one of the most capable pioneers of explosives testing in connection with coal-mining work. We will make these statements somewhat clearer by a short anecdote, which will not, perhaps, be out of place in this review. Professor Galloway was one of the very first to take up the subject of testing explosives with reference to their liability to ignite fire-damp and coal dust, and he carried out a long series of experiments in order to establish certain *data*. Speaking from memory, we believe that he first of all used a piece of rock in place of the steel cannon which has since been adopted; and he went on firing from a bore hole which had been made in this rock until the repeated explosions destroyed his apparatus, and he had to start afresh with a new piece of rock. These experiments were carried out entirely by Prof. Galloway, and the various devices employed were wholly of his origination. The materials of his enquiry were laid before an expert in explosives, and the result was that the expert delivered a lecture on the same. In the course of the debate following the lecture, the expert was liberally eulogised for the great personal danger to which he had subjected himself in conducting these experiments, so risking injury in his dangerous work all for the benefit of the mining population. This praise was received with due modesty, though curiously, enough, the expert who received it had never seen a single one of the shots fired—at least, that is our recollection of the matter; and in any case it is substantially correct.

Prof. Galloway in the present lecture covers a large amount of the ground of his early work, and, considering much of this was done twenty years ago, it is clear that Prof. Galloway's knowledge of his subject is not of any mushroom growth. He refers to various authorities who have interested themselves in this important question, and he arranges their conclusions so as to give a clear idea of the early developments of this department of scientific enquiry.

We would recommend to all who follow the developments of mining explosives to possess themselves of a copy of this lecture, as it will most certainly assist them to form a just conception of the large amount of pioneer work which has been necessary to bring our knowledge even to its present state. Mr. Guttman's lecture, which is referred to in another portion of this issue, shows that even now we are hedged around with questions which it seems almost impossible to determine. How much more difficult, therefore, must it have been in the early stages of Prof. Galloway's work to lay out in something like scientific order the facts which he required to investigate?

Snaffle Papers by "Snaffle." Published by Thacker & Co., London. Price 10s. 6d.

The author of this book, who is a major when not sheltered under the anonymity of the writer, is well-known already to the world of sport by his two former works, "Gun, Rifle, and Hound," and "In the Land of the Bora." That he has increased and not lessened his reputation by his latest effort is perhaps the best compliment we can pay him. In reading through his papers, which he states are for the passing of an idle hour, we felt inclined to wish for an extension of our idleness in order to complete the perusal of the book.

In a series of chatty sketches the personality of the author inevitably takes form, and even if we may be wrong in our conception, we must admit that the picture which has presented itself to our mind is a pleasant one, in fact, one we would sooner not change for something more actual and perhaps more worldly. We conceive, first of all, a young officer who reminds us of a story told of the late Lord Ran-

dolph Churchill, to the effect that he would rather hunt rats in a barnyard than have no sport at all. Fortunately for the author of "Snaffle Papers," his sporting horizon was not limited on the north by the farm-house, and on the west by the cow sheds, so that he has been able to enjoy a variety of outdoor pursuits not open to the stay-at-home shooter, nor even to the more enterprising Cook's tourist. We may suppose that service in India first introduced him to the pleasures of the wilder forms of shooting, as distinguished from that obtainable in the highly organized wild regions of Great Britain; and we infer that the taste once acquired accounts for the many countries which have since contributed their share to the experiences of which we now read in the present book. Having seen so much, and having derived so much amusement, it is only right that the author should record in book form his many pleasant impressions and recollections. These should serve to keep the heart young, even after the body has lost its power of sustaining the fatigues and privations incidental to a life of sport in distant regions.

We notice that in his preface "Snaffle" apologises for the highly technical character of two chapters in the book. We, whose interests are unfortunately more technical than practical, cannot echo this view, nor would we suggest will those who are themselves interested in the practical pursuit of big game. The first of these technical chapters deals with what the author somewhat satirically terms trade bullets. Speaking in the light of experience, he criticises the type of express bullets which is most generally approved by the gun trade. He lays down the requirements of a "stopping" bullet, and he objects to the popular design of the express bullet, on the ground that, while suitably formed to expand, there is not sufficient weight in the base to provide driving power for the mushroomed projectile. He lays down in general terms the proportion of lead and powder likely, in his opinion, to effect the desired result when worked in combination with a modified form of bullet of his own design. It is mentioned incidentally that Mr. W. R. Leeson, of Ashford and London, has made arrangements for supplying the bullets. Reading his comments in a general way, we gather that expansion must never be carried further than the capacity of the bullet to continue its course in the expanded form. The tough and solid tissues to be penetrated, even in soft-skinned game, must, therefore, always be taken into calculation by the designer of expanding bullets; for it must be remembered that animals have not acquired that human state of nerves which adds to the physical effects of a bullet, the moral shock which causes a human being to signal for the ambulance corps.

In the other "technical" chapter a plea is urged in favour of lighter weapons, on the ground that a rifle is more useful to the shooter, even if by reduced length of barrel its range of accuracy is somewhat circumscribed. This chapter would have been of more use to those interested in the manufacture of rifles if the author had been able to speak from a wider practical experience of the more modern small-bore rifles of military calibre. It is this latter class of arm which of late years has superseded the express rifle for big game shooting, and this to such an extent that express rifles are now made in comparatively small quantities. Perhaps the new double ·256 rifles would fit in with the author's requirements, though in discussing these we anticipate that he would have a few words to say about the bullets to be used therewith.

We have always held the opinion that the field of sporting literature is only partially open to the professional journalist, and that there is a certain class of work that must be left entirely to practical votaries of shooting, such as "Snaffle." The present book supports our view on both sides, for while "Snaffle" tells us what the sportsman wants, he has not always the technical knowledge by which the professional writer with a speciality would show how the result would be accomplished. For instance, the author expresses the opinion that he has no doubt but that 42 grains of smokeless powder would efficiently replace the black powder charges referred to as used in his rifles. The familiar standard charge of smokeless powder for a 12-bore shot gun suggests that the author considers that shot gun powder would do for rifles, and it is just as well that he did make the experiment. A smokeless powder manufacturer could tell him of some of the difficulties of working out a smokeless rifle powder for a given gauge of rifle and weight of bullet. Perhaps it is hardly fair to take the author to task for saying that his next scatter gun will be a "vena contracta." It may be that he will carry his purpose into effect; but, anyhow, it is generally recognised that this gun has not justified the favourable anticipations either of its father or godfather. The constriction of the bore has among other things introduced the very serious disadvantage of undue heating of the barrel.

Although we have, perhaps, given rather more space than we usually accord to the notice of publications of an essentially sporting character, we feel that the exceptional treatment of the present book is a well-deserved tribute to the practical manner in which the author has handled the more technical side of the appliances of shooting.

APPLICATIONS FOR PATENTS.

DECEMBER 19TH, 1898—JANUARY 20TH, 1899.

1898.

26,749. Single-trigger Guns. F. Beesley.
26,787. Electric Fuzes for Blasting. H. E. Ticehurst and B. T. Moore.
26,911. Blasting Cartridges. E. S. Clark.
27,110. Recoil Apparatus for Guns. E. Skoda.
27,301. Torpedoes. E. Wilson.
27,316. Explosives. L. Davies.
27,340* Automatic Fire-arm. P. Mauser.
27,397* Smokeless Powder. A. J. Boult (Agent for *F. A. Liedbeck, Sweden*).
27,514* Powder Pneumatic Guns for Throwing High Explosives. W. S. Sims.
27,517. Sights. B. H. Woodward.
27,527* Mannlicher Repeating Rifles. A. Zeke and Redl.
27,553. Method of Firing Guns at Sea. J. R. E. Pattison.

1899.

42. Automatic Gas Check. E. Forbes.
131. Breech Screws for Ordnance. A. T. Dawson.
230. Time Fuse. H. R. Walker.
328. Loading Shot Gun Cartridges. H. J. Harriss.
342. Projectiles. W. T. Clark.
403. Rammers for Ordnance.
479. Sighting Mechanism for Ordnauce. C. F. Jeansen.
647.* Recoil Mechanism for Small-arms. The Dansk Rekybriffel Syndikat and J. S. Schonboe.
805. Cartridge Packet. E. C. R. Marks (Agent for *E. G. Parkhurst, and L. E. Warren, U.S.A.*).
852. Drop-down Guns. W. H. Brighton.
884. Single-trigger Guns. J. Carter and H. Bruntnell.
1,065. Locket for Fastening Rifle Sling. R. Buckley.
1,126. Shrapnell Shells. A. H. M. Thompson.
1,246. Machines for Filling Cartridges into Belts. J. Ramsay and O. Salmon.
1,311. Projectiles. H. C. L. Holden.
1,338.* Nitroglycerine Blasting Explosives. G. A. Nahnsen.
1,470. Cartridge for Sporting Guns. J. Bertrand.
1,473. "Hang Fire Arrangements" for Ordnance. J. Ramsay.

* These Applications were accompanied by Complete Specifications.

SPECIFICATIONS PUBLISHED.

DECEMBER 24TH, 1898—JAN. 14TH, 1899.

24,262 (Oct. 20, 1897). Vickers, Sons & Co., Ltd., Sheffield, A. T. Dawson, and G. T. Buckham, London. A safety electrical firing apparatus, designed to prevent the premature discharge of ordnance before the breech is properly closed and all is ready. Accepted December 20, 1898.

24,264 (Oct. 20, 1897). Vickers, Sons & Co., Ltd., Sheffield, A. T. Dawson & G. T. Buckham, London. When a firing primer is inserted in the breech plug of a gun when the breech is open, it sometimes happens that the primer works back. The present patent describes a means of preventing this. Accepted December 20, 1898.

30,253 (Dec. 21, 1897). H. H. Lake, London (Agent for Col. G.

Cornara, Italy). An explosive formed by the electrical decomposition of water within a closed vessel, capable of withstanding the internal pressure due to their production in a chamber of limited capacity. Accepted December 21st, 1898.

1,550 (Jan. 19th, 1898). L. Silverman and A. T. Dawson, London. A mode of arranging the section of the screw on breech blocks for ordnance, so as to provide for the ready opening of the breech, combined with secure fastening when closed. Accepted December 23rd, 1898.

2,264 (Jan. 28, 1898). A. de Stubenrauch, Germany. A smokeless powder, consisting of grains of wood, which are nitrated, and, after washing, impregnated with a solution of potassio-chromic-oxalate, to increase the proportion of oxygen. The powder is then exposed to light so as to oxydise the chromic salt. Accepted December 17th, 1898.

2,504 (Jan. 31, 1898). Dr. L. Mautner, Ritter von Markhol, Vienna. A means of directly adjusting the sight of a gun on board ship, so as to allow for the lateral movement of the vessel. In the ordinary way, the correction is made by estimations, which are then translated by tables. In the present arrangement, a series of slides provide for the corrections based on the movement of the ship from which the gun is fired, and for the movement of the ship aimed at, &c. Accepted December 23rd, 1898.

2,696* (Feb. 2, 1898), F. Dumoulin, Liége. The Dumoulin Single-trigger Gun.

2,931* (Feb. 5, 1898). W. Baker, Birmingham. Self-cocking Shot-gun Mechanism.

3,010* (Feb. 5, 1898). F. J. Penn and J. D. Deeley, Birmingham. Safety Mechanism for Drop-Down Guns.

3,315 (Feb. 9, 1898). Sir W. G. Armstrong, Ltd., Sir A. Noble, and R. T. Brankston, Newcastle-on-Tyne. A means of removing the balls upon which guns are rotated, consisting of a hole ordinarily filled by a removable plug. The weight of the guns is lifted from the balls, after which the latter may be brought round to the holes. Accepted December 10th, 1898.

3,426 (Feb. 10, 1898). W. Parnall and T. B. Burns, Bristol. A signalling target for rifle shooting, with a swinging arm on the dummy target, which can take up any of the four positions it is required to signal. An additional flag on the rotating disc provides for signalling when an inner circle of the bull has been struck. Accepted December 17th, 1898.

4,192 (Feb. 19, 1898). Dr. J. Regensburger, Germany. A process for making an explosive from ordinary or de-saccharinated molasses by nitration. The mollasses are first treated with peroxide, such as peroxide of sodium, and having animal or mineral oil added to them before nitration. Accepted December 23rd, 1898.

4,704* (Feb. 25, 1898). C. B. Engels and W. Field, Birmingham. Modifications of Martini Rifle Mechanism.

4,795 (Feb. 26, 1898). A. Reichwald, London. *(Agent for Fried. Krupp, Germany).* A means of reducing the effort necessary to open the block of a screw-breech mechanism by arranging for the more economical application of the available powder. Accepted December 23rd, 1898.

6,950 (March 22, 1898). A. Reichwald, London. *(Agent for Fried. Krupp, Germany).* A back sight for ordnance, in which, after the rough adjustment has been made by hand, it is unnecessary to lock the slide upon the screw feed in order to prevent subsequent displacement due to the shock of firing, the desired firmness being secured automatically. Accepted December 23rd, 1898.

7,584 (March 29, 1898). Lieut.-Col. L. K. Scott, Farnborough. Various improvements in the automatic sighting apparatus described in the previous patent by the same inventor, No. 159, 1894. Accepted December 23rd, 1898.

8,250 (April 6, 1898). Explosivstoff-Werke Spiralit Ges., and Max Thorn, Hamburg. A means of preparing the charges of powders which are in the form of sheets. In order to overcome the disadvantage of varying charges due to taking the load from one sheet, the present patent provides for stamping a number of discs from forty or more sheeet, so securing a proper blending. Accepted December 23rd, 1898.

10,372 (May 6, 1898). J. B. Scott, U.S.A. A machine-gun and mounting worked by hand, in which the cartridges are carried to the chamber in the grooves of wheels corrugated around the periphery. Accepted December 10th, 1898.

18,157 (Aug. 23, 1898). Vickers, Sons & Maxim, Ltd. *(Acting as Agents for Fried. Krupp, Germany).* A double-action fuse for use with shells, in which the detonating devices may be kept separate from the shell, so as to avoid all danger from accidents in handling. Accepted December 23rd, 1898.

18,877 (Sept. 3, 1898). F. M. Garland, U.S.A. A machine-gun having two barrels that are so connected that the recoil incident to the firing of one barrel will automatically effect the ejecting and reloading processes for the other. Accepted December 3rd, 1898.

19,163 (Sept. 8, 1898). E. Ternstrom, Paris. Various modifications in the machine guns described in Patent No. 11,435 (1894), of Bergmann, in which the essential principle was the reciprocation of a bolt. Accepted December 10th, 1898.

20,820 (Oct. 3, 1898). P. Jensen, London *(Agent for Krag Jorgensens, Geverkompagni, Christiania.)* Various detailed modifications in the magazine and cartridge feeding attachment, as applied to the class of rifle known in connection with the name of the Company concerned in this patent. Accepted December 10th, 1898.

22,447 (October 25, 1898). C. Puff, Germany. A means of replacing the system of wire winding of guns by the use of sheets of metal wound around the inner tube, the succeeding layers being wound in opposite directions, and the tension being adjusted at each layer. The object of this arrangement is to produce greater longitudinal stiffness. Accepted December 17th, 1898.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

SELF-COCKING SHOT GUN MECHANISM.

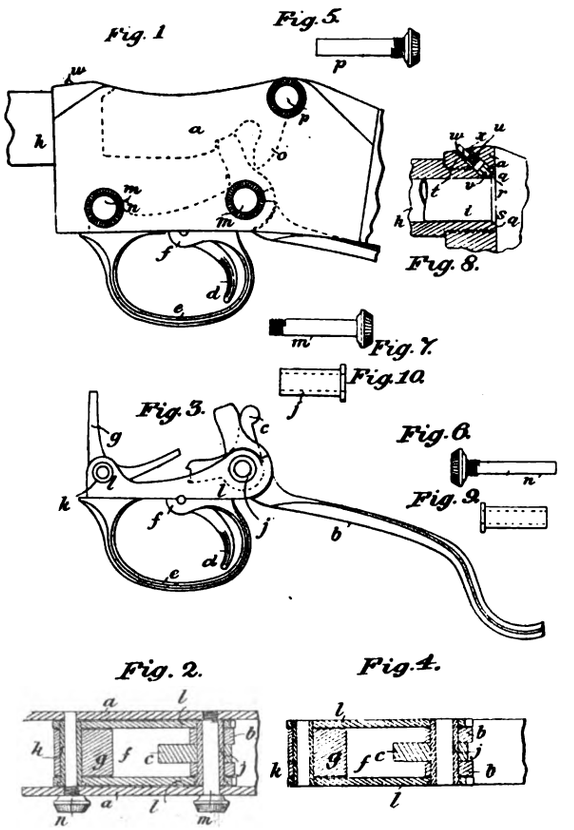
1,931 (Feb. 5, 1898). W. Baker, Birmingham. This patent relates to improvements in self-cocking breech-loading single or double barrelled small-arms, and consists in an arrangement of mechanism whereby the hammer is cocked by means of a slide operated by the breech joint upon the opening of the gun in the manner to be described.

In the illustrations Fig. 1 is a side view, partly in section of a portion of the gun mechanism. Fig. 2 is a similar view to Fig. 1, but showing the gun breech opened. Fig. 3 is a detached plan view of the operating slide and the hammer mechanism. *a* is the action body, *b* is the fore end iron, *c* is the butt of the gun, *d* is the trigger plate, *e e* the lock plates, *f* is the breech joint pin, and *g* the breech joint surface.

A slide *h* is placed upon the underside of the action body *a*, capable of a longitudinal motion, and the slide is dovetailed or similarly placed in the body so that its outer (underneath) surface lies level with the surface of the body. The one end of this slide extends to the fore end iron *b*, and is provided with a projection *i*, which rests against the point *j* of the fore end iron, so that when the gun is opened, as seen in Fig. 2, the point *j* of the fore end iron pushes the slide *h* towards the butt of the gun. The other end of this slide is slightly set back, so as to pass beneath the end *k* of the trigger plate *d*, and thence into the lock chamber, so as to come into contact with the hammer mechanism. Instead of the one slide being made to serve both hammers, it will be obvious that a separate slide may be used for each hammer.

Upon the side of the pivoted hammer *l*, which is pivoted at *m*, there is also pivoted at *n* what may be termed a cranked pivoted slide *o*, which lies somewhat in a horizontal direction, the rear end of which for a considerable length is formed into a stem *p*, upon which is passed a spiral spring *q*, up to and against a shoulder *r*, upon such slide. The outer end of the pivoted slide is carried in a fixed guide *s*, between which and the shoulder *r* the spring is compressed. This spring serves to operate the hammer *l*, or, if desired, another form and adaptation of spring may be used. The front end *t*, of the slide *o*, is carried down in a cranked arm fashion to near the bottom of the chamber, that is, to a position opposite the end *u* of the slide

aforesaid. The hammer and lock mechanism are shown as being carried upon the side lock plates, but it is obvious they may be carried upon or from the trigger plate *d*, if desired. It will be clear that upon opening the gun, as shown in Fig. 2, the slide *o*, in being forced back, carries with it the downwardly cranked arm *t*, and in this way the hammer *l* is thrown into bent, ready for firing the gun. Accepted Dec, 23, 1898.

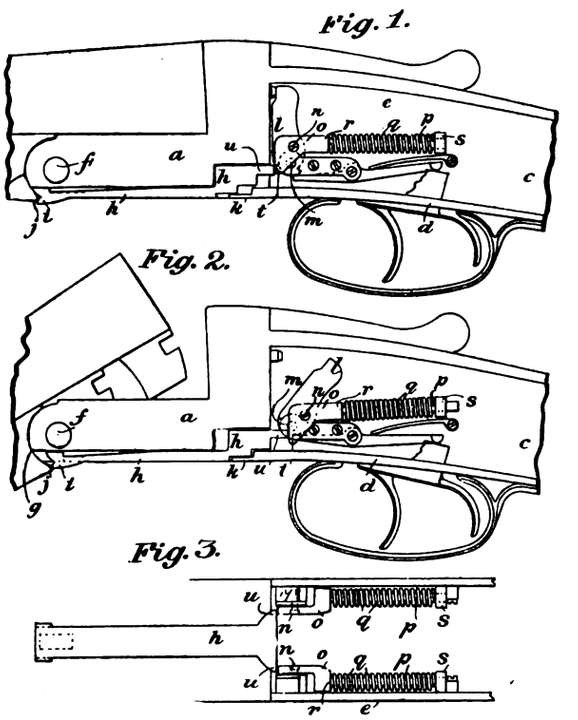


MODIFICATIONS OF MARTINI RIFLE MECHANISM.

4,704 (February 25, 1898.) C. B. Engels and W. Field, Birmingham. This patent relates to improvements in Martini breech loading fire-arm mechanism, or such arms that are constructed upon the same lines, and its object is to provide improved means whereby the internal mechanism in the action body may be readily withdrawn for inspection, cleaning, etc., or without interference of strength or arrangement of moving parts; and in such a manner that when thus removed, the lever, tumbler, trigger guard, and its body, and the extractor shall be connected together as a whole, and thus avoid the danger of losing loose parts when cleaning the gun. Also that the breech block with its striker, &c., shall be removable in a similar manner as another part, independently of the first part; also to provide an indicator mechanism whether there is a cartridge in the barrel or not.

In the illustrations here given Fig. 1 is a general side view of the action body, &c., with the breech closed. Fig. 2 is a part sectional plan view of Fig. 1, showing the method of securing the several parts in the action body. Fig. 3 is a side view of the trigger guard body, trigger guard, lever, tumbler, &c., as seen when removed from the action body. Fig. 4 is a part sectional view of Fig. 3. Figs. 5, 6, and 7, show detached views of the pins for securing the parts in the action body. Fig. 8 is a part sectional view showing the indicator device. Figs. 9 and 10 are detached views of the tubular sleeves, through which are passed the pins shown in Figs. 6 and 7; *a* is the action body; *b* is the lever; *c* is the tumbler; *d* is the trigger; *e* is the trigger guard; *f* is the trigger guard body; *g* is the extractor; *h* is the gun barrel; *i* is the cartridge.

The fulcrum joints of the lever *b*, and of the extractor *g*, are carried upon tubular pins or sleeves, *j*, *k* (Figs. 2 and 4), which are tightly fitted in the two sides *l l* of the trigger guard body *f*, but which can be driven out if desired. Thus, when the trigger guard body *f* is separated from the action body, as shown in Figs. 3 and 4. the lever *b*, tumbler *c*, and the extractor *g*, cannot fall therefrom and thus get lost. Central fulcrum pins *m n* are passed through the one side of the body *a*, and through the tubular sleeves *j k* to the other side of the body *a*, one of which sides is screw-threaded, thus securing the whole in position in the action body. The breech-block *o*, shown in dotted lines in Fig. 1, is also secured by a similar fulcrum screw pin *p* passing through the sides of the body and through the block, in the ordinary manner. These pins, *m*, *n* and *p*, are furnished with enlarged milled edged heads of any suitable shape, by which they may be readily inserted or removed. Thus,



by these means, when these screw pins, *m*, *n* and *p*, are removed, the lever, tumbler, trigger guard and its body, and the extractor, are easily removed bodily as one part, as seen in Figs. 3 and 4, and also the breech block *o*, with its accessory pieces as another part.

The indicating mechanism is somewhat as follows:—Through the action or breech body *a*, and the screw end *q*, of the barrel *h*, or through such other necessary part or parts at the loading end of the barrel or barrels (Fig. 8.), a hole is drilled from the outside, and usually in an oblique direction, which emerges upon the inside at a point immediately behind the recess *r*, into which the head *s* of the cartridge fits. In this hole is fitted a sliding pin *t*, which is pressed

inwards by spring *u*, so that its inner end *v* protrudes through the barrel, when there is no cartridge case in, while under such circumstances its other end *w* lies sunken and hidden from view. Upon the insertion of a cartridge, the pin *t* is pushed forward, so that its end *w* protrudes through the upper exterior of the action body or other suitable part, as shown in Fig. 8, and thus indicates the presence of the cartridge *i*. This pin *t*, and spring *u*, are held by screw nut *x*. Upon the removal of the cartridge case the spring action immediately causes the pin to enter inwards and disappear from view. Accepted December 10, 1898.

SAFETY MECHANISM FOR DROP-DOWN GUNS.

3,010 (Feb. 5, 1898). F. J. Penn and J. D. Deeley, Birmingham. This patent relates to safety mechanism of double barrel drop-down guns and rifles, whether operated by a single trigger or by two triggers in the ordinary way, by means of which the automatic action of the safety mechanism is effected. As the specifications and drawings are somewhat voluminous, we shall be obliged to confine this account mainly to that portion of the specification which refers to the mechanism as applied to single-trigger guns.

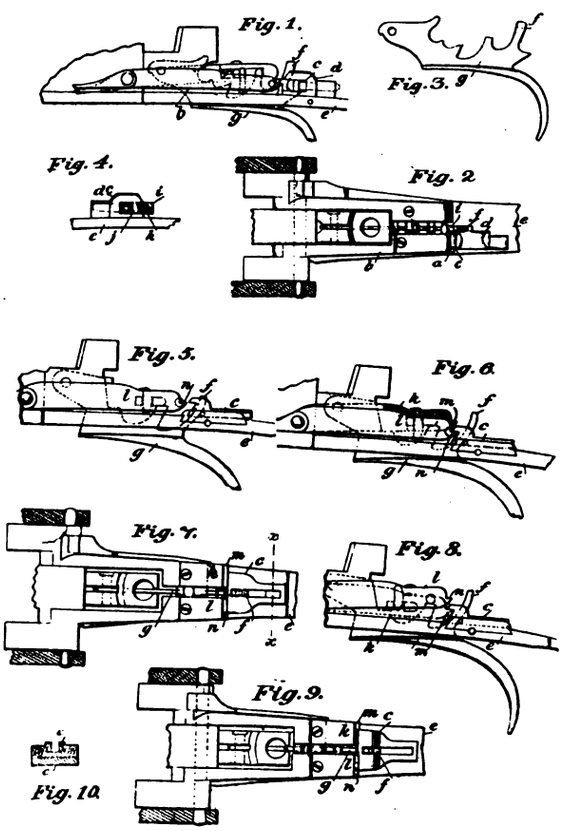
At the rear or tail end of the sear of the left hand or second operated hammer is arranged a sliding sear-locking bolt, this bolt being fitted and sliding in a slot in the trigger plate, or in a separate piece or box fitted to the trigger plate, so as to permit of easy detachment. The sliding bolt, when in its forward position, overhangs a projection on the tail end of the second sear, and thereby prevents the accidental lifting of the said second sear. When the said sliding bolt is in its backward or normal position, it is situated behind and clear of the second sear. The sliding bolt is operated or pushed into its forward position, on the raising of the trigger for the discharge of the first hammer, by an inclined or backwardly extending arm, which occupies an inclined slot on one side of the sliding bolt. By the raising of the trigger, the inclined arm rising in the slot of the sliding bolt, the bolt is urged into its forward position; and on the release of the trigger the inclined arm, assuming its normal position, urges the sliding bolt into its backward or normal position. On the raising of the trigger for the discharge of the second or left-hand hammer, the acting part of the trigger blade, which is now under the second sear, lifts this sear, the sliding bolt on its forward movement passing under the raised sear. In this way the discharge of the second hammer is permitted.

Where the gun is provided with mechanism by which either the right-hand hammer or the left-hand hammer may be discharged first, at the will of the person using the gun, the tail end of each sear is provided with a projection, and the sliding sear locking bolt is made of such a width that on its forward motion, effected by the trigger as before described, the sliding bolt overhangs the projection of the sear of the undischarged hammer, and thereby locks the sear. The part of the sliding bolt behind the sear of the discharged hammer passes under the tail end of the raised sear of that hammer.

Figs. 1 to 10 of the accompanying drawings represent portions of the lock mechanism of a single-trigger double barrel gun containing these parts. The arrangement shown in Figs. 1, 2, 3, and 4 is for effecting the locking of the left-hand sear on the firing of the right-hand barrel of the gun. Fig. 1 represents the arrangement in side elevation with the trigger in its raised position and the sear of the second hammer locked by the advance of the sliding locking bolt. Fig. 2 is a plan of the same, and Fig. 3 and 4 represent portions of the same detached; *a* is a projection at the tail end of the left-hand sear *b*, and *c* is the sliding bolt by the engagement of which, with the projection *a* of the left-hand sear the locking of the said sear is effected. The sliding bolt *c* works in a box *d* on the trigger plate *e*, being moved in its forward and backward motion by a backwardly extending arm *f* of the trigger *g*, as shown separately in Fig. 3, engaging in a slot *h* in the inner side of the sliding bolt *c* (Fig. 4.)

On the lifting of the trigger *g* for the discharge of the right-hand barrel of the gun, the backwardly extending arm *f* of the trigger, rising in the slot *h* of the sear locking bolt *c*, effects the forward motion of the sliding bolt, as is represented in Figs. 1 and 2. The arm *f* on its rising motion acts on the projection *i*, constituting the front wall of the slot *h*, and on its descent acts on the projection *j* constituting the rear wall of the slot *h*. On the release of the trigger its descent causes the backward motion of the slide *c* and the consequent unlocking of the sear, which may be raised on the next lifting of the trigger.

In Figs. 5, 6, 7, 8, 9, and 10 is represented the arrangement last described modified to suit guns in which the right or left-hand hammer may be discharged first at the will of the person using the



gun. Fig. 5 is a side elevation, the parts being in their normal position; Fig. 6 and 7 represent in side elevation and plan respectively the mechanism after the raising of the trigger for the discharge of the right-hand hammer, and Figs. 8 and 9 are similar views, the parts being in the respective positions which they occupy after the raising of the trigger for the discharge of the left-hand hammer. Fig. 10 is a cross section on the line *x x*, Fig. 7.

In these figures the right and left-hand sears are marked respectively *k l*. Each sear *k l* is provided with a projection *m n*, and the sliding bolt *c* is of a width proper to extend nearly from side to side of the trigger plate *e*. The sliding bolt *c* in this case works in a dovetail slide on the trigger plate *e*, as will be understood by an examination of the cross section Fig. 10.

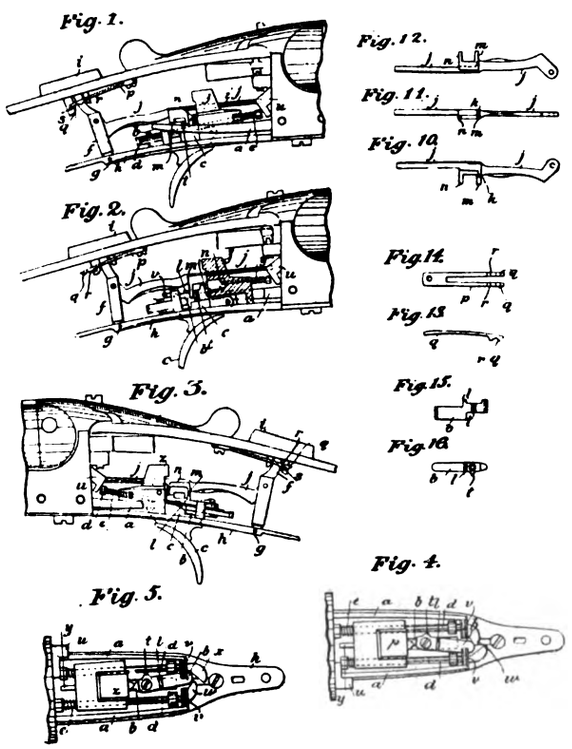
It will be understood by an examination of the several figures that on the lifting of the trigger *g* for the discharge of one hammer, the sliding bolt *c* is urged forward and made to overhang the projection on the tail end of the sear of the opposite hammer, and

thereby effect the locking of the said sear, the sear acted on by the trigger being lifted to such a height that the locking bolt passes under the said operating sear. Accepted December 10, 1898.

THE DUMOULIN SINGLE-TRIGGER GUN.

2,696 (Feb. 2, 1898). F. Dumoulin, Liége. The single-trigger gun mechanism described in this patent is of the type in which a side-swinging lever pivoted on the trigger blade is capable of taking up two positions, one in engagement with the right sear, and the other in engagement with the left sear.

In the illustrations Figs. 1 and 2 are right-hand side views of the mechanism when cocked. In Fig. 1, the safety device is pushed or drawn back for the discharge of the left-hand barrel; in Fig. 2, this safety device is thrown or pushed to its extreme forward position for the discharge of the right-hand barrel, and the lever of the corresponding tumbler is shown in section. The block of the trigger-



guard plate is sectioned centrally and longitudinally. Fig. 3 is a left-hand side view of the mechanism, which is shown in the safety position. Figs. 4 and 5 are plan views of the mechanism as shown in Figs. 1 and 2 respectively, with the two tumbler levers. Fig. 4 represents the right-hand barrel fired, and Fig. 5 the left. These two figures thus shew plan views of the drop-down gun, as though the rear of the barrels were cut away on line *y*—*y* of Fig. 1, the action bolted to said barrels being shown in plan with the safety mechanism removed. The remaining figures show various views of the components of the action mechanism.

In this mechanism the sears *a* of the tumblers are operated or controlled by a piece or an attachment *b* (Figs. 1 to 5 15 and 16) screwed upon the trigger *c*, and which moves vertically therewith; in addition, this movable piece can move horizontally to right or left under the action of the safety mechanism, so as to fire either the right or the left-hand barrel, as desired. This attachment *b* is further horizontally actuated or operated upon by rods *d* (Figs. 1 to 5, and 8 and 9), which, after the discharge of the corresponding barrel, are each brought forward in succession by their springs *f*.

The safety device (Figs. 1 to 3, and 10 to 14) is, in general, of a well-known construction, but it presents special features or peculiarities. It consists of a lever *f*, which can move on or rock around its pivot *g*, placed or secured in the plate *h* of the trigger-guard; it is actuated by a thumb-piece *i*. Upon or to this lever *g* is hinged or jointed a rod *j* (Figs. 1 to 3, and 10 to 12), which is furnished at its left with a projection *k* towards its base (Fig. 10), which, when it is above the tooth *l* of the attachment *b* (Figs. 3, 15 and 16), fixes and locks the mechanism. The rod *j* is also furnished, at its right-hand side, with two teeth *m n* (longer than *k*), which descend for the length of the right side on to the attachment *b*, forward and rearward of the shoulder *t* of the movable piece or attachment *b* (Figs. 1, 2, and 16). When the gun is cocked, if the rod of the safety device be actuated or moved, the teeth *m n* come in contact with the shoulder *t* of the movable piece *b*, and cause the latter to pivot to the left or right according as it is pushed to the bottom or end of the course or stroke to the rear or front, and according as it is wished to discharge the left or the right-hand barrel.

The spring *p* of the safety mechanism (Figs. 1, 2, 3, 13, and 14) has two projections or teeth *q* and *r*. When the peg *s* of the thumb-piece *i* is between the projections *q* and *r*, the mechanism is secured and locked (Fig. 3). If, then, the thumb-piece *i* be drawn back (Fig. 1), the movable piece *b* pivots to the left, and the left barrel may be discharged, whilst, if *i* be pushed right forward, the movable piece *b* pivots to the right, and the right barrel may be discharged, as will be explained further on.

The trigger *c* is shown in side elevation and in plan view on Figs. 6 and 7 respectively. The cocking of the hammerless mechanism takes place in the usual manner; by this cocking the parts *u* (Figs. 1 to 5) are drawn or thrust back by the hammers, and engage the rods *d*, which both assume the position of the rod *d* on the left of Fig. 4. If the thumb-piece *i* occupy the same position as is shown in Fig. 3, that is to say, if the peg *s* is between the projections *q r* of the spring *p* of the safety device, the action-mechanism is locked or secured. If it be drawn or pushed to the bottom or end of each rearward stroke, the tooth *n* of the rod *j* meets or abuts against the shoulder *t* of the movable piece *b*, and causes this to pivot towards the left (Fig. 4); then the movable piece *b* is under the shoulder *v* of the sear *a* of the left tumbler; if the operator press on the trigger *c*, the movable piece *b* is raised with this latter, and the left barrel is discharged. The hammer or firing pin having then struck, the left rod *d* is freed, and under the influence of its spring *e* it is quickly drawn or pushed forward. During this movement the nose *w* of the rod *d* of the left abuts against or meets the rearward, lower, and rounded end of the movable piece *b*, slides upon it, and causes it to pivot towards the right (Fig. 5). The movable piece *b* is then under the shoulder *v* of the sear *a* of the right-hand tumbler, and, on pressing the trigger, the right-hand barrel is discharged. The nose *x* of the right-hand rod *d* abuts in its forward movement by means of the spring *e* against the movable piece *b*, and returns it to its central position.

The right-hand barrel can, of course, be the first discharged; the gun being cocked it is sufficient to cause the thumb-piece *i* to slide forward. The tooth *m* of the rod *j* of the safety mechanism abuts against the shoulder *t* of the movable piece *b*, and causes it to pivot or turn towards the right. Then the piece *b* is under the shoulder *v* of the sear of the right tumbler, and the right-hand barrel will be the first discharged. To impart stability to the movable piece *b* in its firing positions, a rod *y* (Figs. 2, 4, 5) crosses or passes through the block *z* of the plate *h* of the trigger-guard, and is urged rearward by a spring.

The course or stroke of this rod is limited by a set-screw projecting into a groove or notch in the said rod. This rod bears at its lower or rear extremity on to one of the bent sides of the forward or upper extremity of the piece *b*, according to the position occupied by this latter (see Figs. 4 and 5). Accepted Dec. 23, 1898.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

National Rifle Association.—The winter general meeting of the National Rifle Association was held at the Royal United Service Institute on the 27th ult. The chair was taken by Sir Henry Fletcher, M.P., who, in the absence of the Duke of Cambridge, referred with deep regret to the death on the 1st ult. of Colonel Mackinnon, formerly chief range officer, and since 1890 Secretary of the Association. The Council wished again to place on record their very great appreciation of the services he so zealously and faithfully performed. There had been a growing feeling among members of the Council that, with the development of the "Practice Ranges" business, the effective control of its affairs, both at Bisley and London, would be best performed by two separate officials. It has accordingly been decided that the Secretary shall reside permanently at Bisley, giving his whole time to the work of the Association there, thus leaving the control of the London office and of the finance of the Association to another official, who is to be styled the Assistant Secretary, and who is to give part only of his time to the work. The Assistant Secretary is to perform the duties of Executive Officer during the Annual Meeting. Captain M. C. Matthews, who has been Executive Officer for some years, has been appointed Assistant Secretary. The Council hope to announce the name of the new Secretary in a few days. A long discussion followed the reading of the report, and a proposal of the Council that the 8-inch bull for the 200 yards shooting should be reduced to seven inches was strongly criticised. It was, therefore, resolved that the settlement of this question should be postponed, so as to give an opportunity for further discussion and consideration.

Transvaal Dynamite Question.—The future arrangements for the supply of dynamite in the Transvaal have recently come up for serious discussion. Two alternative proposals for the regulation of this trade appear to have been put forward, the one by the Dynamite Company and the other by the Chamber of Mines. The monopoly was granted for a period of 15 years, and at the end of that time the Government has the right to make arrangements for free trade in dynamite, subject to some form of revenue tax jointly imposed upon foreign and home-produced material. It will be remembered that some time ago the price to consumers was reduced by ten shillings a case, half of which came out of the payment to the Company, and the remainder out of the Government tax. It is now maintained that this really only amounts to a five shilling reduction, since the loss of revenue, due to the reduced duty, has to be made up out of general taxation, and consequently the mining community has to find this amount in another way. The present proposal of the Dynamite Company is to supply dynamite at 70s. a case, provided the Government does not claim its share of five shillings. The terms of this offer are so worded that, by accepting it, the Government waives any right it may have to cancel the present monopoly on the grounds that its conditions have been broken. The offer also includes terms to the effect that the Government may, at the end of the existing contract, either itself take over the factory, or if, on the other hand, it decides to lease the factory, the present Company shall have preferential rights in this respect, and at the same time obtain concessions for a further period of fifteen years. It should be remembered in relation to these matters, that the present contract has run for five years, and that there is in consequence an unexpired term of ten years. The offer of the Chamber of Mines is that the Government should strive to cancel the monopoly at once. If it succeeds, the Chamber offers to provide the funds necessary to pay the requisite compensation for the existing factory, the cost of which is roughly estimated at £600,000. The loan of this sum will, it is proposed, be secured upon Government bonds

of like amount. After the monopoly has been cancelled, and compensation paid for the factory, free trade in explosives would be declared in the Transvaal. Such trade would be subject to a tax of ten shillings per case for revenue purposes, and a further ten shillings to be applied as interest and sinking fund on the above sum for compensation. It is anticipated that the second tax of ten shillings would cease at the end of about five years, as the estimated fund available for the service of the debt would amount to £150,000 per annum. Taking the Kimberley prices for dynamite as a basis for calculation, the scheme of the Chamber would mean a price of about 60s. a case for five years, and 50s. after the extinction of the £600,000 loan. This offer of the Chamber of Mines is of course put forward in opposition to that of the Transvaal Dynamite Company of 70s. a case. Considering that the price of dynamite was, prior to May last, 85s. per case, it is clear that, what with the willingness of the Dynamite Company to make concessions on the one hand, and the opposition offers of the Chamber, based on the cancelling of the contract, on the other, better times will result for the mining community in the Transvaal.

The Inanimate Bird Shooting Association.—We are extremely pleased that the various manufacturers and traders belonging to this Association have agreed to a self-denying ordinance with respect to their pre-existing rights of exclusive trading with clubs shooting under the I.B.S.A. rules. In other words, the members of the trade have unanimously given their consent to the removal of the whole of the prohibitions hitherto enforced against materials manufactured by non-members. The effect of this change will be that, for the first time since the formation of the Association some six years ago, the organization may now turn its undivided attention to the furtherance of inanimate bird shooting, and cease henceforward to enforce the short-sighted policy of trying to run a trade protection society. It was quite clear from the very beginning that sportsmen would not tolerate this interference with their rights to use whatever they pleased for their shooting. This paper was the very first to protest against this wrong policy of the Association, but unfortunately it has taken some three or four years for the futility of such restrictive legislation to be officially recognised and condemned. It is to be hoped, now that the Association can devote its whole attention to the furtherance of the sport, that a substantial increase in the number of allied clubs will result. Many of the new clubs which have been started, directly as a result of the example set by existing clubs who belong to the Association, will probably see their way to become affiliated, and by this means it will be made manifest how large has been the increase of popularity on this new sport, so that manufacturers will be encouraged thereby to continue their support to the organisation, even though no *quid pro quo* in the form of exclusive trading rights will be conferred.

Illicit Commissions in Trade.—A Bill will be introduced in the House of Lords for dealing with the much-debated question of secret commissions improperly paid to, or received by, servants or other agents. This Bill is the outcome of a considerable amount of discussion following upon various disclosures relating to illicit dealings between the servants of purchasers and the sellers. By the new Bill all such payments—and the wording of the Bill appears to be very wide on the subject—are laid down as a punishable offence unless the previous permission of the purchaser has been given in writing for the payments of such commission. It would be extremely difficult to decide whether, in the event of this Bill passing, it would put any serious check on the abuses it is intended to remove. Gunmakers are by no means exempt from this form of expenditure, but we have frequently been assured by responsible members of the trade that such payments are not made for services rendered by way of recommending the firm's goods or ammunition, but purely as blackmail. It has been made perfectly clear to us that a sportsman is not governed in the choice of his guns and ammunition by the opinion of his butler or valet, but nevertheless these servants are able to collect from the gunmaker, if not the usual 5 per cent., at any rate a substantial tip. The reason why the gunmaker is in many cases forced to submit to this form of blackmail is not because the valet is in a position to do good, but because should his ill-will be incurred he can do a lot of harm. An actual case in point was once explained to us. A new gun was delivered which had been most carefully examined before putting into the case. Within a day or so a serious complaint was lodged by the purchaser, that when the barrels were taken out of the case a bad dent was found. We do not remember exactly how the matter ended, whether the gunmaker had to fit a new barrel, or knock the dent up, but the fact remains that he was put to considerable expense, and had the very best reason for regretting that he had ignored the valet's claim for commission. With regard to cartridges it is equally easy for ill-disposed servants to store them in too hot or too damp a place, with the result that the next order for ammunition will go elsewhere. Valets also are in the habit of loading for their masters, and this gives them many opportunities for giving vent to their animus for particular guns or cartridges. We have not made a census as to the number of gunmakers suffering in this way, but we believe that they are subject, like almost every other class of West-end firm, to this serious expense. In the case of another business than gunmaking, we were once shown the private pad-locked cash book of the principal, in which enormous sums were distributed in the course of a year in the form of palm oil to servants. Certain well-known West-end mansions were under the superintendence of servants who, judging from this single instance, would, in a very few years, be able to retire upon a private income, similarly to Mr. Morgan, of whose transactions Thackeray gave us an interesting account. No wonder these gentry have the money for starting in private business before middle age has arrived. The question is whether Acts of Parliament will upset the system. The imposition of secret commissions on gunmakers is one of extra injustice, since while in many trades the profits may be increased by such goings on, gunmakers have no compensation whatever for the loss of money they incur. There is another side of secret commissions which might possibly be worthy of attention, but generally speaking we believe that it is amiably winked at by gunmakers. We refer to the manner in which the wholesale suppliers of gunmakers are invited to remember their friends among the gunmaker's staff, and these invitations are frequently of a kind which it is inconvenient to ignore. Perhaps, however, a gunmaker does not worry much about this, as he retains a free hand in regard to his purchases. He may not possibly realise that it is the relations of his staff with his customers which makes the good-will of the staff worth purchasing. We do not wish to imply that this is in any sense a general practice, and certainly we have never come across any case where a man in a position of trust was concerned; but more or less numerous isolated instances have come to our knowledge, where one would at first sight suppose that the servants in question could not earn a tip if they tried.

THE FUTURE OF THE ORDNANCE FACTORIES.

WE reproduce in another column the full text of Lord Lansdowne's important speech dealing with the future administration of the Ordnance Factories. It appears that an Order in Council is being prepared which will make certain changes as to the duties of the various high officials in the Ordnance Department. In the meantime Colonel E. Bainbridge has been appointed the successor of Sir William Anderson, the late Director-General of Ordance Factories. The general line of the proposed changes will be to limit the undefined controlling powers of the Financial Secretary purely to financial matters, while, on the other hand, the Inspector-General of Ordnance will exercise new authority with regard to supervising the types of service materials manufactured. These changes will be accompanied by alterations in the titles of the two latter officers. The Inspector-General of Ordance will be known in future as the Director-General of Ordnance, while the Director-General of Ordnance Factories will be known as the Chief Superintendent of Ordnance Factories. The new policy is intended to give the service experts increased control over the materials manufactured at the ordnance factories, so as to bring the designs more into harmony with the requirements of those who will have to operate them in active service. With regard to the much debated question of civil *versus* service chiefs of factories, to which we referred in our last January issue, we notice that our contemporary *Engineering* has adopted some of our views in an article commenting upon the appointment of Colonel Bainbridge. We cannot, however, altogether follow our contemporary in its slashing attack upon the principle involved in the appointment of a military chief of the factories, and we do not agree with the analogy which it draws between such a state of affairs and the obviously foolish supposition that a coachman is the only man who should be entrusted with the building of a carriage. We certainly think that a man who does build a carriage should either have had experience on the box or to be in close touch with those who have. Our own contention was that the chief duty of the Director-General of Ordnance Factories is the routine work of administration, and that a suitable man for such a position does not necessarily belong to the civilian or the service class of the community, but that the best man, wherever he may be found, should be appointed. Military training is admittedly of a character not likely to foster the peculiar combination of qualities which make a first-class administrator of a large industrial enterprise; but, as Lord Lansdowne pointed out, such men exist, and we have every reason for agreeing that in Colonel Bainbridge such a man has been found. The unfortunate antipathy of military men against having a civilian to direct their work makes it desirable, in the interests of harmony and efficiency, that if possible a man of military rank and training should be appointed Director-General of the Factories, or Chief Superintendent of the Ordnance Factories, as the position will in future be called.

Fortunately, in Colonel Bainbridge an unexceptionable choice has been made. Among military officers there were only two possible candidates, viz., Colonel Bainbridge and Major Haddon, on the former of whom the choice has fallen. Col. Bainbridge has been superintendent of the Royal Laboratory for some years, and it must be remembered that this laboratory does not by any means exclusively consist of bottles and Leyden jars. It comprises the whole of the ammunition manufacturing portions of the Arsenal; and, under Colonel Bainbridge, this department has become known as by far the best administered of any section of the Woolwich factory. Colonel Bainbridge has also been secretary of the Ordnance Committee, and as such he has obtained an unexampled knowledge of military and naval munitions. So great is his experience, that there is hardly any question upon which those in doubt can consult him without receiving a satisfactory answer. Besides these technical qualifications, Colonel Bainbridge is a first-rate administrator, a man who knows his own mind, and can enforce his views, and, at the same time, he is the most popular man in the Arsenal.

COL. E. BAINBRIDGE.

It is difficult to forecast the effect of the numerous changes in the management of the Ordnance Factories which are now under consideration. Certainly, it is to be hoped that they will tend to break down the ridiculous concentration of all business through the department of the Chief of the Factories. Too often this veritable bottle-neck becomes choked with accumulations of work and reports. The bottle-neck should change its character, and partake more of the nature of a telephone exchange for switching two departments, having business to transact mutually, into direct contact. The following is an instance of the way things are now done. Supposing that the Laboratory requires to purchase certain components in order to keep level with the required output of

material, an application to that effect is sent to the Director-General. The Director-General applies to the Financial Secretary. The Financial Secretary confers with the Director of Contracts. The Director of Contracts enquires whether the Accountant-General has sufficient funds to permit of the required expenditure. The funds are there, but the Accountant-General desires to assure himself that the expenditure is necessary, and accordingly consults the Director-General of Ordnance, who refers the matter to the Ordnance Committee; and in due course the Director of Contracts issues the order. Surely, with a responsible chief of the Royal Laboratory, ordinary every-day requirements should not be subjected to these circumlocution tactics.

When it is considered that each unit of the manufacturing sections, which are controlled by the Chief of the Factories. is in itself completely organised on the lines of a commercial undertaking, it seems a pity that trivial details should have to be referred to outsiders. Each unit comprises a superintendent, under whom is a complete staff, including such officers as Chief Clerk, Mechanical Assistant, Manager, Principal Foreman, etc., etc., and it is the more strange, therefore, that the petty cash account should be kept by the Chief of the Factories. This is, perhaps, somewhat of an exaggeration, but the principle certainly exists. It is, we are glad to say, rumoured that General Brackenbury, the late Chairman of the Ordnance Committee, and now Inspector-General of Ordnance, will endeavour to secure a return to the old system, by which each factory, or unit, conducted its own financial affairs under the management of its Superintendent.

We trust that this reform, and many other needful changes, will be introduced now that the administration of the ordnance factories is being revised.

THE REPAUTRAP.

IN our last issue we referred to the fact that a proposal was under consideration for forming a small Company to acquire various rights connected with the sale of the new automatic clay bird trap, known as the Repautrap, and also of inanimate birds similar in character to the kind known as "Blue Rocks," both as manufactured by the Cleveland Target Company of the United States. Since that time the scheme for forming a separate Company has given place to a modified arrangement, which has secured the approval of the powder manufacturers and others who had interested themselves in the proposed Company.

The alternative arrangement, which has now taken definite shape, is the acquirement by Messrs. Eley Bros., Ltd., of the whole of the rights which were to have been taken over by the Company. The reason which has led to this change of policy is primarily that Messrs. Eley Bros. have shown their willingness to take the entire responsibility for a scheme which it was previously thought could only be carried through as a joint enterprise, in which various manufacturers would divide the expenses roughly in proportion to their relative interests in any resulting increased consumption of ammunition. The reasons in favour of a single firm taking over the working of the new traps and birds are, first, that many of the expenses of a separate organisation would be saved, and secondly, that a more consistent policy would be adopted than would be possible were it necessary to harmonise various possibly divergent interests.

The action of Messrs. Eley Bros. is likely to result in a considerable cheapening of the prices of inanimate birds in this country, since there will be only the one profit between the purchaser of large consignments of birds and the manufacturer, or two profits by the time the birds reach the private consumer. In the case of the proposed Company, there would have been at least one additional profit, and to this extent the existing arrangement is superior to the one previously proposed.

At first sight it may appear that Messrs. Eley Bros. are somewhat cutting into the profits of gunmakers and others who handle and manufacture inanimate birds; but it will be seen on consideration that such an objection is not justified. In the first place, the total production of birds in this country does not amount in value to very much more than £4,000 per annum, and it will, therefore, be evident that, even if the whole of this trade were in the hands of one firm, a liberal margin of profit would hardly pay the costs of management. With regard to the profits which have been made in the past in handling inanimate birds, it has for some time been quite clear that prices must eventually have come down to those at which American goods could be supplied into this country. Already such a reduction in prices has begun, and birds are at the present time being offered in Scotland at less than 30s. per thousand, as compared with prices some 5s. higher only last season. Under these conditions, it is obvious that the best interests of the trade at large will be forwarded by a general understanding that birds and traps should be handled so as to allow of their sale to the consumer at the lowest possible prices. In this way the resulting increased consumption of birds would lead to a great development of trade in the more important branches of guns and ammunition.

So far we have not dealt with the considerable impetus in the shooting of inanimate birds, which may be expected to result from the new automatic trap, as we dealt fully with this in our last issue. It is evident that the planting of a large number of these traps in different parts of the country will provide facilities for throwing an enormous quantity of birds, and we may anticipate that these facilities will lead to a largely increased consumption, provided that birds can be supplied at nominal prices. The price of birds is not likely to stand in the way of increased shooting, when a hundred may be obtained for something under half-a-crown; but if the old prices remain, so that the shooter has to pay double or treble this amount, then the increase of shooting may be checked. We trust that gunmakers will not blind themselves to the advantages of co-operating in a scheme for the cheap supply of birds. If they are willing to forego the small profits in this trade, and work at the bare cost of handling the birds, then they may anticipate a reward many times greater than the one they have abandoned.

The subject of cheap cartridges is to a large extent included in that of cheap birds, and this also might well receive the support of gunmakers, provided that the reduction in price does not come out of the profits of the dealer. At the present time a large amount of the cost of a cartridge is made up of the special colouring and marking of the cases, with the result that foreign cartridges, which are not subject to these elements of high cost, are making their appearance in the market. If our own manufacturers of ammunition would

recognise this fact by placing on the market a cheap smokeless powder cartridge, of standard load, which could be manufactured by the million, it would be possible, while still reserving a proper margin of profit for the retailer, to meet the competition which is now causing a certain amount of anxiety. It could be arranged that such a cartridge should not interfere with the higher priced varieties which are already on the market, but that it should enter into competition solely with the foreign ammunition which competes in price, not because it is cheaper to manufacture, but because large quantities are put in hand at a time. We believe that if each of the three ammunition manufacturers in this country were to bring out such a cartridge, the gun trade would be happy to fix a minimum retail price for their sale to the public, and would stock these cartridges on the agreement that any case of cutting prices below the agreed limit should be punished by stopping supplies, or by the withdrawal of a special discount at the end of each year granted to all dealers who had observed the arrangement as to price. If such an arrangement could be made, it would enable gunmakers and ironmongers to sell cheap cartridges on the same footing, while it would leave open to competition the sale of higher priced cartridges having special loads, or otherwise in some particular way associated with the name of the gunmaker or other dealer who supplies them.

THE REVOLVER CONTROVERSY.

A RATHER curious, but still very interesting controversy has arisen between the representatives of the two rival systems of large-bore and small-bore pistols for military use.

It has frequently been noticed in our own columns and elsewhere, that our English manufacturers have allowed the development of automatic pistols to remain entirely in the hands of foreigners. This matter was taken up in a London paper, and it drew a picture of the supineness of British manufacturers. A reply to these charges was forthcoming in due course. A Birmingham newspaper interviewed Mr. T. W. Webley, and learned from him that in his opinion the small-bore pistols would never effectually replace large-bore arms for service purposes. Mr. Leslie B. Taylor, the secretary of Messrs. Westley Richards & Co., Ltd., at once took up the fight on behalf of automatic pistols, his firm having taken the agency of two leading types of these weapons, which are of foreign manufacture.

FOREIGN INVENTORS.

In the first place Mr. Taylor seeks to explain why it is that foreigners appear to have taken the lead in designing this new class of weapon, and he suggests that it is an accident of nationality that Paul Mauser, the ingenious contriver of one of these pistols, happens to be a foreigner. We can hardly allow the matter to pass as stated in this broad manner. We believe that the pioneer of the modern automatic pistol was Borchardt, a German by extraction, who had spent a good deal of his time in American factories. He conceived the idea of applying Mr. Maxim's automatic machine gun mechanism to the working of a pistol, and it was the firm of Ludw. Loewe, of Berlin, who found him the appliances and capital for conducting his experiments.

Herr Mauser, who has very important connections with the firm of Loewe, was in this manner brought into contact with the problem of automatic repeating pistols, and to a very great extent we understand that he was indebted to Mr. Borchardt for the foundation work of his invention in this direction. Speaking from memory, we believe that the earliest difficulties of successfully applying the automatic principle to pistols were found in the designing of a suitable cartridge, and that this cartridge having been obtained, the pistol was built up, so to speak, from the cartridge. Paul Mauser, at any rate, found his cartridge ready to hand, and no doubt he had also acquired a good deal of useful information from observation of experiments with the Borchardt pistol. At one time the Maxim-Nordenfeldt Company contemplated interesting themselves in this pistol, and Mr. Maxim took out a patent dealing with a modified construction of repeating pistol based on the lines of the Borchardt and Mauser weapons. Other workers on the Continent were also eagerly experimenting on the production of automatic pistols, but it would be somewhat difficult to assign the order of priority among them. Certainly Von Mannlicher was among the first, also Bergmann and Pieper, and several others, whom we do not at the moment call to mind.

This little account of the origin of automatic pistols disposes of the supposition that it was by an accident that the Continent was the place of origin of automatic pistols, as it is quite clear that the alertness of a large number of the Continental manufacturers in devoting time and money to such researches shows something more than the accident of birth of any single individual.

We know for a fact that at the time when the Borchardt automatic pistol had already been publicly demonstrated on several occasions in Germany, one of our own leading manufacturers expressed the honest opinion that he did not believe in the alleged performances of the pistol. He was urged to go to Berlin and see the thing at work, but this he did not do In exactly the same way we know that several Continental manufacturers are some five or six years in advance of English manufacturers in the production of an automatic repeating rifle, and should these arms ever be placed on the market, and be adopted by military powers, then again it might with equal justice or injustice be alleged that it was an accident of birth which has deprived Great Britain of the advantage of pioneering these weapons.

We are, against our wish, forced to the conviction that Continental manufacturers, as a class, are more willing to conduct investigations on new types of fire-arms, which investigations, in their earlier stages, suggest academical rather than practical research. It is when these researches are brought to a practical conclusion that one is apt to regard their inception abroad as due to an accident of birth in their designer, so losing sight of the time and money that has been ungrudgingly lavished in the experimental stages of their production. Were our own manufacturers more willing to endow research, there would be no lack of investigators willing to open up any promising lines of development.

SMASHING *v.* PIERCING.

Returning to the controversy as between repeating pistols and revolvers, we notice that Mr. Taylor energetically claims that repeating pistols, while superior in accuracy, are sufficiently destructive in their effects for personal protection in warfare. He quotes as supporting his contention the fact that in certain experiments a horse was instantly killed when

fired at by an automatic pistol. It hardly seems to us that this argument, or others on similar lines, can be considered as conclusive. One bullet might disable a horse; another, striking differently, might not disable the unfortunate quadruped. The gist of the question is which weapon has the greater chance over a number of shots of disabling an enemy when fired under the somewhat indiscriminate conditions of warfare. A high-velocity hard-coated projectile may strike fifty places in the body where it will pass through without causing instant disablement; also it might hit fifty other places where the disablement would be instant and certain. The question is which of the two classes of arm is the more likely to place a man instantly *hors de combat*. This is a question which it is perfectly futile to argue, since it is so well known that the slow-moving large-bore bullet of the revolver is the more efficient for such a purpose.

Mr. W. Ellicott has written in very favourable terms of the accuracy and excellent handling qualities of the automatic pistol, but we cannot see how his argument affects the "man-stopping" question. Admittedly, it is a great advantage for a pistol to be easily handled, but military officers of practical experience are agreed that, given the existence of an arm which can be as conveniently handled as the existing revolver, increased facility in this direction must not be provided at the expense of man-stopping properties.

Mr. Taylor seeks to draw an analogy between the superseding of the Martini and Snider rifles with small-bore rifles shooting jacketed bullets. The analogy would be correct if the weapons were intended for the same class of work, but, unfortunately for Mr. Taylor's argument, the analogy is rendered worthless by the different conditions under which the two arms are used.

Small-bore service rifles were chosen on account of their increased efficiency as long-range weapons, and it is obvious that with such arms *instant* disablement is not a matter of vital importance. The revolver is a short-range weapon, and consequently it is futile to argue that the requirements of the two arms are identical, and that what applies to one equally applies to the other. Until, therefore, it is recognised as part of the duties of an officer to fill in his spare time by taking pot shots at the enemy, we must continue to regard the functions of the pistol as limited to personal protection, and its design must be governed accordingly.

We think Mr. Taylor was on the right track when he stated that an expanding bullet for automatic pistols was under trial; for it is obviously only with some such modification as this that the automatic pistol can be expected to compete with large-bore weapons for personal protection. Its good handling qualities, accompanied by the required efficiency as a man-stopper, would make it *facile princeps*. Anything Mr. Taylor may have to tell us on the subject of an efficient expanding bullet for automatic pistols will rouse our deepest interest, and we can only regret that he has not turned more of his attention in the present controversy to this problem. Although small-bore pistols have been adopted by certain foreign governments, the fact remains that no nation can equal the experience of Great Britain in small wars against fanatical enemies, and it is in these wars where the true function of the officer's weapon is established. We therefore prefer to pin our faith to the requirements laid down by our own officers, particularly as many of them have seen small-bore pistols used in action.

PUBLIC TRIAL.

On the 17th ult. Messrs. Webley organised a public trial of their revolvers to show their effect upon a rump of beef not containing any bone, and that of bullets fired from automatic pistols. It was so clearly obvious beforehand that the pistol would punch a small hole, and the expanding man-stopping bullet a large one, that the trials can only have been intended to convince the general public on this subject. Colonel Barker, of the Royal Small Arms Factory, and other prominent experts, were present on the occasion, and took notes of the results of the different shots that were fired. Very unfortunately we were unable to accept the Company's invitation to be present, so that our information is restricted to the newspaper reports. From these it appears that the small-bore bullet made a clean hole, and that the large-bore expanding bullet set up and made a hole suggestive of man-stopping properties.

CONCLUSIONS.

Academical arguments about the difference between muzzle energy and muzzle velocity will never settle this question. Practical experience shows that a large bullet, capable of expansion in soft tissues, and having the required driving power is more reliable than a small bullet, which either may do a lot of damage or may do none at all.

SIX *versus* HALF-A-DOZEN.

Mr. Taylor quotes the dead horse, but for every dead horse, killed instantly by the first shot, it would be possible to find a dead sheep where events turned the other way. This balancing of results shows that small-bore bullets involve too much lottery for work at close quarters. To make our meaning clearer, we reproduce the account of Mr. Taylor's horse, the obituary notice of which appeared in the *Militar Wochenblatt*, and also that of a dead sheep, the circumstances of whose demise are recorded in the *Delhi Morning Post* of January 21st this year.

THE DEAD HORSE.

"On the 1st of March, 1897, an experiment was made, which consisted in firing at a horse of average size from a distance of 40 to 50 mètres. The effect of the shot was described by a veterinary surgeon, and from his report, which is appended to the paper under review, we extract the following concerning the first shot only:—"This first shot struck the horse behind the neck of the shoulder-blade and entered the pulmonary cavity, passed through it diagonally in a length of 43·5 centimètres, and remained buried under the skin at the level of the middle of the right fore-leg. The horse had been suspended in belts, and was killed instantaneously. The dissection of the dead body showed that the mortal shot had injured the third left rib at its lower third, causing a sharp-rimmed loss of substance. It further perforated the shoulder head artery, separated the nerve of the diaphragm, and passed through the breast bone at the top of the third rib. It split the right shoulder bone into 17 pieces, and penetrated into the skin over the shoulder bone, where it was cut out. In the chest cavity a great quantity of coagulated blood was found. The resumé of the entire experiment reads as follows:—The pistol shot fired at a distance of from 40 to 50 mètres is capable of the following: (1). It may instantaneously kill a horse by injuring important inner organs of the vesicular or the nerve apparatus. (2). It may render a horse unfit, or kill at once, by destructive injuries of the tubular and joint

bones which enclose the central nervous system (brain and spinal nerve)."

THE DEAD SHEEP.

"Every officer probably knows something of the Mauser pistol. The advantages of this pistol consist in having ten shots as against six in a revolver, the rapidity of loading, and the sighting, which is up to 1,000 yards. And they are supposed to be capable of stopping a man at close quarters; but this has been questioned by several men. Captain Dawding, 2nd Essex Regiment, recently carried out some experiments with certain soft-nosed bullets (the lead of which was exposed for some distance beyond the envelope), in hopes of doing something to solve the question. He experimented on the carcass of a close-clipped sheep, freshly killed, and weighing about 40 lbs., and a paper screen was placed 4 ft. behind it. His object was to ascertain, if possible, the effect produced on flesh, etc., at short range, and whether the bullets 'set up' on impact so as to give reason for believing that they would act as an effective 'man stopper.' The results of his experiments may be summarised as follows:—(*a*) All the shots passed through the carcass and the paper screen behind. The shape of the holes made in the latter were practically uniform, namely, a dumb-bell shape figure exactly half an inch by a quarter of an inch; any variation in size was less than the breadth of a line on an ordinary tape measure. The shape did not vary, whether bone had been hit in transit or not. (*b*). The wounds at the points of exit were not appreciably larger than at the points of entrance, even when bone had been struck in transit. (*c*) Wherever bone was hit it was badly splintered and knocked all to pieces. (*d*) When the bullet did not meet bone in its passage, the wounds and the injury inflicted were small. It appears doubtful from these experiments whether the bullet would be capable of stopping a man in a rush at close quarters, unless it hit a vital part or a leg bone."

THE WEBLEY ACCOUNTS AND MEETING.

THE report and balance sheet of this Company were issued last month, and they deal with the year ending December 31, 1898. It will be remembered that the Company was promoted in October, 1897, and that the businesses of Messrs. P. Webley & Son and W. & C. Scott & Son were taken over as from December 31, 1896, while that of Messrs. Richard Ellis and Sons was taken over as from the 30th June, 1897. The profits for the year 1896 of the two former firms amounted to £30,301, and Messrs. Webley guaranteed that the profits of the year 1897 should be at least equal to those of 1896. We do not remember any publicly issued profit and loss accounts for the year 1897, but from the Chairman's speech at the annual meeting of the Company, which was held on the 21st ult., reference was made to the fact that the profits for the year 1897 exceeded £31,000. The present accounts show that the profits for the year 1898 have come down to £10,251. The profits of the year 1897 became the property of the new Company, but they were subject to a charge for interest on the purchase money, dating from the time when the business was taken over. In the absence of the 1897 accounts it is, therefore, somewhat difficult to understand the present balance sheet. It appears that to the profits of the year 1898 the sum of £6,100 must be added, this latter sum being described as the balance of divisible profits from October 26, 1897, to the end of that year. The total of these two amounts is £16,351, of which £9,869 was distributed last July in the form of interim dividends. The available balance has been utilised for the payment of further dividends, which make a total distribution of 5 per cent. *per annum* on the preference shares, and 3½ per cent. on the ordinary shares from the "dates of payment" until the end of the year 1898. These payments leave a balance of £815 to be carried forward to the next accounts. The present balance sheet and profit and loss account practically deal with the business of the Company since its formation. A balance sheet was issued for December 31, 1897, but not a profit and loss account. The depreciations written off in the earlier balance sheet appear again in the latest balance sheet, together with the additions of the depreciations for the year 1898.

CHAIRMAN'S SPEECH AND DISCUSSION.

The following is a full report of the proceedings at the annual meeting. Lord Ebury presiding, which was held on the 21st ult., at Winchester House, with the exception of certain references by the Chairman to the controversy regarding revolvers and automatic pistols:—

"The Secretary (Mr. FRANK T. MURRAY) having read the notice convening the meeting,

"LORD EBURY, Chairman of the Company, then said:—I cannot but regard it as a great misfortune that on this, the first occasion when we have what ought to be the pleasure of personally presenting you with accounts, the results exhibited should be so inadequate to satisfy your reasonable expectations. It may be that a trade in Revolvers and Arms, even when of long-standing and thoroughly established, is subject to conditions of greater uncertainty than most of us foresaw when we embarked in it, but that the profits of a business, which in 1896 exceeded £30,000, and in 1897 exceeded £31,000, should decline in a single year to little more than £10,000, is a grave and, even at first sight, an appalling circumstance, which challenges curiosity and demands explanation. Speaking generally, the explanation is not difficult to give; is more simple indeed than satisfactory. In the year 1898, as compared with the year 1897, there was a falling off of 30 per cent. in the volume of the business, a very serious thing in itself, rendered doubly serious because the management did not find themselves able to meet it with a corresponding reduction of expenditure. But behind this explanation there are various facts, which it will be as well to analyse before inferences are drawn. Let me point out in the first place that the reduction in the volume of trade was not only unexpected, but exceedingly sudden, having been established for the most part in the closing months of the year, and that it was confined to the Revolver department, which is, under ordinary circumstances, the most profitable branch. The business of the Company for purposes of analysis may be roughly divided into two parts: work done for Governments at home and abroad, which is almost exclusively in connection with revolvers; and work done for the trade, in which, although revolvers play a considerable part, guns and rifles are the leading feature.

"To begin with the work done for the British Government. The Webley revolver with its 'man stopping' bullet is the official arm, and when the Government require pistols either for naval or military service they come to us for a supply, but the requirements of the Government vary, and for 1898 were over 50 per cent. less than the average requirements from that quarter for 1896 and 1897, and, moreover, the contracts came in such driblets and at such intervals that the cost of production was materially enhanced. Glad as we are of Government work, and proud as we are of the proof of confidence it involves, it has this drawback—you must always keep a

skeleton force of skilled men able to cope with it, and when it comes you must, regardless of cost, fill up the ranks at a moment's notice. In 1896, Messrs. Webley, in consequence of a correspondence and interviews with the War Office authorities, and as an alternative to their suggestion of a night shift, which turned out economically impracticable, decided to lay down new plant and machinery at very considerable expense. In 1896 and 1897 the contracts received were sufficient to leave a good profit after wiping off the fixed charges which Government work entails. In 1898 that was not the case, yet I hardly think anyone will contend that during a year when rumours of war were unusually rife we should have been justified in disbanding our forces and leaving ourselves helpless in the case of a very possible emergency. Another cause of disappointment in the year 1898 was the absence of support from Foreign Governments. In 1896 and 1897 Messrs. Webley executed contracts for Governments abroad to the extent of over £20,000, but when the year 1898 came to a close a nearly blank page, under the heading of supplies of foreign goods, was superadded to complete the tale of our discomfiture. Before I turn from the subject of our relations with governments, I have still one disappointment to record. I remember expressing a hope at the statutory meeting that the expected reward for Mr. Webley's invention of the man-stopping bullet, which had then been adopted for the military, and has since been adopted for the naval service, would be received in time to form an addition to the profits of the year 1898. That hope has not been realised, chiefly, I think, because the Government expert to whom the matter was entrusted died in the course of the year, and the appointment has but lately been filled up, so there is something on that score to be relied upon in the not distant future, for civilised governments, if slow, are reasonably sure.

"Turning now to that part of our work which concerns supplies to the trade, the gun and rifle trade, as I hinted before, has been well maintained, but even here a deficiency of profit occurs arising out of circumstances too technical to be dwelt upon here connected with modifications in the manufacture of gunpowder and a consequent revolution in the testing process [*sic*]. This, I am happy to say, has now been successfully accomplished, with a promise of good results for the future, so I think we may dismiss the gun and rifle trade without further comment as affording no subject for present anxiety. Passing on, however, to the demand for revolvers on the part of the trade in 1898, we are again confronted with a deficit approaching 30 per cent., caused, I cannot help thinking, by one of those fluctuations of fashion, to which, I suppose, the great majority of trades are subject. The public fancy would seem of late to have set in the direction of automatic pistols, and particularly of one called the Mauser pistol, which we do not at all fear as a permanent rival.

"I may add that during the past year the Company has been engaged in many costly experiments, not by any means all of which have proved successful, and that with a single exception, where we deem that complete success has been attained, the whole expenditure has been charged to revenue. Reverting to more concrete aspects of the financial situation, there is one which I must not omit to mention, because it is likely to have a sensible influence on the current year's accounts, and an important influence on the accounts of the future. Towards the close of 1897 the business of Messrs. Webley was converted into a Joint Stock undertaking, and the year 1898 has been called upon to bear the full weight of the expenditure inseparable from the conduct of business under those conditions; but you will bear in mind that with Messrs. Webley's business two smaller ones were incorporated, and that substantial economies were foreshadowed as likely to arise from working the three concerns under a single roof and a single administration. Our belief in the likelihood of effecting those economies is in no way shaken; they have been well thought out, and we hold them, so to speak, in the hollow of our hands; but, as I told you at the Statutory Meeting, the erection of buildings is a preliminary necessity. Those buildings are in a forward state, and if open weather continues the contractor promises to have them ready for occupation in July, so that the current year's account should participate in the benefits of the impending change, which will partially operate even before the buildings are completed; the whole cost of building and machinery will not, we believe, exceed £13,000, and the Company has ample funds to meet the outlay.

There is one more point with which I will venture to trouble you; I just glanced at it in my opening remarks, but I think it calls for a fuller explanation. In an interim report, dated June 2nd, 1898, which we issued with the balance sheet for 1897, there was a statement that the Directors were satisfied that the state of the business justified them in paying an interim dividend at the rate of five per cent. per annum, and a dividend to that amount was accordingly paid on the ordinary shares. As I have already pointed out, the falling off in trade assumed its more acute development in the closing months of the year. That the volume of trade was never equal to that of the preceding year is very likely true, but the profit for 1897 was £31,000. To pay five per cent. upon both preference and ordinary shares requires less than £17,000, and at the date of the interim report there was no indication at all that the profits for the year were likely to fall below that level. That they ultimately did fall below it, is matter for sincere regret, but I am not at all disposed, merely because in 1898 all the chances of trade turned against us, and we came off second best, to take the view that a business of world-wide reputation with those traditions of management unbroken, which have achieved a prosperous and honourable past, is going as a Joint Stock Company to degenerate into a struggling concern, unable to pay a fair rate of interest upon the investments of its shareholders.

The items in the profit and loss account will perhaps not interest you much seeing that you have no previous accounts to compare them with. The one which appears most likely to attract attention is that under the heading of office and general salaries, directors' fees and other disbursements, amounting to £5,198. This item includes, though it is not by any means entirely composed of, the charges which are inseparable from the existence of a Joint Stock Company, and of which, as I have previously pointed out, the year 1898 has borne the full weight. From accounts to which I have had access, I find that the charge under the same heading for the year 1897 was £2,291, and though certain adjustments on both sides of the account would be requisite in order to bring out the exact figure, the balance of £2,900, including the Managing Director's fee and the Secretary's salary, may be taken as approximately representing the sum which would have been deducted from the profits of previous years if the now united businesses had then been separately worked as a joint stock undertaking, but I have already pointed out the economies which we propose to effect by their union, and which I hope will go far to neutralise that burden upon profits. The sum of £3,328, which you will observe is added to the first item on the credit side of the balance sheet, represents the sum which has actually been paid to the contractors, who have the new buildings in charge, and lower down an addition of £971 to plant and machinery account is for machinery already supplied in those buildings. As regards the remaining items I think it will be admitted that they have been subjected to adequate and even liberal depreciations, although it must be admitted that there is one important exception applying to the item for goodwill and other valuable considerations, the reduction of that account under the circumstances, which I have had the privilege of explaining to you, is necessarily deferred to a more convenient and prosperous season. I now move the adoption of the Report and Accounts.

MR. E. LUDLOW seconded the motion.

MR. DAVIS considered the charge under the heading of office and general salaries and directors' fees exceedingly heavy under the circumstances, and mentioned that nothing had been placed to reserve. He could not congratulate the directors upon the result of the past year's working.

MR. DUTTON pointed out that the profits of the businesses, according to the prospectus, were in 1894, £15,412; in 1895, £19,082; in 1896, £30,000; and in 1897, £31,000. In 1898, they had dropped back to a little over £10,000. The busi-

nesses, he believed, were acquired by the Company on the basis of the profits for 1896-7, and, therefore, he considered they were sold to them for a very unfair price. He suggested Mr. Webley should give his views regarding the future.

MR. T. W. WEBLEY (Managing Director) said they had done everything to induce the Government to give the Company work in the past year. In 1897 he was led to believe that in 1898 they would have a large naval order, but, as a matter of fact, only thirty revolvers were ordered. In 1895-6-7 they had a run of foreign contracts, and there was every probability of their being continued. By the end of 1897 all the contracts were completed, and in 1898 they had not a single foreign contract. The Government business was less than half in 1898 compared with 1897. He believed they would do a good Government trade this year. Probably he would go abroad again to look up foreign business. Preparations were being made for the manufacture of their own barrels on an economical system, which would increase the profits. He looked forward with confidence to the declaration of a 5 per cent. dividend on the ordinary shares. He had been buying shares since the formation of the Company, and also the Chairman and Mr. Ludlow. Not a single director had parted with his shares. He had every faith in the Company.

The CHAIRMAN, in reply to questions, said the vendors paid the preliminary expenses up to allotment. The expenses the Company were responsible for were being written off at the rate of one-fifth per annum. No one looked with greater regret than he did upon the results of the past year, which the Board hoped would improve in the future.

The resolution was carried unanimously.

Final dividends of 2½ per cent. on the preference shares, and 1 per cent. on the ordinary shares (making 5 per cent. per annum on the preference, and 3½ per cent. on the ordinary shares) were agreed to, and the auditors, Messrs. Turquand, Youngs, Bishop and Clarke, having been re-appointed, the proceedings terminated with a vote of thanks to the Chairman.

NOTES.

STOWMARKET CORDITE.—We are very pleased to note that the Government have recently recognised the enterprise of the New Explosives Co., Ltd., in having erected the model Cordite factory, which we described in a recent issue. This recognition has been accorded in the extremely welcome form of a large order for Cordite; and we have every confidence that the excellent administration of the factory and its first-rate equipment will enable the Company to execute this work with as much satisfaction to the Government in regard to quality, as to themselves in the way of economical production and absence of rejects.

MR. PAUL NORTH.—Mr. Paul North, who has been negotiating for the sale in this country of the repautrap and American birds on behalf of the Cleveland Target Co., returned to the States on the 25th ult. He has carefully studied during his visits the conditions under which inanimate bird shooting is carried on in this country; and it is to be hoped that the valuable suggestions he has made, based, as they are, on a wide knowledge of the working of this sport in the States, will bear fruit.

ELECTRIC BLASTING.—The concluding part of four papers by Mr. William Maurice on electric blasting appears in the latest edition of the "Transactions of the Institution of Mining Engineers." The author has dealt with this interesting subject with a fullness of detail, and a mastery of electrical science, unexampled in any similar contribution that we remember to have seen. Those who wish to read thes papers in their original and now complete form would do well to purchase the last four volumes of "Institute Transactions," which are issued at 6s. each.

MESSRS. ELEY BROS., LTD.—We have received a copy of the balance sheet of this company for the past year, and it shows that, owing to the stress of competition and the exceedingly bad shooting season, the net profits of the last year are somewhat less than those of the previous year. The profits amount to £38,870, which, with the £14,000 brought forward from the previous account, gives a total available for distribution of £52,886. In addition to the interim dividend at the rate of 5 per cent., which was paid in July last, it is now proposed to pay a further dividend of 10 per cent., making 15 per cent. in all. In this way something over £1,000 is added to the unappropriated balance of profits.

THE PERSIAN GULF FIREARMS QUESTION.—The following resolution, inviting Lord Salisbury to receive a deputation on the subject of the alleged illegal seizure of arms in the Persian Gulf, was recently passed by a meeting of gunmakers:—"That this meeting testifies to the suffering caused among workmen by loss of wages through stoppage of trade resulting from the Persian Gulf seizures, and humbly requests your lordship to receive a deputation of employers and workmen with the view of inducing your lordship to use your influence with the Persian authorities to permit this trade to be continued." Lord Salisbury's reply, which is dated Feb. 6th, is as follows:—"Sir,—I am directed by the Marquis of Salisbury to acknowledge the receipt of your letter of the 28th ult., forwarding a resolution passed at a meeting of the Gunworkers' Union, in which his lordship is requested to receive a deputation of employers and workmen in connection with the trade in arms with the Persian Gulf. I am to state that nothing has occurred to alter the views of her Majesty's Government on this question since Mr. Curzon received a deputation on June 9 last, and that no useful purpose would be served by a fresh interview on the subject. Any written statement which you may wish to make will receive attention. I am, etc., (signed) T. H. SANDERSON."

STANDARDISING GUN CHAMBERS.—Gunmakers have frequently felt worried in the boring of their barrels to decide upon the best form of chambering. In the ordinary way a gunmaker has but little difficulty in deciding upon the amount of play which it is desirable to leave between the cartridge case and the chamber. This play must be regulated so that the permanent expansion of the case, due to the firing, will not cause it to press against the sides of the chamber, and so resist the operation of the injector. On the other hand, the play must not be so large as to allow the cartridge tube to expand beyond the limits of its elasticity, as the result of this would be a fractured case and the escape of gas. In the same way the recessing of the rim must not be excessive, nor, on the other hand, insufficient. If the rim recess is too large, then the cartridge is not properly held in the chamber, with the possible result that the expansion of the tube against the chamber will cause the unsupported base to be blown backwards, and so become separated from the tube. If the

rim recess is too small, difficulty will be found in closing the gun, and possibly still greater difficulty in subsequently opening it. Gunmakers know what are the proper allowances necessary to meet these circumstances, provided always that they have a standard cartridge as a basis for the calculations, but unfortunately this uniform standard does not exist. Messrs. Eley and Joyce use one standard and Messrs. Kynoch another. Although the differences seem slight when expressed in thousandths of an inch, they give a good deal of trouble to the gunmaker who has to bore his chamber to suit any cartridge. We believe that experiments are at the present time being carried out for the purpose of determining the gauges of chamber and of cartridge which will be mutually satisfactory both to the gunmaker, on the one hand, and to the ammunition manufacturer, on the other. It is possible that it will be some time before the results of this work are ripe for general discussion, but, in the meantime, gunmakers will be grateful for the efforts which are being made to place the boring of chambers on a reliable basis.

MESSRS. VICKERS SONS, & MAXIM, LTD.—The directors of this Company recommend the following dividends, viz:—£2 10s. per cent. for six months on the £750,000 preferred five per cent. stock, and the same on the five per cent. preference shares; also a final dividend of 2s. per share on the ordinary shares. In the event of the shareholders passing the special resolutions necessary for the increase of the capital by 250,000 new ordinary shares of £1 each, and for the allotment of such new shares at par to the registered holders of the existing ordinary shares (that is to say, at the rate of one new ordinary share for every four existing ordinary shares), the directors will recommend a special bonus of 5s. per share (free of income tax) on the existing 1,000,000 ordinary shares of the company (making £250,000), to be payable out of the reserve fund, and will allot the new ordinary shares rateably as above, so that any holder of ordinary shares who desires to take his allotment of new ordinary shares will be able to apply the bonus in payment of the amount due on his new shares. The actual dividend distribution is at the same rate as last year, but with the bonus and profit on the new shares there is a considerable additional profit.

NEW EXPLOSIVES CO., LTD.—This Company is to be congratulated on the very successful results shown in the Report and Balance Sheet for last year, which has just been issued. The net profit for the year 1897 was £2,601, while that for the year now under review is no less than £13,431. This, added to the amount brought forward from the last accounts, gives an available total of £17,375. It has been decided that a dividend of 10 per cent. shall be paid. This, together with the interim payment already made, will absorb £9,000. Of the balance £3,000 has been added to the Reserve, and the remainder, viz., £5,375, is carried forward to the next account. These figures do not fully represent the very satisfactory results of the past year. For instance, the interest on the £30,000 of debentures, which were created for the purpose of erecting the new Cordite factory described in our last December issue, has been deducted before arriving at the net profit. Further, £2,308 has been written off for depreciation of plant and property, and, in addition, £832 has been written off the amounts expended on patents and experiments up to the 31st December last. The issue of £30,000 for debenture has not met the costs of the new factory by £5,158, and the balance sheet shows that this additional expenditure has been met without issuing fresh debentures. It is explained in the report that, as debenture capital of the Company is too small to permit of the granting of a Stock Exchange quotation, it is proposed to redeem the debentures as quickly as the profits of the Company will allow. The position of the Company, as shown by the balance sheet, is most flourishing, and the past year is, in the opinion of the directors, the best that the Company has experienced for many years. That the future promises well may be deduced from the fact that the present year has opened with a large amount of work in hand. The total assets of the Company, including their various properties and stocks, together with cash in hand and owing, amount to £142,420. The profit and loss account shows that the gross profits of the manufacturing account amount to £28,034, and that the office and other expenses amount to £10,847, the net profit available for dividend purposes being arrived at after deductions for debenture interest, income tax, and other items.

SMOKELESS POWDER CO., LTD.—We understand that a distribution of 2s. per share has been made to the shareholders of this Company. It will be remembered that it went into voluntary liquidation last October, since which time the work of realising the assets has been actively progressing, and it is expected that a final distribution will be made towards the end of the present month. This liquidation has, of course, nothing to do with the Smokeless Powder and Ammunition Co., Ltd., which is the name of a company formed by the old Schultze Company, to work the factory and take over the business of the Smokeless Powder Co., a substantial sum having been paid at the taking over of the old company's property and goodwill, etc.

THE MARS AUTOMATIC REVOLVER.—At the recent demonstration in Birmingham of the expansive powers of different revolver and other bullets, the firm of Webley exhibited the working of a new automatic revolver which, although not quite complete in all its details, is rapidly attaining a high degree of perfection. When the Webley Company saw the influx of automatic pistols they very quickly came to the conclusion that it would be well-nigh impossible to construct, within reasonable limits of weight, an automatic magazine loading pistol which would fire the standard type of service ammunition. In their opinion it was necessary that the advantages of automatic cocking and reloading could only be accepted by military experts, when working in combination with ammunition giving the required shock on impact. They therefore determined that the most feasible means of providing for the automatic loading of large bore ammunition would consist in applying this principle to a weapon with a revolving cylinder. When Captain Gabbett-Fairfax subsequently invited the attention of the company to his experimental work in this direction, he was at once granted facilities for continuing his researches. One of the earliest difficulties was to provide for the certain rotation of the cylinder due to the recoil of firing a shot, and as this has been effectively dealt with in addition to various other incidental problems, we may anticipate that the final form of this weapon will shortly be arrived at. The reloading of the revolver will be effected in

the ordinary manner. The cartridges will be simultaneously extracted and fresh ones will be inserted in the chambers. This may not provide for quite such rapid firing in the case of a large number of cartridges, as would be possible with an automatic pistol having a magazine capacity of ten cartridges. On the other hand, the advantage of quick-firing within the limits of the chamber capacity is fully secured. It is evident that this revolver will not, as regards recoil, accuracy of aim, and other features, differ in any material way from weapons of the revolver class. But as recoil is chiefly a function of the ammunition used, any comparison in this respect with the small-bore automatic pistol is out of place. Of course, if it were possible to obtain the small recoil of the automatic pistol, in combination with the stopping powers of the large bullet of the revolver, any weapon containing such a range of advantages would hold the field; but, so long as an elephant rifle gives more kick than a 22-bore repeater, we may rest assured that such conditions are mutually antagonistic.

HOTCHKISS ORDNANCE COMPANY (LIMITED).—Separate general meetings of the preference and ordinary shareholders were held on the 28th ult., at Winchester House, Admiral Sir W. Hornby in the chair, to consider the provisions of a certain agreement, confirming it under the powers conferred by clause 13 of the articles of association, and directing it to be carried into effect. Addressing the meeting of the preference shareholders, the chairman stated that they had really met to consider the reorganization of the capital of the company. Twelve months ago a committee of the shareholders was appointed with a view of devising a scheme with this object, and he pointed out that it was a shareholders' and not a directors' scheme, and he urged them to accept it. Mr. John Balfour, in proposing a resolution approving the scheme, stated on behalf of the committee that the latter had endeavoured to make the proposal fair to both parties. Mr. William C. Slaughter seconded the motion. The solicitor afterwards read and explained the agreement. The resolution was then put to the meeting, and was carried with one dissentient. A poll was demanded by Mr. Slaughter, in order to avoid the possibility of any legal quibble, and it was taken at once, with the result that 30,942 votes were recorded in favour of the resolution and 15 against it. At the ordinary shareholders' meeting the chairman practically made the same statement as at the former meeting; and on the motion of Mr. Balfour, seconded by Mr. Lea-Smith, a resolution approving the agreement was carried unanimously. Mr. Balfour stated that 38,703 votes had been recorded by proxy in favour of the agreement and 400 against it. A combined meeting of both classes of shareholders was held subsequently, when resolutions were passed altering the articles of association of the company as set out in the advertisement calling the meeting.

IMPROVEMENTS IN THE LEE-ENFIELD RIFLE.—Messrs. Westley Richards & Co., Ltd., whose special function in this world appears to lie in the direction of improving the British service rifles, have recently added another feather to their well-plumed cap. The recent modifications in the Lee-Enfield rifle are intended to improve the working of the arm from the point of view of the sportsman. In the first place, they have applied a modified form of the bayonet point to the fastening of a detachable barrel, so that the latter may when required be removed for more convenient transport. They have also provided a thumb-piece for blocking the sear on the top part of the grip, so that sportsmen who are in the habit of using guns and rifles having this form of safety will not be troubled by having to remember the special construction of the ordinary Lee-Enfield safety. The new safety is automatically brought into play by working the bolt in a manner analagous to that of ordinary shot guns and rifles; so that before each shot it is necessary to push the thumb-piece forward. Another of the modifications consists in providing an alternative size of magazine constructed to hold five cartridges, the object being to cut down the size of the ordinary ten-shot magazine, so that those who do not require a larger reserve than five cartridges at a time will have the advantage of a handier weapon. The final improvement is the addition of an aperture back sight. A good deal of ingenuity has been displayed in the adaptation of aperture back sights to magazine rifles, and the late Mr. William Lyman spent the last year of his life in the design of sights which would occupy the required central position, and yet would not project into the line of travel of the bolt. Messrs. Westley Richards have taken the bull by the horns and put the sight right in the way of the track of the bolt; but they have obviated the apparent difficulties connected with the use of such a sight by hinging it at the base and fitting a spring which tends to keep the sight in an upright position. When the bolt is retracted for the reloading of the rifle, it forces this back sight into an inclined position, but after the bolt is returned the spring readjusts the back sight in the vertical position requisite for firing. Illustrations of this rifle show that the back sight is mounted somewhat to the rear of the thumb-piece mentioned above, and it, therefore, lies on the grip slightly in advance of the comb of the stock. As we have not handled the rifle, we cannot say whether this will interfere with the proper holding of the weapon, though, no doubt, this point has been practically considered by Messrs. Westley Richards, and they have probably satisfied themselves that the new sight does not prevent the proper gripping of the rifle in the right hand.

THE ADMINISTRATION OF THE ORDNANCE FACTORIES.

LORD LANSDOWNE made the following important statement when recently questioned in the House of Lords regarding the future administration of the Ordnance Factories:—

"The present organisation of the Ordnance Factories dates from the year 1887, when the late Mr. Edward Stanhope introduced important reforms into their management. Even those who think the present system capable of improvement will acknowledge the great value of those reforms. In order to establish this proposition, it is only necessary to compare the condition of the factories as Mr. Stanhope found them and as he left them It is enough to say that before his time the different factories were unconnected, that there was no system of independent inspection, and no proper financial control over their proceedings, while outside the factories the services had no voice in the selection of the weapons and equipment which were supplied to them.

"Mr. Stanhope left the factories under the administration of one responsible head, under proper financial control, and under independent inspection, and he admitted the principle that the military and naval authorities should have the right of selecting their own stores and equipment, and of accepting or refusing it according as it succeeded or failed in passing the test of military inspection. The result has been a system under which, whatever its imperfections, there have been no scandals of the kind which attracted so

much attention in Parliament during the years which preceded Mr. Stanhope's reforms, and no complaints that the services have had forced upon them faulty weapons or inferior stores.

"If we have come to the conclusion that certain further changes are necessary, they will certainly not be in the direction of a departure from the main principles laid down by Mr. Stanhope

"It will be convenient that I should describe the present system so far as it affects the principal officials concerned. The whole of the manufacturing departments of the Army are, by Order in Council, placed under the control of the Financial Secretary. The nature of the control which he is to exercise is not defined, but it was apparently intended to be something more than the ordinary power of financial review which he exercises over the whole of our military expenditure. The Financial Secretary is, of course, a civilian and a Parliamentary official. Under the Financial Secretary there is the Director-General of Ordnance Factories, a post which, though not necessarily held by a civilian, for the past ten years has been held by a civilian, the late Sir William Anderson, an officer of very great ability and experience, whose untimely death towards the end of the year was greatly deplored by all who knew him. Under the Director-General there is a Deputy Director-General, a mechanical engineer, who is also a civilian.

"It will be observed that under this arrangement the Ordnance Factories, so far as these higher posts are concerned, have of late been under civilian control; and I call special attention to the fact that the Inspector-General of Ordnance—who, under the Order in Council which governs the constitution of the War Office, is charged with supplying the Army with warlike stores and equipment, with dealing with questions of armaments, of patterns, of inventions and designs, and with the duty of advising the Secretary of State on all questions connected with his department—is given no voice whatever in the management of the factories, and no right of giving a single order within them.

"It does not seem unnatural that, in spite of the undoubted ability of the officials to whom I have referred, in spite of all the pains which they have taken, there should under such a system have been a good deal of friction, and a feeling on the part of the services that their requirements were not always sufficiently understood or attended to with sufficient promptitude. It is often said that manufacture is better in civilian hands, and should be entirely left to civilians. That is, I think, a statement which requires some qualification. It would be truer to say that manufacture should be in the hands of men who, whether they have begun life as soldiers, sailors, or civilians, have been trained to manufacture, and who are accustomed to the processes and routine of manufacture, and who know how to get the best value out of the men and the machinery which they employ. A soldier may be an extremely able soldier, he may know exactly what kind of weapon the Army wants, but he may be quite unable to make it, and the idea of bringing in a clever soldier, with no experience but that which he has acquired in the Army, for five years, and handing over to him the management of a great business concern, would be ludicrous.

"Upon the other hand, a soldier or a sailor who is thoroughly conversant with the design and manufacture of warlike stores—and we know that such soldiers are to be found—has this great advantage, that he not only understands manufacture, but that he is able to understand better than a civilian the requirements and, I would almost venture to say, the prejudices of the services, while the services, knowing that this is the case, are inspired with a confidence which they would not otherwise feel. There is another consideration of which we should not lose sight.

"The factories are concerned not only with the manufacture of warlike stores, but with the invention and design of such stores, and with the conduct of experiments relating to them. We look to them to carry out for us those modifications in our war material which are constantly required by the ever-varying conditions of the service. Now I do not think that it will be seriously disputed that in regard to all questions involving the design of warlike material it is right that the soldiers and sailors by whom that material will be used should have a voice.

"We arrive, therefore, at this—that, in so far as the Ordnance Factories are concerned with design, it is necessary that the services should have a *locus standi* within them. Then arises the question whether it is possible to divorce design from manufacture. I believe you cannot, and that the attempt to do so would result in the most lamentable failure. Design and manufacture must go hand in hand.

"That is certainly the view which prevails in the great private firms upon whom we depend to a great extent for our warlike material. Sir Andrew Noble, the head of the well-known Elswick firm, writing to me a few days ago, says:—'I say distinctly that in my opinion it would be fatal to separate designing and manufacturing if you desire to make any progress.' And you will find that in these works, and in all other great enterprises of the same kind, the closest contact and the most constant intercourse is maintained between persons engaged in design and those by whom the process of manufacture is carried out. We have, in these circumstances, come to the conclusion that steps should be taken in order to bring the Ordnance Factories into closer touch than heretofore with the services. I say 'the services,' because it will not be forgotten that the Navy are as much interested as the Army in this matter. The Navy are customers of the Ordnance Factories to quite as great an extent as the Army; and I am able to say that the views which I am expressing are shared by the Admiralty.

"The steps which it is proposed to take are these. In the first place, I have appointed as head of the Ordnance Factories a soldier—Colonel Bainbridge. He has been for many years past in charge of the Royal Laboratory, and has had under him about 8,000 operatives. Although he is a soldier, he is thoroughly versed in manufacture, and is, I believe, in all respects fit for this promotion. I may add that he is no longer on the active list of the Army, and that his tenure of office is governed by the rules of the Civil Service.

"It is also proposed to alter the Order in Council so as to make it clear, on the one hand, that the control exercised over the factories by the Financial Secretary is financial control only—that is, I need not say, in a great industrial enterprise of this kind a very extensive control indeed—and, on the other hand, that the Inspector-General of Ordnance has the right of exercising direction over the factories. It is, of course, not intended that he should take their management out of the hands of the Director-General, but, considering that he is, as I have already said, responsible for supplying the Army with warlike stores, and for dealing with the design of such stores, we think it desirable that he should be placed in direct contact with the factories, and that he should have some voice in their affairs. This, of course, does not imply that the factories will be in any sense emancipated from financial control. To that control it is quite clear that they must remain subject, and we have no idea of relaxing it.

"In order to bring the title of the Inspector-General of Ordnance into closer correspondence with his duties, we propose that he shall be styled Director-General of Ordnance, and, in order to avoid confusion, the head of the factories will have the title of Chief Superintendent of Ordnance Factories. These are the changes which we mean to make. They are intended to bring the services into closer touch with the factories whose business it is to supply them with their equipment, and to do that without in any way abandoning the idea that the factories must be managed on business principles and kept under strict financial control.

"I am strengthened in these conclusions by the fact that no less than three Committees and Commissions—viz., the Royal Commission on Warlike Stores, presided over by Sir J. Stephen, in 1887, the Royal Commission on Civil Establishments, presided over by Sir Matthew White Ridley, in 1887, and the Committee on the Organization of the Army Manufacturing Departments, presided over by Lord Morley about the same time—recommended that the Ordnance Department, and, as part of it, the Ordnance Factories, should be under military control; and, at a later date, the Royal Commission on the Civil and Professional Administration of the Naval and Military Departments, presided over by the Duke of Devonshire, in 1890, called attention to the fact that these recommendations, to which they apparently gave their adhesion, had not, so far as they concerned the manufacturing departments, been acted upon. I ought, perhaps, to add that there are other questions concerning the eternal organisation of the factories upon which I have not touched because they are still under consideration."

CORRESPONDENCE.

GAUGING OF SHOT GUN BARRELS.

TO THE EDITOR OF *Arms and Explosives*.

DEAR SIR,—As a subscriber to your paper I call your attention to Messrs. Hahn, in Cassel (Prussia), the well-known makers of micrometric gauges and all other instruments for ballistic science, artillery and gunnery. For gauging shot gun tubes they make an instrument as you describe in your No. 77. Two rounded steel pins are pushed further apart from each other, or brought closer by a very correctly shaped hardened steel wedge-like piece, the movement of which is

brought about and measured by means of a micrometric screw, and read off on a divided disc. The screw, of course, is enclosed within a brass tube, that may be passed inside the barrel to be gauged at any part of its entire length. I have seen the instrument at a visit I paid to the makers some years ago. It is in constant use at the Versuchs-Anstalt fuer Handfeuerwaffen (Small-arms Testing Institution) in Halensee, near Berlin, under Major Thiel, for testing the amount of shake in shot gun barrels. I think the makers have the instrument always ready on hand, or at least would make it to order in a short time. It would be the best plan, I think, to ask for their catalogue previous to an order, the more so as this is sure to contain illustrations of various apparatus of great interest to a professional man in your important and responsible position.

I have the honour to be, dear Sir,

Yours respectfully,

Hanover, Feb. 15, 1899. W. SONNEMANN (C.E.).

THE TESTING OF BLASTING EXPLOSIVES.

MAJOR COOPER-KEY, R.A., has issued his second annual report on the testing of explosives at Woolwich in connection with the Coal Mines Regulation Act. The report is addressed to Col. A. Ford, R.A., H. M. Chief Inspector of Explosives, and it deals in the same manner as the report of the previous year with the working of the Woolwich Testing Station. By its separate issue the loss of time is avoided by postponing appearance until the publication of the Annual Report of the Inspector of Explosives. Major Cooper-Key reports as follows:—

As in 1897, I will avoid a categorical statement of the work done day by day; but will only bring to your notice certain definite points, a discussion of which may appear to be of general interest. I propose then to confine my remarks to the following points, viz.:—

(1). The apparatus and its working.
(2). The conditions of the "Test."
(3). Some remarks on the new explosives admitted to the Permitted List.
(4). Determination of equivalent charges.
(5). Experiments—
  (*a*) On the inflammability of anthracite dust.
  (*b*) With detonators.
(6). The guncotton yarn "tell-tale."

THE APPARATUS.

The apparatus continues to work quite smoothly. Doubts were at one time entertained as to the capability of the gas engine to yield sufficient motive power to do the necessary work, and it was even suggested that the electrical power mains from the Arsenal should be extended to the Testing Station, with a view to the establishment there of a motor. By means, however, of an auxiliary gas bag, but chiefly by reason of the increased sympathy between the engine and its driver (Brooks), all difficulties have been removed, and it is possible to fire between 30 and 40 shots in a day without any undue strain. There is a certain grim satisfaction in the fact that, with the best will in the world, we have found it quite impractable to utilize any suggestion in the nature of an improvement from outside sources, notwithstanding the number and experience of the experts, both British and Foreign, who have honoured us with a visit. Captain Lloyd has made some slight alterations in the "drill," with a view (1) to ensure that the tube shall be thoroughly cleared of all residual gases after each shot, and (2) to empty the gas-holder on the completion of the mixing by means of the fan, instead of by hand as heretofore. The removal of the concrete screen between the cannon and the observer is a decided improvement, inasmuch as the recoil and the appearances at that end of the tube when a shot is fired are, on occasions, exceedingly instructive.

THE CONDITIONS OF THE "TEST."

The necessity for altering the conditions of the test has not yet arisen and does not seem likely to arise, at any rate, for some time. No complaints have reached my ears as to any want of uniformity. In all essential particulars the conditions are identical on every occasion. There are apparently only two channels by which errors may creep in notwithstanding all our efforts, viz.: (1) Atmospheric influences; (2) the fact that the stemming is done by hand. As regards (1), it would be almost, if not quite impossible, to experimentally determine the effect of the varying conditions of the atmosphere on the explosive properties of the gaseous mixture. These conditions may be divided into four classes, barometric, thermometric, anemometric, and hygrometric, and each of these may again be subdivided into "exceptionally high," "average," and "exceptionally low," and when it is considered that the experiments must necessarily be of a negative nature, and that, therefore, nothing under a very large number of shots would be of any value, and that the number of ways in which these conditions might be severally combined amounts to no less than 81, and lastly, that every class of explosive would have to be separately tested, it follows that many thousand shots would have to be fired in order that a definite conclusion might be arrived at; and even if the requisite weather could be supplied to order, this would involve an amount of work which would scarcely be commensurate with the object to be attained; it being exceedingly doubtful if in the end we should find that atmospheric changes had any material effect on the results. I have, however, a strong suspicion—although at present it is no more than a suspicion—that there is one somewhat rare meteorological condition which appreciably affects the explosiveness of the mixture—I refer to the case of a high barometer combined with a moist atmosphere, a combination which appears to render the mixture distinctly more explosive. Why this should be I am not in a position to state, but that it is so I have fair reason to believe, and since coming to this conclusion, I have received the independent testimony of a well-known mining engineer in corroboration of my view. As regards the other channel by which want of uniformity may be introduced, viz., stemming by hand, Captain Lloyd has suggested that this should be done by hydraulic means, in which case the personal error would be entirely eliminated, and the stemming might be applied both as to amount and consistency with mathematical precision.

THE QUESTION OF "UNIFORMITY."

I have dwelt somewhat on this question of uniformity, inasmuch as it is to my mind the hub round which all other considerations should revolve, and the importance of which is, I regret to say, not yet fully realised, even by experts. I have been frequently asked by men whose opinions carry the greatest weight in the mining world, why the conditions of the test are not more assimilated to those obtaining in a mine. To particularise, the addition of coal dust to the explosive mixture has been continually urged as being a necessary adjunct if useful information is to be obtained. "Information," in fact, is the rock on which they split. The "information" gained by previous experiments has no doubt culminated in the formulation of a "Test," but once this "Test" is settled, surely everything should then give way to considerations of uniformity, *i.e.*, "fairness." It became apparent at a very early stage that no sort of uniformity could be obtained if such a variable influence as coal dust were allowed a place. How much dust should be added? How should complete incorporation of this dust with the gaseous mixture be ensured? How should the apparatus be thoroughly cleaned after each shot? How, again, should an absolutely equal degree of sensitiveness to ignition be attained? These and other similar question proved unanswerable. Take the first and simplest. How much dust should be added? If we have already the most sensitive possible mixture of combustible and oxygen, why add more of the former? Dr. Haldane,*

* "Causes of Death in Colliery Explosions."

than whom a higher authority on these matters would be hard to find, states that more than ·1 per cent. by volume of coal-dust in suspension in pure air would probably render the mixture non-explosive—indeed, he goes so far as to say that it is a question whether watering and otherwise reducing the quantity of available dust in a mine is not rather favourable to the very result it is desired to avoid—the formation of an explosive atmosphere. Moreover, although the theory that coal-dust without the addition of fire-damp cannot initiate an explosion was sore stricken at Camerton in 1893, and received its death blow at Timsbury two years later, yet the fact, as evidenced by the official reports on these catastrophes, the said theory died hard, seems to prove, if proof were required, that up to that time such well qualified judges as H.M. Inspectors of Mines were convinced that an explosive mixture in which the combustible material was added in the form of fire-damp was far more sensitive than when this material was added in the form of dust. Indeed, it would appear that in order to *originate* * an explosion the necessary conditions would involve an abnormally intimate mixture with the oxygen of the air of precisely the correct percentage of dust, combined with a source of heat of considerable volume as well as intensity, whereas a very varying proportion of fire-damp will form with air an inflammable mixture, and one liable to be ignited by a comparatively insignificant source of heat. If this can be said of methane, it is even more true of coal gas, not only on account of its lower temperature of ignition, but also from the wider percentage limits between which a mixture of the latter with air remains inflammable. If, then, we have the most sensitive mixture possible, which is at the same time in the most manageable form, why interfere with it in order to introduce a substance which, although doubtless always present in a coal mine, has in only a very few authenticated cases been the *originating* cause of a disaster. It is scarcely conceivable that an explosive which can be fired with impunity through a mixture such as that in use at the Testing Station is less safe than one which, under precisely similar conditions, can be so fired. So long as the necessity is deemed to exist for the use of explosives in coal-getting, so long will accidents occur; holes will be bored through fissures containing gas; blowers of gas will be tapped in the course of boring—an inflammable atmosphere in either case being brought into actual contact with the explosive; the stemming may, in the case of a blown-out shot, impinge on a solid body and set up locally a dangerous temperature; and, lastly, a shot may be fired unstemmed either by accident or design; but it is surely possible for us to assist, by means of such technical knowledge as we may possess and by frequent experiments, the ceaseless efforts of H.M. Inspectors of Mines towards reducing the number and minimizing the effects of these lamentable sources of disaster, without in any way interfering with the uniformity and fairness of the test.

NEW EXPLOSIVES ON THE LIST.

As foreshadowed in my last report, gunpowder of a high class, in combination with a chemical "cooler," has obtained a place on the Permitted List. Not only this, but specially manufactured gunpowders have at length been produced which are capable of passing the test even without the assistance of a cooler. These results, I would venture to suggest, may be regarded as directly due to the Explosives in Coal Mines Order. The necessity having arisen for such a gunpowder in consequence of this Order, manufacturers have found comparatively little difficulty in producing one satisfying the conditions imposed, whereas, had no such necessity arisen, they might well have been content with an explosive for which they had already an assured sale and have made no effort to improve thereon.

With regard to the other explosives on the list, there is little to remark. A reduction has been sanctioned in the fee to be paid in the case where an alteration in the packing or method of firing an explosive already on the list necessitates a re-test, or rather a *confirmatory* test under the slightly altered conditions.

Steps are being taken to provide each of H.M. Inspectors of Mines with a special metal case, as approved by the Railway Clearing House, for the conveyance as ordinary goods of samples of permitted explosives to the Testing Station, in order that an abbreviated test of say 10 shots may be carried out; and mine managers and others are encouraged to take advantage of this facility in all cases where they entertain the slightest suspicion as to the behaviour of any permitted explosive used by them.

EQUIVALENT CHARGES.

The method of obtaining the equivalent charges of the various explosives by means of lead blocks remains unchanged. So far as regards high explosives the results are probably fairly accurate, although no doubt somewhat disadvantageous to those of them which have been purposely "tamed" for use in soft coal. No more practical method, however, has yet been produced, and it is moreover unreasonable to suppose that a quarter of an ounce or so in the weight of the charge can make any material difference in the result of the "Test."

With gunpowder it is a somewhat different matter. The "time" factor, ignored by the lead block, is now of more importance. A combination of the "mortar" and "expansion" tests, such as the propulsion of a ball from a lead block, might possibly meet the difficulty—although this is somewhat doubtful—but, in case an alteration in the conditions of the test should at any future time be deemed expedient, it would, I venture to think, be more satisfactory on the whole to use equal charges of all non-detonative or low explosives, and trust to the exigencies of trade for the elimination of such as would only pass the test by reason of their want of explosive power.†

The adoption of this principle would, however, still leave undecided the very important question of the comparative efficiency of high and low explosives, and I would suggest for your consideration that, in order to settle this vexed question once and for all and set up a standard which could hereafter be regarded as official, it might be well to initiate a short series of experiments in a stone of medium hardness (or if preferred in a hard coal) to compare the effect of a good gunpowder with that of carbonite or some other of the less violent high explosives. Although the solution of the problem should perhaps be a matter more for private enterprise than for Government interference, yet it is impossible to establish anything in the nature of a *standard* unless the results receive the hall mark of official sanction.

During the past year, for instance, I have many endeavours to obtain from unprejudiced experts a definite answer to this question, but without success. I have gathered, however, that the semi-official standard established in Germany, and quoted by me in a footnote to my last year's report, disagrees very considerably with the results obtained in this country. Although the ratio of 3 to 1 adopted at the Testing Station (*vide* Report for 1897) is perhaps, having regard to the conflicting opinions on the subject, as fair a proportion as any other, yet it would appear somewhat unsatisfactory, where large and important interests are at stake, to decide the question by hearsay alone, when it can be by no means impossible, by actual experiment, to arrive at a reasonably accurate conclusion which may be quoted as a quasi-official standard of comparison.

INFLAMMABILITY OF ANTHRACITE DUST.

A deputation of the South Wales anthracite colliery owners having approached the Home Secretary with a view to the relaxation of the Explosives in Coal Mines Order in favour of

* The *propagation* of an explosion by means of dust is quite a different matter—indeed, in these days of careful inspection and efficient ventilation, it would appear doubtful whether it would be possible for such propagation to take place without dust—but from a "Testing Station" point of view this is a matter of no moment whatever. The originating cause is the one important consideration.

† Practically this is what obtains at present—the equivalent charges varying between 5½ and 6½ ozs. with, however, the additional risk of assigning a prohibitive charge to a comparatively powerful and efficient explosive by reason of its slow action and consequent insignificant expansion of the lead block. The converse is so unlikely to occur as scarcely to be worth consideration.

certain of their mines in which fire-damp in appreciable quantities was unknown, a series of experiments took place at the Home Office Testing Station at Woolwich, on the 29th July, to determine the inflammability or otherwise of various samples of anthracite dust (1) in suspension in air alone, (2) in suspension in a mixture of air with a small percentage of coal-gas.

Representatives of the mine owners and miners were present, in addition to five of H.M. Inspectors of Mines and three of the officials in charge of the Testing Station, and the following programme, partly arranged beforehand and partly suggested on the spot, was carried out:—

(1.) Two ounces of a non-permitted explosive were fired in the open under a heap of quite uninflammable clay-dust.*

(2.) The same was repeated under a similar heap of steam coal-dust.

(3.), (4.), (5.), (6.), (9.) The same repeated under similar heaps of anthracite coal-dust from various mines.

(7.) The same repeated under a heap of especially inflammable steam coal-dust.

(8.) A repetition of No. 1 experiment.*

(10.) A treble charge of a *permitted* explosive was fired under a much larger heap of steam coal-dust.

(11.) A 1 lb. charge of non-permitted explosive was fired from the cannon in the vertical cylinder stemmed with clay only.*

(12.) A similar charge, but stemmed up to the muzzle with anthracite dust, was fired into a mixture of the same dust and air.

(13.) A more than equivalent charge of a *permitted* explosive was fired under exactly similar conditions.

(14.) A 1 lb. heap of the non-permitted explosive was placed on an iron plate in the vertical cylinder and covered with anthracite dust. Some of the same dust was then fanned into the cylinder and the heap of explosive fired.

The general result of these experiments was to prove to the satisfaction of all present that, although doubtless steam coal-dust was more inflammable than anthracite, yet the difference was purely one of degree, the latter dust, even when mixed with over 30 per cent. of foreign mineral matter from the main haulage roads, &c., giving a large volume of bright flame in every instance where a non-permitted explosive was used. Moreover, in experiments Nos. 10 and 13, in which a *permitted* explosive was used, there was absolutely no appearance of flame whatever, showing very conclusively that any relaxation of the Order so as to sanction the use of non-permitted explosives in dry and dusty anthracite mines would be attended with grave risk.

A distinctive feature of these experiments, and one to which I would venture to draw your attention, is the fact that in no case did we obtain a true *explosion* of dust. A combustion which occupies an appreciable time can scarcely be dignified by the name of an explosion. The dust appeared to be ignited by the shot, and to burn for such time as the particles were able to communicate sufficient heat from one to another. There was no instantaneous conversion of the solid into the gaseous form, and no noise beyond that due to the shot itself. Can it be that there are two distinct means by which a so-called explosion of coal-dust can occur, viz.:—(1) The comparatively gradual oxidation of the solid particles of dust with the evolution of light and heat, commonly called combustion; and (2) the destructive distillation of the coal-dust followed by instantaneous oxidation of the hydrogen and methane evolved. For the production of the former of these two phenomena the dust cannot well be too thickly distributed through the atmosphere, whereas for the latter, according to the above quoted authority, any material increase beyond 1 per cent. by volume renders the mixture innocuous, either by reason of the heat absorbed by the superfluous dust, or by the production of so much gas as to exceed the limit of inflammability. Of one thing, however, I think we may rest assured, viz., that either phenomenon is equally dangerous in a fiery or dusty coal pit.

But to return to the experiments. Although the main object of these was now fulfilled, it was thought advisable, in order to make the investigation more complete, to determine whether the addition of coal-dust or anthracite dust to a non-explosive mixture of coal gas and air would render this mixture explosive.

With this object in view the gas gallery was brought into requisition. A 4½ per cent. mixture of coal gas and air having been prepared, the cannon was loaded with a 2 oz. charge of a non-permitted explosive loosely tamped with 9 inches of dry clay. On firing there was no explosion in the gallery.

Several shots were now fired with anthracite and steam coal dusts loaded in the cannon as stemming, in such a manner that the explosion of the charge projected the dust in a fine state of division into the otherwise non-explosive mixture of coal gas and air. In every case there was an explosion of the mixture with a considerable appearance of flame at the valves of the gallery.

This result was confirmatory so far as coal-dust was concerned, but it can scarcely be considered to conclusively prove that an inexplosive mixture of gas and air can be rendered explosive by the addition of coal-dust, inasmuch as the circumstances of the two experiments were by no means identical. In the former case, viz., the case in which no coal-dust was used, the shot was stemmed with clay (although the clay was very loosely inserted), whereas in the latter the shot was practically fired *unstemmed* into a mixture of coal-dust, gas and air. Nevertheless, the experiments on the whole were extremely instructive.

DETONATORS.

On the 29th November I was present when Captain Lloyd carried out some interesting experiments to test the distance at which one detonator will fire others. The detonators used were Nobel's, containing 80 per cent. fulminate and 20 per cent. chlorate of potash, and the *modus operandi* was as follows:—

A sufficient number of little pads of puddled clay having been manufactured, one, supporting the firing detonator, was placed in the centre of other similar pads, each of which held in an upright position an ordinary non-electric detonator with its open end stuck into the clay. Thus the distances could be accurately measured, and the composition was not exposed to the direct action of the flash. The following programme was then carried out:—

I. (*a*) A No. 6 (1 gramme) was fired in the centre, with others arranged round it at 4, 6, 9, and 12 inches distance respectively. Result—None fired.
(*b*) Repeated, but with one at 1 inch, one at 2 inches, and two at 3 inches. Result—All fired.
(*c*) Repeated, but with four arranged round at a radial distance from the centre of 3 inches, the whole being confined by an up-ended barrel. Result—All fired.
(*d*) Repeated, but without the barrel. Result—3 fired.

II. Carried out similar experiments with a No. 7 (1½ gramme) in the centre. Result—at 6 inches radius, none fired; at 4 inches radius, all fired; at 5 inches radius, 2 fired.

III. A similar experiment with a No. 8 (2 grammes) in the centre. Result at 7 inches—1 fired.

IV. (*a*) A bundle of 5 No. 6 detonators were fired in the centre of a circle of 4 others at a radius of 12 inches. Result—1 fired.
(*b*) The number in the bundle was increased to 20 and the radius of the circle to 24 inches. Result—1 fired.
(*c*) Repetition of (*b*), except that the bundle was screened by means of stout cardboard and the radius reduced to 12 inches. Result—3 fired.

V. A 2-ounce cartridge of gelignite was detonated in the open in the centre of a circle of detonators at a radial distance of 24 inches. Result—None fired.

VI. A No. 6 detonator was fired half-an-inch away from a cartridge of gelignite from which the wrapper had been removed, with the result that the gelignite was not fired.

* The object of this was to enable the amount of flash from the explosive itself to be noted.

Experiments I., II., and III. seem to prove that a—

No. 6 will not fire others at 4 inches distance:
No. 7 " " 6 " "
No. 8 " " 8 " "

or more simply a—

No. 6 is unlikely to communicate explosion to others at 6 in.
No. 7 " " " " 7 "
No. 8 " " " " 8 "

Experiments IV., V., VI. present certain features of interest, more especially when considered in conjunction with the circumstances attending an accident which occurred in a lead mine in Derbyshire early in November last, by which a miner unfortunately lost his life. In this case, the unhappy man was evidently leaning over a box about 18 in. long by 10 wide, containing about 90 No. 6 detonators at one end and about 3 lbs. of gelignite at the other. In his waistcoat pocket he was carrying a fully prepared charge of gelignite with a fuse and detonator attached. He was killed by the explosion of the 90 detonators in the box, but neither the gelignite in the box nor the charge in his pocket was fired—a somewhat startling result, but in the light of the foregoing experiments not so very improbable. While on the subject of detonators, I am glad to be able to report that we have experienced no recurrence of the epidemic of miss-fires referred to in my last year's report. Moreover, from information supplied by Mr. Stokes, H.M. Inspector of Mines for the Midland District, I am now able to furnish a probable solution of the problem. Mr. Stokes has proved beyond question that missed shots are occasionally due to the priming composition being shaken away, not from the "bridge," but from the fulminate. This would quite account for the fact that, as reported by me last year, "the circuit tester in connection with the firing key invariably showed a current *after* the operation of stemming was completed, although the only possible explanation of the miss-fire would appear to be the breaking of the 'bridge' *during* the operation."

THE GUNCOTTON YARN "TELL-TALE."

Further experience has shown that the guncotton yarn at the end of the tube is not so certain as could be wished in its action as a "tell-tale." At best it was never suggested that it should be regarded as infallible, but only as an assistant to the officer in charge. From its liability to be ignited by a blow from the stemming on the one hand, and not to be ignited by a very mild explosion on the other, it would certainly appear advisable to provide a more reliable "tell-tale," which could be absolutely depended on, not only to assist, but actually to guide the testing officer's opinion. The requisites of a good tell-tale are two, viz. (1) to be so far removed from the actual line of fire as to preclude all liability of being struck by the stemming or fired by the explosive itself, and (2) to be in such close proximity to the gas that the very slightest combustion of such gas will not fail to ignite it. Neither of these considerations are fulfilled by the present arrangement, but Captain Lloyd has suggested a means by which these two conditions may be ensured, *i.e.*, by means of an auxiliary tube placed parallel with the present gas gallery, and which will contain a similar mixture to that in the main gallery. The guncotton "tell-tale" might be placed actually inside this tube. Another and perhaps simpler suggestion, due to Captain Thomson, is that a hole should be drilled in one of the leads from the gas-holder to the gallery, and a plug, to the end of which a tuft of guncotton yarn might be attached, should be fitted to this hole. The only disadvantage of this plan would be that the guncotton yarn would not be visible to the observer, and on occasions a misunderstanding might possibly arise as to whether or not any yarn had been attached before firing the shot.

It is a matter for regret that no progress has been made with the investigation of the influence on the behaviour of an explosive of (*a*) the diameter of the bore-hole, and (*b*) the varying velocities of the evolved gases; but this omission must be put down to the changes in the Department rennered necessary by the sudden and lamentable death of Sir Vivian Majendie. I was at once called on to take my full share of inspectorial duties which, added to the routine testing work, left me no opportunities of initiating a course of experiments of sufficient extent to be of any value. I am confident, however, that in handing them over as a legacy to my successor the ultimate result will more than justify the postponement.

APPLICATIONS FOR PATENTS.

JANUARY 23RD—FEBRUARY 11TH, 1899.

1,544. Machine Gun and Carriage. W. H. Fitz-Gerald.
1,639. Brakes for Gun Carriages. A. Reichwald. (*Agent for Fried. Krupp, Germany*).
1,700.* Explosive Shells and Fuses. H. P. Hurst.
1,771. Torpedoes A. J. Van Stockum.
1,899. Cartridge Loading. H. F. Land.
2,083. Breech-loading Small-arms. J. Okell. (*Agent for Bela Schratzenthaller, Austria-Hungary*).
2,084. Breech-loading Small-arms. J. Okell. (*Agent for Bela Schratzenthaller, Austria-Hungary*).
2,149.* Explosives. J. O'Brien Gunn.
2,191. Walking Stick and other Air Guns. C., J. B. and E. Lane.
2,568. Adapting Guns for Firing Miniature Ammunition. Morris Tube Co., Ltd, and A. J. H. Wyatt.
2,645. Process for Nitrating Cotton. F. C Henchman.
2,662. Running out Springs for Guns. Vickers, Sons & Maxim, Ltd., A. T. Dawson, and G. T. Buckham.
2,663. Worm Gear for Training Guns. Vickers, Sons & Maxim, Ltd., A. T. Dawson, and G. T. Buckham.
2,664. Ammunition Wagons and Limbers Vickers, Sons and Maxim, Ltd., A. T. Dawson, and G. T. Buckham.
2,698. Sighting Ordnance. L. K. Scott.
2,711.* Torpedo Controlling Devices. W. D. Litchfield.
2,926. Blasting Cartridges. J. Macnab.
3,004. Spherical Bullets and Shot for Fire-arms. J. F. Wright.
3,070. Magazine Fire-arms. G. M. Brand.
3,123. Projectiles. P. Pondorf.
3,134.* Single-trigger Guns. J. Carter and H. Bruntnell.
3,211. Stick Guns. A. J. Boult. (*Agent for C Ramus, France*).
3,247.* Explosives. A. J. Brown (*Agent for E. Callenberg, Germany*).
3,421. Pigeon Traps. R. Ramsbottom and G. A. Brookes.
3,488.* Testing Flash Holes of Cartridge Cases. P. Pondorf.
3,651. Shells for High Explosives. W. P. Thompson. (*Agent for W. S. Isham, U.S.A.*)

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JANUARY 28TH—FEBRUARY 18TH, 1899.

28,790* (Dec. 6, 1897). H. W. Holland and T. Woodward, London. The Holland-Woodward Single-trigger Gun.

28,807 (Dec. 6, 1897). D. W. Nightingale, London. A Blasting Explosive, of which one of the ingredients is the prohibited material, chlorate of potassium, the other ingredients being soda, saccharine matter and salt. Accepted Jan. 6th, 1899.

1,720 (Jan. 21, 1898). H. S. Maxim and A. T. Dawson, London. A form of base for a Projectile provided with an expanding ring gas check, which will be compressed with a force greater than the powder pressure, so providing an effectual resistance against the erosion due to the leakage of gases past the projectile. Accepted Jan. 14th, 1899.

1,793 (Jan. 22, 1898). A. Reichwald, London. (*Agent for Fried. Krupp, Germany*). A Breech Mechanism for Ordnance, consisting of a breech wedge which at the first opening moves at a slow pace, and when once started increases its speed by means of a special gear. Accepted Jan. 14, 1899.

2,197 (Jan. 27, 1898). A. V. P. M. Berthier, France. A Magazine Rifle, described in great detail in a long Specification and with a large number of drawings; the Rifle is of the bolt type, and the cartridges may be fed into the magazine by means of clips, or singly as may be required. Accepted Jan. 21st, 1899.

2,296 (Jan. 28, 1898). E. A. W. Phillips, India. A Safety Butt for Rifle practice, constructed on the system of a series of stop butts intermediate between the target and the shooter, and provided with openings to let the correctly-aimed bullets pass on to the target while others are intercepted. Accepted Jan. 21st, 1899.

3,471 (Feb. 11, 1898). D. Scott, Manchester. A special form of Rifle pull-through Cleaner, in which the piece of rag is so shaped that when fastened to the cord its whole length shall bear upon the sides of the bore, instead of the present method by which the bunching up of the rag in one place leads to the fowling of the rag through only a small part of it being in use. Accepted Jan. 14th, 1899).

4,132 (Feb. 18, 1898). J. Vavasseur, London. A means of attaching the trunnions to Ordnance, and also various means of effecting the attachment of the recoil cylinder with the gun. Accepted Jan. 28th, 1899.

4,156* (Feb. 19, 1898). H. Greener, Birmingham. The Greener Single-trigger Gun.

4,817 (Feb. 26, 1898). J. Vavasseur, London. A means of effecting the fastening of the breech of a gun by a sleeve which may be turned instead of turning the screw breech block. Accepted Jan. 7th, 1899.

4,824 (Feb. 26, 1898). S. W. Silver and W. Fletcher, London. A form of india-rubber Pad for the Butts of Small-arms, formed with interior cavities which will supplement the ordinary elasticity of the rubber with the elasticity due to the air confined in the closed chambers. Accepted Jan. 7th, 1899.

6,228 (Mar. 14, 1898). P. Cornet, Belgium. A Blasting Explosive to be known as "Minolite," consisting of nitrates of ammonium, sodium, barium, nitrated napthalene, Quebrach's sawdust and resin dissolved in alcohol. These are mixed cold, and when the mixing is complete, the powder is formed in cartridges, the paper coverings of which are air-proofed in a special way. Accepted Jan. 21st, 1899.

6,520 (Mar. 17, 1898). A. Reichwald, London. (*Agent for Fried. Krupp, Germany*). A safety device for the locking of the Breech Mechanism of Ordnance, so that the opening of the gun and the firing of the cartridge cannot be effected at the same moment. Accepted Jan. 28th, 1899.

8,887 (April 16, 1898). A. Reichwald, London. (*Agent for Fried. Krupp, Germany*). A form of racket-worked Ammunition Hoist, which comes to rest when a cartridge has been raised to the position of delivery, and does not start again until the cartridge has been removed. Accepted Jan. 28th, 1899.

16,897 (Aug. 4, 1898). A. E. Lard, U.S.A. A short Gun Mechanism for the operation of three barrels by means of successive pulls on a single trigger, the mechanism being also applicable to a gun with two barrels. Accepted Jan. 14, 1899.

18,587 (Aug. 30, 1898). M. Weiss, Hungary. A Protective Cap or covering for Projectile Fuses, calculated hermetically to seal the contents of the fuse so that it shall remain unaltered over a long duration of time. Accepted Jan. 7th, 1899.

18,731 (Sept. 1, 1898). Col. L. K. Scott, Hants. Various Improvements in the mechanism described in previous Patents of the same inventor, for automatically adjusting sights for guns used against objects at sea, the present patent dealing with means for overcoming the loss of transmitted movement due to play in the gears, and other practical points not previously dealt with. Accepted Jan. 21st, 1899.

19,496 (Sept. 14, 1898). C. Qvist and A. P. V. Andersen, Denmark. An Automatic Magazine Rifle, consisting of a longitudinally reciprocating bolt, having an external bolt handle, which permits of using the arm in the ordinary way if required. Accepted Jan. 28th, 1899.

19,635 (Sept. 15, 1898). E. Schneider and J. B. G. A. Canet, France. An intermediate gear to be used in connection with the class of gun described in Patent No. 24,377 (1895), for the purpose of modifying the leverage at the early stages of opening the breach. Accepted Jan. 21st, 1899.

24,066 (Nov. 15, 1898). H. H. Lake, London. (*Agent for Austin Cartridge Co., U.S.A.*) A Stamp and Die for cutting Gun Wads singly from a strip of material fed into position. The arrangement also provides for placing a cartridge underneath the die, so that the wad when punched may be passed directly into use. Accepted Jan. 28th, 1899.

25,568 (Dec. 3, 1898). G. von Geldern-Egmond, Austria. The manufacture of Explosives from Nitrate of Ammonia, combined with naturally carbonised cellulose, or, in other words, decayed vegetation, such as peat, leaves, or decayed wood. Accepted Jan. 14th, 1899.

27,397 (Dec. 28, 1898). A. J. Boult, London. (*Agent for A. Liedbeck, Sweden*). A means of removing the solvent from smokeless powder, by passing hot air over a layer of the explosive and evaporating the contained solvent before adding the next layer, and so on until the required thickness of sheet has been obtained for producing the finished grains of explosive. Accepted Jan. 28th, 1899.

SELECTED PATENTS.

THE HOLLAND-WOODWARD SINGLE-TRIGGER GUN.

28,790 (Dec. 6, 1897). H. W. Holland and T. Woodward, London. The object of the present arrangement is to effect improvements in the lock mechanism of single-trigger guns, so that the shifting piece, which connects the trigger successively with the two sears, shall move the sear and intercepting sear of either lock at the same instant of time, not one before the other, as may happen (with locks of the ordinary construction having the intercepting sear close behind or before the true sear) if the shifting piece has not quite completed its movement from one sear to the other.

Fig. 1.

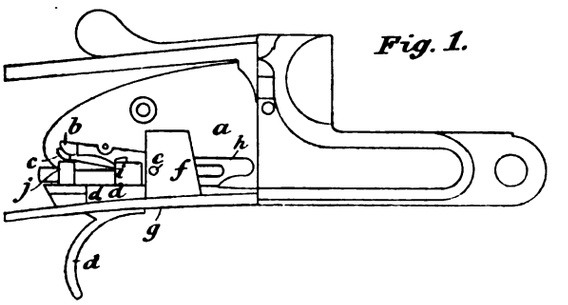


Fig. 2.

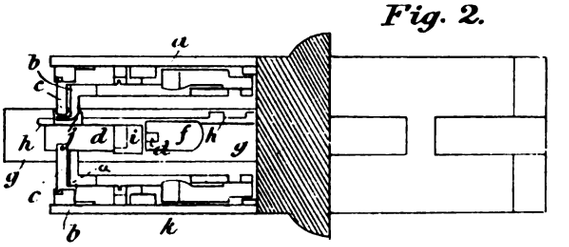
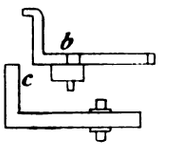


Fig. 3.



This is accomplished in the following manner:—The extreme end of the sear tail or intercepting sear tail, whichever may be found most convenient, is so formed that the bearing surface upon which the shifting piece operates is brought directly into line with the bearing surface upon its corresponding sear or intercepting sear, so that it is impossible for the shifting piece to arrive under one sooner than the other. Consequently when the trigger is pulled there will be no fear of the tumbler or hammer falling into the interceptor, and so prevent the discharge of the gun when required. The sear tails must be so formed as to leave either sear or intercepting sear free to act, independently of each other in the usual manner.

The best method of carrying out this arrangement is to turn the end of the sear tail or intercepting sear tail over the end of its corresponding sear tail or intercepting sear tail by means of an U- or L-shaped bend, so that the bearing surface of the sears upon

which the shifting piece operates shall lie upon the same plane, on a line crossing the gun, so that the shifting piece in its movement must come under the sear and intercepting sear at exactly the same moment of time.

The accompanying drawings show a portion of a gun, with a lock constructed as above described, and will be more clearly understood by reference to the prior Patent, No. 4893 (1897) by the same patentees, which describes single-trigger guns of the type to which these improvements are applicable. Fig. 1 is an elevation of a portion of a gun with the right-hand lock removed, only the parts of the left-hand lock *a* necessary to show the construction being retained; *b* is the intercepting sear tail, which is slightly raised from its true position, to show the manner in which it overlaps the tail of the true sear *c*; *d* is the single trigger, which is mounted upon a pivot *e* carried by the lump *f* upon the trigger plate *g*. The shifting piece *h i j* slides to and fro upon the top of the trigger *d*, and is provided with studs or lugs *i j* upon its right and left-hand side, which operate upon the sears of the right and left-hand locks alternately. The lug *j* is in position for discharging the left-hand lock when the trigger is pulled.

Fig. 2 is a plan of the same gun, but with both locks and their mechanism in their proper positions. The left-hand lock *a* is constructed according to the new arrangement, the right-hand lock *r* being constructed in the ordinary manner. It is not necessary to alter the construction of the right-hand lock, as the lug *i* upon the shifting piece *h* passes from under the right-hand sear, after the right-hand barrel is fired, and then takes up the position shown in the drawings, ready for firing the left-hand barrel. In so doing it would arrive under the tail of the true sear *a* before it arrived under the tail of the intercepting sear *b*, unless the construction had been altered in the manner shown in these drawings.

Fig. 3 shows the intercepting sear *a* and the true sear *b* when removed from the lock, and they are slightly separated to show the method of construction more clearly. Accepted June 6, 1899.

THE GREENER SINGLE-TRIGGER GUN.

4,156 (Feb. 11, 1898). H. Greener, Birmingham. The object of the present single-trigger gun mechanism is, among other things, to provide means by which the recoil action from firing shall be utilised to prevent the liability to cause the accidental firing of the second barrel.

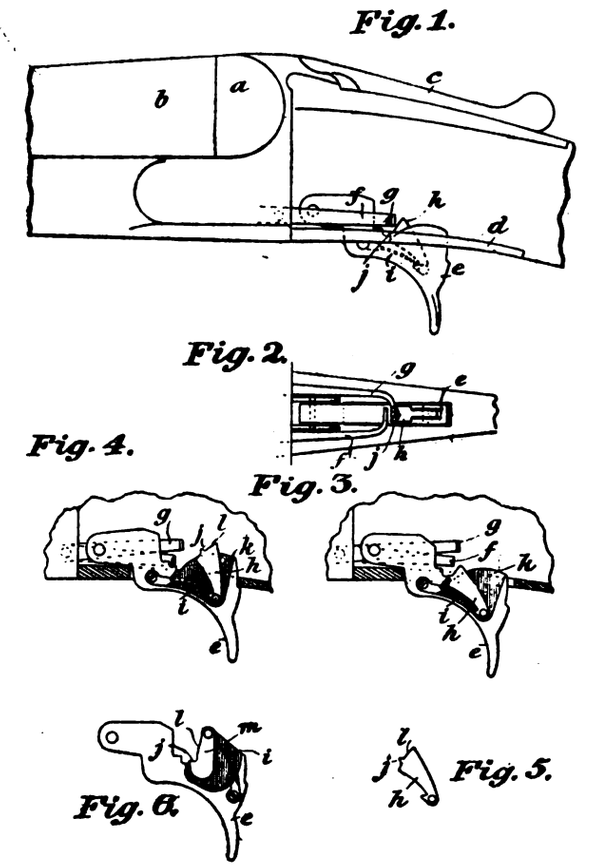
A movable piece is employed which, in its normal state, lies in a position to operate, or to permit of the operation of, the sear lever of the first barrel, but which, after firing, finally assumes a similar position for the second barrel sear lever, and so on. This movable piece may be of a pivoted arm or of a pendulous form, and may be weighted, more or less, at the movable end, and is moved forward into position by a spring, but is otherwise free to a considerable reverse motion. This movable piece may be carried by the trigger, or elsewhere, so long as, with the lifting of the trigger, it operates the sears.

It is well known that in guns of this class, when a barrel has been fired, the trigger finger is liable, during the recoil, accidentally to fire the next barrel.

In the present arrangement, during the sudden rearward movement of the recoil which succeeds the firing, an impetus is given to the movable piece, which overcomes (for the time being) the opposite force of the spring, and consequently the piece is thrown backwards. In this way, before the spring has had sufficient time to bring it forward once more to the position for the next sear, all danger due to the return forward movement of the gun against the trigger finger has passed, and even should the trigger be inadvertently lifted, no firing can take place. The shape of this movable piece is made to accommodate the sear levers, etc., so that upon the recocking of the gun it shall be brought back into its primary position.

In the accompanying illustrations Fig. 1 is a general side view of the mechanism with both barrels unfired; Fig. 2 is a plan view; Fig. 3 is a view showing the device when one barrel has been fired, and the parts are left in position for firing the second barrel; Fig. 4 shows the mechanism while under the recoil action; Fig. 5 is a detailed enlarged side view of the movable piece; and Fig. 6 shows a modification in the shape and disposition of the movable piece. *a* is the breech block, *b* the barrel, *c* the bolt lever, *d* the trigger guard plate, *e* the trigger, *f g* the sear levers. The sear levers operate directly or indirectly to release the hammers and fire the gun. Upon the trigger is pivoted the movable piece *h*, the movable end of which is comparatively heavy. This piece is acted upon by a light spring *i*, which tends to pull it forward into the position shown in Figs. 1, 2, and 3. Upon the face of this piece *h* is a tooth or projection *j*, which serves to lift the ends of the sear levers *f* and *g*. As will be seen, considerable room is left for rearward movement of the piece *h*, as it may reach the face *k* should circumstances demand it.

Under a state of rest this piece assumes the position shown in Fig. 1, that is, the tooth *j* lies beneath the sear lever *g*, and is prevented from further forward movement by the face *l*, resting against the end of the sear lever. Now, if the trigger be raised, the one barrel is fired, but in the sudden recoil which succeeds the firing an impetus is given to the movable piece *h*, which overcomes for the time being the opposite force of the spring *i*. Consequently, the piece *h* is thrown backwards into such a position that, before the spring *i* has had sufficient time to regain its influence, all danger due



to the return movement of the gun against the trigger finger has passed. Even should the trigger be inadvertently lifted, no firing would take place. This period, however, having passed, the tooth *j*, is carried to the position beneath the second sear lever *f* (Fig. 3). Upon the trigger being raised the second barrel will be fired. The tumbler and sear of the first lock are what is known as "false gaited," so that, the tail of the sear remains elevated until recocking takes place.

In the recocking of the gun as the end or ends of the sears move downward they strike the inclined surface *l* of the piece *h*, and move backward to permit their passing into position; and, in so doing, the movable piece is reset into position, in which its tooth *j* lies beneath the first sear *g*, as seen in Fig. 1, ready for a repeat action.

As before mentioned, this movable piece may be modified in position and shape while yet performing the same service, as, for instance, as seen at *m*, in Fig. 6, where it assumes a pendulous form, in which its lower end is made comparatively heavy for the reasons before stated. The form shown in Figs. 1 to 5 appears to answer best. Accepted January 21, 1899.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Price of Cartridges.—The notices which were simultaneously sent out by the ammunition manufacturers at the commencement of last month, informing the trade of an increase in wholesale prices, is no doubt justified on the grounds of increased cost of production. The large increase in the price of copper, though partly due to artificial causes, is not likely to disappear within the near future. We believe that the price of copper is likely to be maintained for some time to come, on account of the buying up, and the consequently enforced idleness of many low-grade mines, which could work at a profit at a good deal below the present prices. The large increase in the consumption of copper during the past few years is a natural cause tending to the raising of its market price, and this influence, added to the artificial limitation of production, will assist to maintain prices at a high level for some time to come. Copper, as the chief ingredient of brass, must affect the ammunition manufacturers, who are also adversely influenced by the big rise in the lead market. By mutual agreement the three ammunition manufacturers in this country have arranged to put up prices, and no doubt they have satisfied themselves that the rise in raw materials is so universal that it will equally affect their foreign competitors, and consequently that it will not alter the relative consumption of English and foreign ammunition in this country and abroad. When prices are raised from the top, it is always a question who will have to bear the ultimate loss. Unfortunately, in the present case, it looks as though it will be the gunmaker, but there are, perhaps, some slight compensations for such a loss in their profits. The chief problem of the retail trade in cartridges, from the point of view of the gunmaker, is to compete with dealers who cut prices and turn over their goods at a nominal margin of profit. In such cases it is practically certain that prices will have to be advanced commensurately with the raising of the wholesale rates. If the gunmaker continues to charge the same rates as in the past, the margin of difference between the prices of his goods and those of the general dealer will be narrowed down, and he will consequently be in a better position to compete than in the past. It is, of course, open to anyone to argue that, if the gunmaker has found it difficult in the past to pay his working expenses out of the margin of profit he has hitherto made, it will be that much worse if the wholesale gross prices are raised roughly by five per cent. This argument would hold good if all gunmakers had exhausted their last season's stocks and had received delivery for the whole of last season's contracts; but following upon a bad game season, such reserves are exceptionally great, and, in consequence, the full effect of the present raising of quotations for fresh orders will not be felt for some time to come. So long as such stocks remain it will certainly not be to the interest of those holding them to raise their retail prices, since they stand to do an increased trade by virtue of the reduced competition of those who, not holding such stocks, will be forced to raise the prices. Without going into details, we may indicate generally that the reserves of ammunition in the hands of gunmakers, and of powder manufacturers who load cartridges, are greater in proportion than those in the hands of general dealers. Under the

circumstances of the case, as explained above, it looks as though, for the present season at any rate, whatever small losses may be suffered by gunmakers through the reduction in prices, they will be more than compensated for by the increase of trade which, it may be anticipated, will fall their way. Certainly the present raising of the question may give facilities for arrival at a better understanding among individual firms in the gun trade as to the fixing of a minimum margin of profit, and it is to be hoped that the efforts of the Gunmakers' Association in this direction will be honourably supported. To our mind, the most serious factor in the case is one that must be vigilantly watched by the ammunition manufacturers themselves. It is the temptations which will be placed in the way of general dealers to push foreign ammunition, since the greater cheapness of such goods, even if their price is proportionately advanced on account of dear metal, might enable the dealer to maintain last year's prices by substituting foreign for the English cartridges that he has hitherto sworn by.

French Smokeless Powders.—The President of the French Association of Gunmakers addressed two letters last January to the French Minister of Finances and the Minister of War respectively. The Minister of Finances was petitioned to increase the margin of profit allowed to those who sell the monopoly powders of the French government. The Minister of War, in his turn, was invited to produce a more suitable smokeless powder than those hitherto available for use in shot guns. It was pointed out that the two best powders in use divide the various requirements of excellence more or less evenly between them. But what is wanted appears to be a powder which will contain in itself the desired combination of good qualities, since it is not possible to blend two different powders, with the result of obtaining a happy medium which contains the good qualities of both, and none of their faults. The requirements enumerated can only suggest one thing, viz., that the powders already on the market signally fail in the most elementary qualifications. If the powders are really as bad as one might assume from the letter, it is a great pity that the French Government did not see its way, when the question was ventilated in the Chamber of Deputies in February, 1897, to throw the market open to English and other foreign made powders. The Government would not have suffered if suitable duties had been imposed; but, unfortunately, the request for freedom to use English powders was attributed, amid cheers from the Deputies, to "snobisme." We must, therefore, regard the desire of the French gunmakers to have a reliable smokeless powder as arising from the same failing, and one must assume that French gunmakers are all snobs because they wish the Government to produce a powder having the following qualities:—(1), Absence of smoke and residue; (2), Moderation of pressure; (3), Absence of bad smell; (4), Regularity in the size and density of the grains; (5), Independence to atmospheric changes; and (6), Hardness of grain, to prevent the formation of dust which leads to excessive pressures. We will not pursue the criticisms made by the French gunmakers further, as we can only assume from the precedents of the past, that their request for a powder "equal to the best foreign powders" will be attributed to a snobbish admiration of things British. In fact we are afraid that French gunmakers are guilty of one of the worst forms of Anglophobia.

THE NEW N.R.A. SECRETARY

In accordance with their announcement at the Annual General Meeting of the National Rifle Association, the Council have lost no time in appointing Lieut.-Col. C. R. Crosse as Secretary of the Association in succession to the late Colonel Mackinnon. Fortunately for the Association, they have been able to secure the services of an officer who has had very large experience in the distinctly specialised work which is entailed in the management of such an organization.

Colonel Crosse has been connected with the range department of the Association for 14 years, while during the last eight years of this period he has acted as Chief Range Officer, to which position, curiously enough, he succeeded Colonel Mackinnon, on the appointment of the latter to the secretaryship of the Association. The department, under the control of the Chief Range Officer employs about 90 officers, who come from all branches of the army, and on their chief devolves the responsibility of all matters concerning the ranges.

It will be seen that Colonel Crosse's special qualifications will fit in excellently with the new arrangements of the Association, by which the secretary will reside permanently at Bisley, while Capt. Matthews, as assistant secretary, will carry on the work of the London offices. In this way Col. Crosse will have plenty of time for applying his past experience to extending and popularizing the use of the Association's ranges for practice throughout the year. The increasing difficulty of obtaining suitable ranges in the vicinity of London is resulting in a largely extended use of the Bisley ranges for ordinary rifle practice. The Association is doing its utmost to make its ranges and general accommodation of the greatest possible service to the volunteer organization. Among other things, it especially desires to encourage the use of its pavilions for the accommodation of volunteer battalions under training. All these things will be under the special guidance of the new secretary, and his appointment opens up many chances of forwarding this policy in a manner which has not been possible in the past.

Colonel Crosse was for four years the Adjutant of the 2nd Battalion of the Royal West Kent Regiment, and five years Adjutant of the 3rd Volunteer Battalion of the same corps. He is at present Brigade-Major of the Portsmouth Volunteer Infantry Brigade, in the uniform of which he is represented in the accompanying photograph.

Among the questions which will require the earnest attention of Col. Crosse during his first year of office will be to find a remedy for the large number of ties which have resulted from the greatly increased accuracy of shooting of the new service rifle. The opposition to the reduction in the diameter of the 200 yards bulls-eye at the last annual general meeting, has caused the Council to withdraw the proposed amendment of the rules, and to revert to last year's order of things. It is difficult to say how far it will be possible to do anything in the arrangement of the programme to reduce the large number of ties. In any case, it is clear that very little can be done in this direction, and consequently we must wait till next year before any effective remedy can be put into effect. There is, however, so very little shooting in any position at the 200 yards range that rough weather would go far to prevent the large amount of high scoring which was the chief source of trouble last year. The increased accuracy of the new rifle

and of its ammunition will always tend to higher scoring than with the old Martini-Henry; and consequently the situation, which was rendered the more acute by the excellent weather conditions of last year, will have to be faced sooner or later. The opinion seems to be held among a good many authorities that, if the change in the 200 yards target had been introduced as part of a scheme providing for the much more necessary alteration of the target for 500 and 600 yards ranges, it would have been accepted without demur. Now that the matter will have to stand over for another year, there is plenty of time for giving practical consideration to all suggestions, both old and new, and it is to be hoped that a satisfactory solution of the difficulty will be found.

The question is by no means as simple as appears at first

Lieut.-Col. C. R. Crosse.

sight. A reduction in the size of the bulls-eye tends to place difficulties in the way of shooting which are not, strictly speaking, of the kind to promote skill in the use of the rifle under service conditions. The straining of the eye in sighting at a small bull, especially in adverse weather, would certainly reduce the scoring. Whether this method of increasing the difficulty of making high scores will lead to a corresponding improvement in the skill of the competitors is a question which it is not quite so easy to decide.

Extra difficulties imported into the conditions of rifle shooting should be such as may be overcome by a higher degree of skill. They should not add "trickiness" to the task of a kind which is overcome rather by good fortune than by good shooting. It is a practical question how far the size of the bull may be reduced, and it can only be settled by expert opinion. The required solution is one which will not place undue visual difficulties in the way of the shooter, but which will require from him a more accurate calculation of the various elements which contribute to the firing of a successful shot.

We have every confidence that in this, as in all other matters connected with the work of the Association, the Council will receive the most intelligent assistance from Colonel Crosse.

CHAMBER AND CARTRIDGE GAUGES.

In our last issue we referred to the fact that experiments had been undertaken with a view to arriving at standard gauges to govern the construction of shot-gun chambers, and we are pleased that things are so far progressed as to enable us to give an account of what has been accomplished.

Mr. T. W. Webley, managing director of the Webley and Scott Revolver and Small Arms Co., Ltd., and Mr. J. C. Irvine, of Messrs. Eley Bros., Ltd., have acted jointly in the work of producing these gauges. The undertaking is now so far completed that nothing remains to be done but to submit the gauges for the consideration of the members of the allied trades of the gunmaker and ammunition manufacturer.

The question of gun-chamber gauges is inseparably connected with that of cartridge making, and chamber gauges must, therefore, be in complete harmony with the cartridge gauges. Not only must these gauges be mutually suited to one another, but they must, as far as possible, be suited to the practice of foreign manufacturers, who will not necessarily be guided by the standards adopted in this country.

Guns sent abroad will be expected to shoot the foreign ammunition in local use, and cartridges exported from England must give good results when shot in foreign-made guns of the same nominal gauge. Ideal results may not follow when opposite extremes in gun chambers and cartridges are brought together; but in designing a set of standard gauges it is advisable to arrange the decimal measurements of the gauges so as to represent a happy mean between the most opposite of extremes.

At the present time there is but little harmony in this country in the gauging of gun chambers and ammunition. The 12-bore cartridges made by Messrs. Eley and Messrs. Joyce follow one set of gauges, while Messrs. Kynoch work to different measurements. Messrs. Eley Bros. issue a chamber gauge in the form of a plug, and gunmakers use it as the standard for chambering their barrels. In so doing they are not as favourably placed as they might be for working to the required nicety, first because a single plug is not by itself an exact measuring instrument, and second because the chambers when finished must suit the Kynoch cartridge, which is made to a slightly different standard.

An exact system of gauging cartridges and chambers must consist, broadly speaking, of two sets of gauges; one set for the cartridge and another for the chamber. The cartridge gauges must consist of a maximum and a minimum setting forth the extreme variations of size allowable. The chamber gauges should similarly consist of a maximum and a minimum, and the actual dimensions of all chambers should lie

between the two extremes. The cartridge gauges must be so harmonised with the chamber gauges that satisfactory results will follow from the shooting of a cartridge complying with the requirements of the cartridge gauge when fired in a chamber which has similarly passed the test of the chamber gauges. Since nothing can be manufactured mathematically true to theoretical dimensions, it follows that one must ascertain the limits between which variation may be allowed. In other words, things must be so arranged that a cartridge of the minimum allowable gauge will shoot satisfactorily in a chamber of the maximum allowable gauge, and *vice versa*.

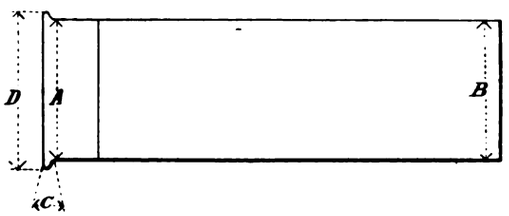


DIAGRAM SHOWING PARTS OF CASE TO BE GAUGED.

A—Diameter under Rim. C—Thickness of Rim.
B—Diameter of Nose-End of Case. D—Diameter of Rim.

These extremes, in decimals of an inch, are clearly set forth in the following table, which shows the sizes adopted in the new gauges:—

NEW GAUGES FOR 12-BORE 2½-INCH GUN CHAMBERS AND CARTRIDGES.

STANDARD MEASUREMENTS.	GUN CHAMBER.		CARTRIDGE.	
	Maximum	Minimum	Maximum	Minimum
Diameter under Rim ..	·813	·811	811	·808
,, Nose-end of Case	·801	·799	·798	·795
Thickness of Rim ..	·074	—*	·072	·069
Diameter of Rim ..	·885	·882	·882	·879

* No latitude allowed.

For the sake of comparison we append, as nearly as our information allows, the corresponding sizes hitherto adopted by Messrs. Eley, Joyce, and Kynoch, and it should be noted that exact sizes, and not maximum and minimum sizes, are given:—

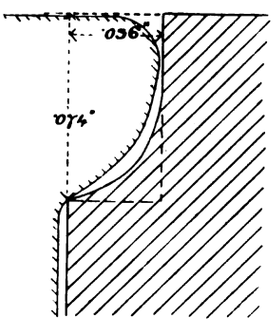
ELEY, JOYCE AND KYNOCH 2½-INCH CHAMBER SIZES.

STANDARD MEASUREMENTS	ELEY AND JOYCE.	KYNOCH.
Diameter under Rim	·816	·817
,, ·625 from Rim ..	·809	—*
,, Nose-end of Case ..	·800	·802
Thickness of Rim	·075	·065
Diameter of Rim	·885	·885

* Straight taper.

It will be seen from the above tables that the new gauges have a straight taper from under the rim to the nose-end of the case, and that the old Eley and Joyce gauges provide for two stages of tapering, viz., a reduction of ·007 for the first ·625 of an inch, measuring from under the rim, and a further reduction of ·009 for the remaining 1·800 inches of the case's length. The extreme length of the case is, of course, taken at 2·500 inches.

The set of gauges required for checking off the sizes set forth in the first table will require some explanation, and we will deal first with the chamber. While a chamber gauge must consist of a plug of the required form, this alone is not sufficient, and each plug must be accompanied by a corresponding female gauge, into which it must fit exactly. The object of the female gauge is to act as a standard for checking any variations which may occur in the male gauge through wear or accidental damage; this in spite of the fact that both are made of hardened steel. Further, the female gauge will be found indispensable for testing the chambering tools before use. We therefore require two male and two female gauges, one pair exactly conforming to the maximum dimensions shown in the table, and the other to the minimum sizes. In using these gauges the maximum should either refuse to enter the chamber or be an exact fit therein, and the minimum should enter. For practical work the plug chamber gauges should be supplemented by three separate gauges. If the ordinary minimum plug gauge refuses to enter the chamber, it is necessary to ascertain where the error lies, viz., whether under the rim, in the middle of the chamber, or at the extreme end. To effect these measurements, one plug is made having a bearing surface corresponding with about the first three-quarters of an inch, measuring from the rim; another plug is constructed so as to go half-way down the chamber, and so gauge the central portion; and a third serves to measure the furthest end of the chamber adjoining the cone. According to which plug or plugs fail to enter the chamber to the required distance, one may determine at what part of the chamber the error lies. These plugs deal with the diameter of the sides of the tube of the cartridge. Another male and female pair of gauges serve to determine whether the thickness of the rim, groove, or recess, has been properly followed. For this there is no maximum and minimum, since the thickness of the rim must exactly conform to the required dimensions. In other words, the plug must be neither incapable of entering the rim groove, nor, when in, must it have any shake.

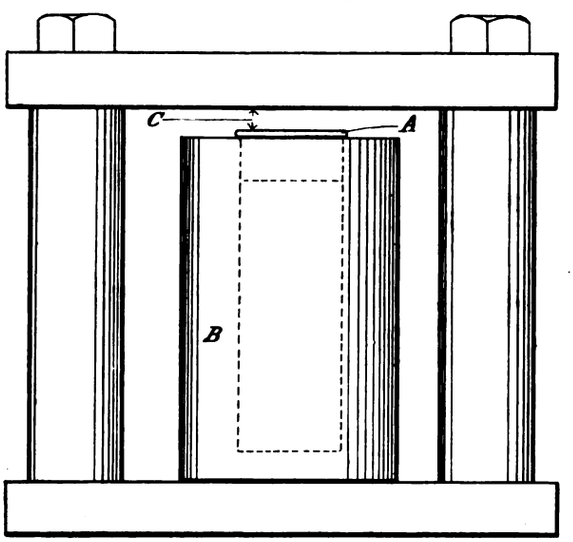


(Scale much enlarged.)

DIAGRAM SHOWING FORM OF RIM GROOVE.

The shape of the cone is left to the judgment of the gunmaker, while that of the rim, though also left unspecified beyond the dimensions laid down, might well follow that adopted in the new rim gauge. The latitude referred to occurs in the shape of the corner (the shape of the rim recess being considered sectionally) joining the surface parallel with the length of the barrel to the surface at right angles with the barrel. The accompanying sketch shows approximately the shape of the rim groove in the new gauges, while the dotted lines show the same dimensions of rim groove as cut out with a square-nosed tool. The figures showing the distance that the rim

extends sideways beyond the side of the chamber are obtained from the values given in the table of the sizes for the diameter of the rim and the thickness under the rim. The sketch also shows a rough view of the cartridge as it might be supposed to lie within the chamber, and we have shown that the cartridge takes its bearing under the rim upon the sharp edge of the barrel where the rim groove joins the chamber. We have somewhat exaggerated this state of affairs in order to make a certain point clear. It is that while this edge must in all guns be more or less rounded, the rim gauge will not check off the amount of chamfering, and a few thousandths variation in the amount of corner taken off would make roughly an equal difference to the distance the cartridge enters into the chamber. All such edges are made theoretically square, and it is considered that they require to be so made in order to provide for the satisfactory working of the ejector. In the first table of dimensions it will be seen that no latitude is allowed in the depth of the rim groove in the gun chamber, and consequently, to secure the full benefit of such exact tude, this edge must be as nearly square as is consistent with the avoidance of a knife edge such as would be likely to give way rapidly in the use and cleaning of the weapon. In this way the greatest possible uniformity between one chamber and another will be secured.



System of Testing Thickness of Rim.
A—Rim of Cartridge Case. B—Female Cartridge Gauge.
C—Distance to be Gauged.

As regards the gauges for measuring the cartridges, two sets are required for testing the sides of the case, viz., a male and female, exactly corresponding with the maximum sizes, and a male and female for the minimum sizes. In this case it is the female gauge which will be actually used, the male acting as the standard by which any deviation of the female gauge from accuracy may be detected. The thickness of the rim is tested by means of a gauge, consisting of two parallel flat pieces of metal so mounted that their inside faces are rather more than the length of a cartridge case apart. The cartridge case is dropped into one of the female gauges, and the gauge is then stood upright upon the lower of the two metal surfaces. There is then a certain space between the base of the cartridge as it stands above the end of the female gauge and the lower face of the upper piece ot metal. A flat steel gauge is passed into the space between the cartridge base and the adjoining metal surface. This flat steel gauge is double-ended: one end represents in thickness the minimum space, and the other the maximum space allowable between the two surfaces. The thickness of the rim is measured by maximum and minimum male and female gauges, similar in kind to those described above for measuring the rim recess of the gun chamber.

We have endeavoured to set forth as clearly as possible the results of the able work which has been accomplished by Mr. T. W. Webley, and Mr. J. C. Irvine, for exactly determining the much-needed standards for the gun chamber on the one hand, and the cartridge chamber on the other. We understand that the actual manufacture of the gauges has been carried through by the Webley and Scott Revolver and Arms Co., Ltd., under the superintendence of Mr. Webley. One must see the gauges to appreciate the high standard of mechanical skill necessary for their correct production. In the designing of the gauges much anxious thought has been given to the task of setting up practical standards which can be adhered to, and not those of the kind which, while theoretically perfect, are outside the scope of commercial production. This has, we believe, been successfully accomplished, and we may, therefore, anticipate that the gauges, once they are officially adopted by the allied trades, will be followed in actual practice. Of course, their adoption must be preceded by the most careful consideration on the part of all those who are concerned thereby, and we understand that it is intended shortly to issue an authoritative description of the gauges, so that every detail may be open to examination. In the meantime, the present article gives a rough sketch of what has been done.

GUNMAKERS' ASSOCIATION MEETING.

A meeting of the Gunmakers' Association was held at Effingham House on Thursday, March 23, 1899, and there were present:—Messrs. John Rigby (in the chair), C. Rosson, Charles Ingram Annan, C. F. Liversidge A. H. Gale, F. Beesley, H. A. A. Thorn, and R. T. Woulfe.

Minutes.—The minutes of the previous meeting were duly read and confirmed.

Messages of Regret.—Messages of regret for non attendance were read from Messrs. H. W. Gibbs, H. W. Holland, J. F. Smythe, James Carr, C. E. Greener, and T. W. Webley.

Alteration of Rules.—Formal notice, in accordance with the rules of the Association, having been given regarding a proposed alteration of Rule 18, the following resolution was brought before the meeting, and duly seconded and carried by the required majority:—

That Rule 18 should be so altered that the Annual General Meetings should in future be held in May, instead of in April, as in the past.

It was put forward as a general recommendation that the meeting in question should be held as early as possible in the month of May.

PROPOSED MEETING IN YORK.—The Secretary reported the outcome of his correspondence with Mr. Smythe, of Darlington, regarding the proposal to hold a meeting of gunmakers, not necessarily confined to members of the Association, in the City of York. A short discussion took place regarding the proposed arrangements, and various suggestions were made for increasing the utility of such a meeting. The following resolution was passed giving the Secretary definite instructions on the subject:—

That the Secretary be instructed to make arrangements for the holding of a meeting of gunmakers in York, and that the details of the meeting shall be settled between Mr. Smythe, Mr. Horsley and himself, subject to the direction of the Executive. The meeting shall be for the discussion of trade questions with a view to the information of the Central Association, and generally for promoting the better organization of the trade.

CHAMBER GAUGES.—By the wish of certain members of the Association, the Secretary made a formal report to the meeting to the effect that careful experiments had been conducted with the view to arriving at a series of gauges for regulating the relative dimensions of gun chambers and cartridge cases. These experiments had partly arisen from the ventilation of this subject by the Association three years ago. When the gauges were ready for submitting for the consideration of the trade, the Gunmakers' Association would be invited to consider the same in detail. A short discussion on the subject took place, but it was decided that the matter should be adjourned, pending the communication of the exact particulars which would shortly be forthcoming. It was generally agreed that the Executive should go carefully into the subject, with a view to making proper arrangements for securing a full consideration of this subject by the trade prior to any definite action being taken.

PRICE OF CARTRIDGES.—A long discussion took place on the subject of certain circulars sent out by the three sporting cartridge manufacturers in this country, giving notice that, owing to the increased price of raw materials, the wholesale price of cartridges would be put up to a sum representing roughly an increase of five per cent. on the gross prices of ordinary cases and loaded cartridges, and roughly 13 per cent. in the case of ejector cartridges, this latter being a class of cartridge where there is a larger proportion of metal than in ordinary cases.

The discussion on the subject of the retail prices to be charged during the coming season covered a good deal of ground.

As regards the general condition of the trade in cartridges, it was pointed out that prices for best goods could be maintained at a level which would pay a working profit to provide a fair recompense for the special care required in loading cartridges capable of maintaining a high-class reputation for the seller, and that the possession of such a reputation would always enable the seller of high-class cartridges to obtain a good price for his work.

It was further pointed out that the circular sent out by the ammunition manufacturers could not affect existing contracts, and that the bad game records of the past season had led to gunmakers having an unusually large stock of cartridges, either delivered or awaiting instructions, forming part of contracts signed and accepted before the raising of the prices. Under these conditions it was thought that the increased prices of cartridges would not have its full effect until after the end of the forthcoming season.

With regard to the comparative effect of the present increase of prices on the various qualities of cartridges, it was pointed out that the margin of profit is generally cut so fine in the case of cheap cartridges that the prices of the latter are practically bound to be raised proportionally to the increase in the wholesale quotations. In just the same way cartridges of a good quality sold at a small margin of profit must equally be raised in price to cover the minimum margin for working expenses.

The above facts and opinions were brought forward during the course of the discussion, and it appeared to be generally agreed that the balance of advantages would lie on the side of maintaining during the coming season the prices charged last year. It was felt that by so doing the margin of difference in price between the best cartridges, as sold by members of the gun trade, and the cheaper cartridges would be narrowed, and that gunmakers would thus have an opportunity of doing an increased business, and that this would recoup them for any loss that might be occasioned by the increase of wholesale prices. This view was upheld by those present at the meeting with one exception, this member being in favour of increasing the retail prices proportionately to the advance on the wholesale quotations.

It was thought that a general expression of the views of the trade on the subject under discussion should be obtained by means of a circular letter sent out from the offices of the Association, and that such a circular should invite the opinions of the whole of the members of the Association as to what prices should be put forward as representing the minimum which should be charged for the various leading classes of ammunition. Such a minimum would in no way limit the power of a gunmaker to charge higher prices than the minimum rates agreed upon by the trade.

It was the opinion of those present at this meeting that it would be better to obtain an expression of opinion from the whole of the members of the Association before definitely recommending the minimum prices in question for the guidance of the trade in making arrangements for the forthcoming season. The meeting therefore provisionally recommended the following minimum prices, with a view to submitting them for approval in the circular letter above referred to:—

Best paper 12-bore game cartridges, 10s. 6d. per hundred for cash.

Ejector cartridges, 11s. 6d. per hundred for cash.

Eley's Pegamoid cartridges, 10s. 9d. per hundred for cash.

The Secretary was instructed to call a meeting of the Executive for Monday, April 10, and the hope was expressed that members would send in their replies without delay. In the meantime it was suggested that the issue of price lists for the coming season should be postponed until this matter had been considered by the Executive and the members had received their report thereon.

GENERAL DISCUSSION.—Mr. Charles Ingram Annan referred to the presence on the British market of rook rifles and other arms, either partially or completely manufactured in Belgium, which bear the English proof marks, and which are frequently engraved with English names; and he brought the matter to the attention of the Association, as he considered that English manufacturers were prejudicially affected by such a proceeding. The subject was discussed at some

length, especially with regard to its relation with the Merchandise Marks Act, but no resolution was passed.

CONCLUSION OF MEETING.—The meeting terminated with a vote of thanks to the Chairman for presiding, Mr. Thorn having, during the latter part of the meeting, taken the place of Mr. Rigby, who had been obliged to leave.

THE BIRMINGHAM PROOF HOUSE RETURNS.

The Balance Sheet and Accounts of the Birmingham Proof House, for the year 1898, which have recently been issued, show a profit of £744, as compared with a surplus of £722 in 1897. Although 1898 appears to be the better year, by reason of the slightly greater amount of profit, there were in 1897 9,176 more barrels proved than in 1898. The reduction in the total number of proofs made is accounted for by an increase of 43,024 in the provisional proofs, and a reduction of 52,200 in the definitive proofs, the net loss being 9,176 as above noted.

As will be seen from the following table the provisional proofs are the greatest in number for the past seven years, and it will be noted that the high figures for the year 1898 are most nearly reached by the 1892 records. The table also shows that, in spite of the large drop in definitive proofs, as compared with the year 1897, the figures for the year 1898, with this single exception, show the highest record during the period dealt with.

	Provisional	Definitive	Total
1892	219,504	159,582	379,086
1893	212,694	122,577	335,271
1894	173,878	125,395	299,273
1895	182,514	146,277	328,791
1896	160,684	164,214	324,898
1897	176,535	225,580	402,115
1898	**219,559**	**173,380**	**392,939**

In order to make it more clear where the increase in the provisional proofs has occurred, we have compiled the following table from the records of the Birmingham Proof House for the two past years. Instead of reproducing in full the fifty or so classifications of definitive proofs, we have divided the most important of them into four main classifications, and have dealt with the remainder as unclassified.

PROVISIONAL PROOFS.

	1897	1898	
Twisted Single-Birding Barrels ..	10,515	12,003	increase
Twisted Tubes for Double-Birding Barrels	48,920	57,598	increase
Plain Iron and Steel Military Barrels..	36,354	13,557	*decrease*
African Barrels	66,643	118,420	increase
Unclassified in this Abstract	14,103	17,981	increase
Total ..	176,535	219,559	increase

We may safely attribute the decrease of 22,797 on plain iron and steel military barrels to the stoppage of the Persian Gulf firearms trade by the Government. This large decrease is more than counterbalanced by the substantial increase in the other classes of provisional proof. Adding the net increase of 43,024 on the total provisional proofs, it will be seen that this is an addition of 65,821 distributed over the remaining classifications. African barrels account for 51,777 of this increase, twisted tubes for double-birding barrels account for 8,678, ditto for single-birding barrels account for 1,488, and miscellaneous proofs for the remaining 3,878.

In 1897 there was a decided fall in the number of twisted tubes for single and double-birding barrels proved, as compared with 1896; whereas last year there were a great many more provisional proofs in this department than there were either in 1896 or 1897.

The following table relating to definitive proofs has been similarly compiled to the previous table relating to provisional proofs:—

DEFINITIVE PROOFS.

	1896	1897	
Twisted Double-Birding Barrels ..	9,144	8,508	*decrease*
Breech-Loading Birding Barrels (2nd Proof)	38,733	38,064	*decrease*
Proofs with Nitro-Powder	3,846	5,641	increase
Breech-Loading Choke-Bore Barrels (2nd Proof)	18,989	23,869	increase
Military Barrels (2nd Proof)	14,728	7,593	*decrease*
Foreign Military Barrels (2nd Proof) ..	25,443	6,762	*decrease*
Revolving Pistol Chambers	75,488	48,268	*decrease*
Foreign Revolving Pistol Chambers ..	19,954	14,936	*decrease*
Unclassified in this Abstract	19,255	19,739	increase
Total ..	225,580	173,380	*decrease*

The total decrease in definitive proofs amounts to 52,200. It will be seen that the only items where there are increases, are in the proofs with nitro powders, which show a steady advance, and in choke bore barrels, besides which there is a small increase in the miscellaneous section.

The large decrease in the number of definitive proofs is to a certain extent balanced by the increase in provisional proofs. The combined receipts for definitive and provisional proofs during 1898 amount to £4,507, as against £4,742 for 1897. The decrease in the receipts for 1898 amounts to £235, though the profits for 1898 exceed by a nominal amount those for 1897. This is accounted for by the fact that last year's expenditure is considerably less than that of 1897, during which year repairs to building, &c., law charges, and extra gunpowder and cartridges caused an expenditure greater by about £258.

The Proof House accounts are not prepared in a manner rendering it possible for the outsider to draw any really definite conclusions as to the state of the gun trade in Birmingham. Local manufactures are not uniformly separated from foreign-made goods. Generally, we may attribute the decrease to a falling-off in the poorer class of work, but this conclusion might equally well be drawn from a knowledge of the total number of proofs in each section, since cheap guns and rifles are always in a large majority, and consequently they mainly account for the more marked fluctuations in the totals.

A general survey of the figures tends to suggest that in the better class of work the year 1898 has fully maintained the standard of the previous year, but it is not of much advantage to pursue these speculations when there is really so little groundwork of exact knowledge.

NOTES.

GUN BORE TREATMENT.—A concern known as the Gun Bore Treatment Company, of 7 and 9 Warren Street, New York, is making a special feature of chemically treating the barrels of guns and rifles. According to the Company's circular the treatment changes the colour of the bore to a dark blue or black, making the surface hard and smooth, and penetrating the pores of the metal, filling them and preventing the entrance of corroding agents. The treatment cannot fill up pits and rust spots, but it is claimed that all further pitting or rusting is arrested. It does not change the resisting power of the metal or its tensile strength. The Company guarantee that the finest gun or rifle may be treated without injury and with the results claimed. The treatment requires from five to six days, according to the character of the metal, and may be equally well applied to the exterior of gun barrels. From testimonials and other particulars, it looks as though the bores of rifles and shot guns are far less likely to rust and pit, even when put away after shooting without cleaning, than is the case with ordinary untreated steel. The Company appears to make out a very good case for the value of the process, and means will, we trust, be found for giving the system a trial in this country. The particulars given in the circular read almost too well to be true, but we hope to take the opportunity of forwarding a barrel for treatment, with a view to submitting it to exhaustive tests on its return to this country. Our readers will probably remember the reference which appeared in our last December issue to Col. Lockyer's lecture before the Royal United Service Institution, in which he described the well-known effects of Cordite on the service rifle, even when carefully cleaned immediately after firing. If the treatment assists the metal to resist the erosive effects of Cordite there should be a great future for it in this country, and it would be well worth the while of the Government to conduct experiments with a view to obtaining definite information on the point. The prices of treatment seem rather high, but no doubt in large quantities a substantial reduction could be made. The cost for interior treatment of the barrel of double shot guns and rifles is five dollars, while the charge for single-barrel weapons is three dollars, the additional charge for external treatment being three dollars and two dollars respectively for the two classes of arm. Particulars of the process of treatment are not given, but we are assured that heat is not used to an extent liable to injure the strength of the metal, the greatest heating being that due to a few boilings in water.

PRICE OF INANIMATE BIRDS.—In view of the expected reduction in the cost of inanimate birds for clay bird shooting, due to Messrs. Eley Bros. having made arrangements for selling birds manufactured by the Cleveland Target Company, the firm of Cogswell & Harrison have issued a circular notifying substantial reductions in the price of Swift-sure birds. The trade terms quoted are at the rate of £1 2s. 6d. per thousand, cash against invoice and carriage forward at buyer's risk from Malden, Surrey. In lots of ten thousand the cost is reduced by 6d.; while lots of twenty-five thousand are quoted at £1 1s. per thousand. In every case an increased charge is made for payments by monthly account, the explanation being that these prices are so low as to necessitate the conducting of business on cash terms. Another price list gives quotations specially appealing to clubs, who are treated as favoured buyers. The club prices are at the rate of £1 4s. per thousand, with reductions for a quantity on a similar scale to the trade quotations.

PRIZE GIVEN BY MR. JOHN RIGBY.—Mr. John Rigby is the donor of a very appropriate prize for a shoot being organised in the United States by Capt. J. S. Conlin. The shoot is known as the Sportmen's Jubilee Tournament, and Mr. Rigby's prize, which is to be shot for in one of the competitions, is an artist's proof engraving of the celebrated painting by Staples entitled "The Last Shot for the Queen's Prize, 1897." The engraving is published by Mr. T. McLean of 7 Haymarket, London, and, as will be remembered by those who are familiar with its details, it contains likenesses of celebrated shooters and patrons of the national rifle tournament.

CHILWORTH GUNPOWDER CO., LTD.—The balance-sheet of this Company for the year 1898 shows a net profit of £7,502, which, added to £160 brought forward, makes an available total of £7,662. A dividend at the rate of ten per cent. has been declared, which leaves £210 to be carried forward to the next account. The directors report that the volume of trade for the year has slightly increased, but the prices have not been so favourable as in former years. The balance-sheet of this Company shows its financial position to be very strong. With a paid-up capital of £74,520, its assets amount to £202,058, which are subject only to an allowance of £39,542 on account of creditors, and the above £7,662 representing the profit of the past year and the carry forward. The remaining £80,333 is put on one side as explosives assurance and reserve funds.

GUN PROOFS IN FRANCE.—The *Bulletin Mensuel de Armurerie Française* publishes the statistics of last year's proofs at St. Etienne. It appears that the number of provisional proofs amount to 57,470, as against 59,762 in 1897. This represents a reduction of 2,292 on the figures of the previous year. Double-barrel steel tubes account for 22,236 of the above total, while Damascus tubes amount to 24,915, the remainder of the total being made up of single barrels, pistols, revolvers and miscellaneous tubes. The total number of definitive proofs amount to 28,365, as compared with 26,465 in the year 1897, showing an increase of 1,900. Of this total 18,000 are for ordinary and superior proofs of double-barrelled guns, 7,000 odd are for special proofs with J powder, M powder, R powder, and S powder, the balance, of about 3,000 proofs, referring to single barrels and carbines. Our contemporary reproduces an interesting comparative table, showing the proofs of double-barrelled guns for the past thirty-three years, and it is extremely interesting to notice that the figures remain practically stationary, though, if anything, the last six years have shown an increase over the

previous averages. The mean for the total period seems to be about 40,000 barrels for double guns per annum, while more recently the figures have risen to approximately 50,000 per annum. In remarking upon these figures, the observation is made that the periods of greatest depression have occurred during the time of the two exhibitions of 1878 and 1889, the year 1871 naturally being unfavourable for this class of weapon on account of the war. The explanation of the theory that exhibitions cause bad years is that the patrons of the gunmaker spend their money in other directions, or if they do buy guns, that they are more likely to purchase foreign-made weapons shown in the exhibitions. The article concludes with the expression of a hope that next year will prove an exception to this unfortunate rule.

THE KYNOCH SCOTCH AGENCY.—We understand that Mr. J. G. Rowan, who was the principal partner in the firm of Messrs. J. G. Rowan & Co., of 27 Royal Exchange Square, Glasgow, has severed his connection with the house. The firm will, however, continue to act as Scotch agents for ammunition to Messrs. Kynoch Ltd., as the business will in future be conducted by Mr. A. W. Dick, whose portrait we here reproduce. Mr. Dick joined Mr. Rowan some years ago, and took an active part in the management of the business. There is every reason to anticipate that the excellent connection built up by Mr. Rowan will not only be maintained but increased by his partner, and now his successor. With the introduction of the Kynoch smokeless powder there are added prospects of increasing the business done with the trade. In spite of two somewhat unfavourable seasons, the future of the ammunition trade in Scotland promises well. It is a grievance with a good many gunmakers in the north that a number of English sportsmen who rent shoots in Scotland bring their ammunition with them; but there is a growing tendency among them to obtain their supplies locally, and it is anticipated that this will gradually increase the volume of Scotch trade. Mr. Dick enters upon the duties of his modified and more responsible position with our best wishes.

Mr. A. W. DICK.

COTTON POWDER CO., LTD.—The report of this Company for the year ending December 31, 1898, was issued last month. The gross profit shown in the trading account amounts to £8,875, which, after the deduction of office and other expenses of administration, is reduced to £1,492. Of this amount debenture interest absorbs £560, depreciation £121, and balance of Profit and Loss account from 1897 account £585, the remaining £226 being carried forward. The Report states that the position of the Company during the past year has been more satisfactory than in 1897, but that the various repairs necessitated by the flood which did so much damage to the works, still leave the Company indebted to its bankers to the extent of £2,500. Large sums have been spent on additions and repairs to the works, and the whole of the departments, which now include Cordite and "permitted explosive" sections, are in full working order. The contract for Cordite which was received from the Government has not, within the period dealt with by the accounts, affected the turnover, as up to Dec. 31 no deliveries had been made, but since that date substantial deliveries have been made the profits from which will appear in the current year's accounts. The board express regret that Major S. S. Young has resigned his office as a Director, and the opportunity is taken of referring to his valuable services in the past. Mr. Owen F. Jones has been re-elected a Director to fill the vacancy, and Mr. J. Todhunter has also been elected a member of the board.

THE NEW WEBLEY FACTORY.—The new buildings for the enlargement of the Webley Works are proceeding at a rapid pace, and the roofs are now on. As the buildings at present stand they give a very good idea of the excellent accommodation which they will provide when completed. The buildings are excellently lighted, forming, as they do, a square with a large courtyard in the middle. This latter space will be subsequently occupied by the smiths' forges and barrel making departments. The basement of one of the new wings is to be used as a polishing shop, while the upper floors will accommodate the machine shops and similar departments. Fire-proof floors and other substantial elements of construction show that these works are intended to have a long and useful career. When everything is completed, the plant and appliances at present in use in the old Scott Works in Lancaster Street will be removed to the new site, and in the same way the Ellis department of the Company will find quarters in the new home. A useful feature of the new buildings is an eighty-yards tunnel which has been constructed underground. It passes diagonally from corner to corner of the factory, and if necessary it could be extended a further twenty yards. This tunnel will be used as a shooting range for the sighting and firing of rifles. Hitherto a range of forty yards fitted up on the roof has been used for this purpose, but there will be numerous advantages arising from the additional length of range provided by the new tunnel.

NEW SCHULTZE GUNPOWDER CO., LTD.—The balance-sheet of this Company for last year shows a profit of £20,864, out of which £3,220 has already been paid as interim dividend to the preference shareholders. A further payment of £2,031 will complete the amount payable on the preference shares. This makes a total preference share distribution of £5,251, though in future years £8,125 will be required for this purpose. The difference is accounted for by the fact that the interest has been calculated according to the dates of payment for the shares, the final £2 on the £5 shares having been paid on May 3, 1898. On the other hand a note appears in the balance-sheet to the effect that the above profit has been made since March 22, 1898, and as the present Company took over the business as from January, of the same year, it is the provisions of the Company Act which prevents the distribution of profits made prior to the purchase of the company. These two conditions probably about neutralize one another, so that the loss of profit up to March 22 balances the saving by the *pro rata* payment of dividend on the preference shares according to the dates of the calls. The commission to the superintendent and the auditors' fees absorb £1,127, so leaving a

balance of £14,485 available for dividend on ordinary shares, reserves, etc. Of this £9,750 is appropriated for an eight per cent. dividend on the ordinary shares, which is paid as from the formation of the company, since £13,000 would be required to pay eight per cent. on the ordinary capital for an entire year. The sum of £300 is paid as a bonus to the employees of the Company, and £4,435 is carried forward to the next account. Turning to the balance-sheet, it will be seen that the capital and creditors together amount to £329,812, and to this is added £17,656 of undistributed profits. On the assets side appears the item of £253.425 for goodwill, etc., £17,258 for freehold and leasehold property, £20,614 for plant and furniture, £18,869 for stock-in-trade, £21,799 for debtors, and £15,501 for cash in hand and on deposit. The Company is to be congratulated on having paid in its first year of existence the dividends foreshadowed in the prospectus, and though the carry forward is not so large as might have been expected by the sanguine shareholder, it is fortunate that the indifferent game season of the past year has had no more serious result. Various items in the report show that the Company has lost none of its old enterprise. The quality of its products has been fully maintained, and various arrangements providing for the more efficient and economical manufacture and distribution of the powder will shortly be available. In the same way it is anticipated that negotiations now pending will provide for a large increase in the Company's foreign trade. Now that the original Schultze Gunpowder Co., Ltd., has ceased to exist under that name, the word "New" in the title of the present Company will be dropped as soon as the formalities necessary for this change of title have been complied with.

ROBURITE EXPLOSIVES CO., LTD.—From the 1898 balance-sheet of this Company it appears that the business has been once more established on a proper working basis after the disorganization resulting from the litigation in which it became involved about three years ago. The net profits for the year are £5,264, which, added to the balance brought forward from the last account, gives a total of £5,339. After transferring ten per cent. of this amount to the reserve fund there is a balance of £4,805. Of this sum £4,780 has been applied to the payment of the arrears of cumulative dividend for the period ending June 30, 1896. In this way there is a balance of £24 to be carried forward. The directors report that by reason of the Coal Mines Regulation Act of 1896, the demand for the Company's explosives have shown a steady increase, and that there is every reason to anticipate a continuation of the present favourable conditions.

MESSRS. F. JOYCE & CO., LTD.—The eleventh annual report and balance-sheet of this Company for the year ending December 31, 1898, have recently been issued. The gross profit for the year amounts to £610, and after deductions for directors' fees, bad debts, etc., the net profit works out at £19. This, added to the balance brought forward from the year 1897, viz., £469, makes a total of £488, which sum is carried forward to the next account. The directors regret that enhanced prices of raw materials and increased stress of competition have resulted in such a bad year's trading. With reference to the valuation of plant and machinery, the directors have had a fresh examination of the property, with the result that it comes out at £3,421 more than the books show. It has therefore been decided to appreciate this item by £2,800, and to balance this increase on the assets side of the balance-sheet by an entry for a similar sum on the liability side, to be entitled "reserve." The capital of the Company is £60,000, and this added to various other items makes a total on the liability side of the account of £69,497. This is balanced on the assets side by £17,670 for debtors, £23,365 for stock-in-trade, plant, £19,856 machinery and buildings, etc., £7,550 for goodwill account, and £1,073 for cash in hand and at bankers. The directors are Sir John R. Heron-Maxwell, Bart., chairman; Mr. John Parnell, Mr. William Stacey and Col. Horace Ricardo; the latter has taken the place on the board occupied by Mr. R. G. Joyce prior to his retirement.

HOTCHKISS ORDNANCE CO., LTD.—We have received from this company two small pamphlets containing the proceedings at the extraordinary general meetings held in February and March of this year. At the latter meeting the new scheme for the re-arrangement of the capital was confirmed by a large majority, well above the prescribed excess necessary for carrying the resolutions into effect. The particulars of the re-organization are given in the two following resolutions out of the three which were passed this week:—

"Provided that in case, before the 31st day of December, "1899, the capital of the Company be reduced by writing off "as capital lost or unrepresented by available assets the sum "of £7 15s. from each of the 45,000 fully-paid ordinary shares "of the Company, then each ordinary share of the reduced "capital shall be, and be deemed sub-divided into two shares "of £1 each, and one share of 4s., and each preference share "of the original capital of the Company shall be, and be "deemed sub-divided into ten shares of £1 each, of which "six shall be called preference shares and the remaining "four shall be called ordinary shares, and as from the 31st "day of December, 1897, the preference shares resulting from "such sub-division shall confer on the holders thereof the "right in a winding-up or distribution of capital, to repay-"ment of the amounts credited as paid thereon in priority to "any repayment of the amounts paid on the ordinary shares, "but only to a non-cumulative preferential dividend at the "rate of five per cent. for each year on the amounts paid "up thereon, instead of a cumulative dividend at the rate of "7 per cent. per annum, and the ordinary shares resulting "from such sub-division shall not confer the right to any pre-"ferential dividend, but shall rank both in respect of capital "and dividends as ordinary shares for all purposes, and be "deemed ordinary shares within the meaning of this Article "and Article 110."

"That the capital of the Hotchkiss Ordnance Co., Ltd., be "reduced from £800,000, divided into 35,000 preference shares "and 45,000 ordinary shares of £10 each, to £449,000, and "that such reduction be effected by writing off and can-"celling, as capital, lost or unrepresented by available assets, "£7 16s. from each of the 45,000 ordinary shares, and reduc-"ing each such share to a share of £2 4s."

NATIONAL EXPLOSIVES CO., LTD.—This Company is to be heartily congratulated on another year of brilliant progress. The profits for the year 1898 are £30,737, which, with the balance brought forward, provides an available total for distribution of £31,092. The sum of £19,017 is distributed as dividends in the proportions laid down by the Articles of Association, the preference shareholders receiving 9 per cent.

on the year, allowing for the interim dividend already paid, while the 2½ per cent. interim dividend on the ordinary shares is now made up to a total of 11 per cent. Of the remainder of this year's profits, £7,500 has been carried to a reserve account, which will now stand at £10,000. The property account was written down last year by £5,000 appropriated from the profits of 1897, and the present year by £2,109 which has been spent on additional buildings and plant, and it has been decided not to add this to the property account, which will continue to remain at £90,000. Every item of the balance sheet shows the finances of the Company to be in the soundest possible condition. Obviously, with such a satisfactory balance sheet to lay before the shareholders, the directors do not consider it necessary to discuss the position of the business, but with the increasing demand for Cordite we may anticipate that in this department, at least, the works will be fully occupied in the future. The annual meeting takes place at Winchester House on the 6th inst.

MESSRS. WALKERS, PARKER & CO., LTD.—The balance sheet of this Company for the year 1898 shows a net profit of £5,783, which compares favourably with the loss of £1,195 during the year 1897. The directors regret that they cannot recommend the payment of a dividend on the preference shares, although there is now £12,410 of undivided profits in hand. This is caused by the Company's indebtedness to its bankers. The year 1898 was very unfavourable for the working of the business, as the coal strike very much enhanced the price of suitable fuel. The large fluctuations in the price of lead have also given the directors a good deal of anxiety, as it was found extremely difficult to know when to make their purchases. These unfavourable elements in the year's work were only partially neutralized by the increase of trade and improvement in prices. The Company is labouring under the disadvantages of having inadequate working capital, with the result that it is very difficult to provide a profit for the shareholders after paying interest on borrowed moneys and debentures. At the annual general meeting the chairman, Mr. W. Newall, expressed the hope that the directors would be able to bring forward a scheme under which the Company could be put on a dividend-paying basis; but the success of the scheme would largely depend upon the willingness of the preference shareholders to allow their shares to be written down below the present nominal prices.

THE NEW WESTLEY RICHARDS' WORKS.—The new works of Messrs. Westley Richards & Co., Ltd., will be completed in about a month's time. They occupy a site near Selly Oak, within a short distance of the works of the Cycle Components Co. Shortly after Easter it is expected that the large amount of machinery, at present installed at the old works in High Street, will be removed to the new shops, and the works will be fully equipped some time about May, and this without serious interruption of the manufacturing work of the firm. There is no doubt that the comfort of the workpeople and the handling of the business will both be advantageously affected by the change. For instance, there is a 100 yards open-air rifle and shot-gun range actually adjoining the premises, while the rifle butts of the Birmingham Volunteer Corps are in an adjacent field. The firm's shooting instruction and gun-fitting ground, which is also the headquarters of the Edgbaston Gun Club, is but a short walk from the works across the fields. In this way it is apparent that many conveniences will follow from the change which will shortly be made. The old works of the firm occupy a very valuable freehold site, which will subsequently be utilised for town improvements, involving the erection of a new arcade. The offices of the Company will be at Selly Oak, so that the city depôt will in future be the Company's premises at 12, Corporation Street, which are under the charge of Mr. D. J. P. Haines.

KYNOCH NOVELTIES.—We notice that Messrs. Kynoch, Ltd., have now placed upon the market in an attract ve form the .303 cartridge pencil case and the 12-bore shot gun matchbox which were a special feature on the occasion of the visit of the Gunmaker's Association to their factory, in so far that every visitor was presented with a specimen of each. These novelties are displayed on a card, and no doubt their cheap price will recommend them to those members of the public who like to have their equipment of pocket utensils in a fancy form.

MANAGERSHIP OF THE COTTON POWDER WORKS.—We understand that Mr. George Trench, who has been the manager of the Cotton Powder Company's Works at Faversham for many years, is now retir ng to the post of Consulting Engineer to the Company, and the post of Manager of the Works is now becoming vacant in consequence.

MESSRS. CURTIS'S & HARVEY, LTD.—We are informed that Messrs. Curtis's & Harvey, Ltd., have removed their offices from 74 Lombard Street, E.C., to 3 Gracechurch Street, E.C., to which address all future communications should be sent.

MR. WM. MACNAB.—Mr. Wm. Macnab, the well-known authority and expert on explosives, sends us notice that he has removed his laboratory and offices from 14 Great Smith Street, to Edinburgh Lodge, Howick Place, Victoria Street, E.C.

TESTING STEEL FOR BARRELS.

THE rough and ready method of finding out the best steel for gun and rifle barrels, which consists in observing the number of rejects from the Proof House, has disadvantages, both from scientific and commercial aspects. In the first place, a large amount of work has been put into the making of barrels, and the whole of this is thrown away, should they fail to pass the proof. Further, the difficulty of jointing a fresh pair of barrels to the original action is an unusually difficult job, because the filing and surfacing have to be done chiefly on the barrel, which means that the job, besides being a difficult one, is not so satisfactory in the end as is the case where both the action and the barrel may be filed and adjusted to one another.

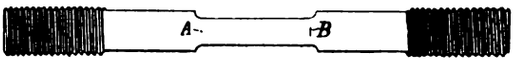
By taking specimens of different brands of steel, and submitting these to suitable tests, a great deal may be learnt with a small expenditure of time and money; and further, when a suitable steel has been selected, it is possible to maintain greater punctuality in the completion of orders, since the

delay due to having to replace barrels spoilt in proof is prevented. In the same way tests may be made of the material for forming the actions, which will similarly prevent the utilization of a metal which is liable to fail to satisfy the proof requirements. In the case of certain types of weapons, the proof stresses are very much severer in proportion than in others, and this is especially the case in express rifle barrels and in small bore barrels of the military type. In express rifles, for instance, the Proof Houses appear to be unable to find a proof which will proportion the stresses at different points along the barrel to the relative degrees of pressure of the service charge. Curiously enough, the greatest stress exerted in the case of express barrels is at a point about three inches beyond the end of the chamber, and this area of excessive proof pressure extends over about a quarter of an inch of the length of the barrel. The result is that a large number of express barrels have been ring-bulged in proof at about six inches in front of the breech face. Nothing in the normal pressures along the barrel of the service charges suggests the necessity of exceptional strength at this place, and yet the Proof Houses—notably, the London Proof House—calmly inform gunmakers that they must remedy this alleged defect in their barrels. In the case of the ·303 and other similar rifles, the Proof Houses seem equally incapable of suitably adjusting the stress at different parts of the barrel, so as to provide a fair test of their safety under service conditions. The Government test is quite different from that adopted by the two Proof Houses, and is far less severe.

The gunmaker is left no choice in the matter, and has to build his weapons to stand the tests laid down by the Proof Houses. Even if these tests require a strength of barrel far in excess of the actual necessities of the case, gunmakers have still to make their barrels heavier, or, as an alternative, choose a tougher quality of steel, if such can be found. If clumsy barrels result from attempts to conform with the requirements of the proof, gunmakers may fail to compete for export orders with foreign barrels which are not subjected to similarly unreasonable tests. If the gunmaker can find a steel, within ordinary requirements of weight, tough enough to stand the required stress of proof, he is lucky; but it must be remembered that the tenacity of steel cannot be indefinitely improved, at any rate, within workable limits of hardness.

The Webley and Scott Company have been special sufferers by the severe tests imposed by the two Proof Houses, and they have been put to great expense to select suitable metals for their different barrels. Of course, if the action of the Proof Houses leads to the finding of suitable metal, in quality far beyond what would be obtained had the Proof Houses been less severe, British arms will benefit in the end; but, in the meantime, the experience is rather an expensive one.

Tests of steel for barrels are of a similar character to tests of metal for other purposes. They comprise a determination of the power of the metal to resist a given degree of tension without expansion, and further, of the amount of its expansion before breaking. The ordinary manner of making these tests is to take a piece of metal of known sectional area, and to put it under tension in a testing machine. Various measurements are made during this process, and from these the quality of the steel or other metal is determined. There are various machines for the different kinds of work, but Messrs. Webley have found that reliable results can be obtained from a wire testing apparatus. Such a machine consists of a kind of lathe-bed carrying two chucks. The steel is fixed into these, the tension is applied by increments shown on a dial, and the behaviour of the steel during the process of the experiment is carefully noted, the measurements and other data being carefully recorded.



Scale, Full Size.

SPECIMEN OF STEEL AS PREPARED FOR TESTING.

We here give an illustration of the manner in which the pieces of steel are prepared for the purposes of these experiments. A piece of metal is screwed at each end, and reduced in the centre to a diameter of ·146 of an inch. The steel is punched at the point marked A with a small dot, while at the part marked B it is advisable to copper the metal by moistening it and then rubbing on a little copper sulphate. The object of coppering the metal is to render the marks subsequently to be scribed at B more easily examined. The sample of metal is then ready for the test. The screw ends are fixed into small chucks, and these are connected with the apparatus. The first process is to put a tension on to the sample which will take up any play in the chucks and other parts. The dial for showing the various degrees of tension is then set at zero. One leg of a pair of divider compasses is then placed in the dot-punched hole A, and with the other leg adjusted to mark off ·6 of an inch, the scratch marked B in the illustration is made. The handle is then turned, which applies a gradually increasing tension on the specimen of steel, the dividers still being kept in the position noted. An occasional marking on the scribed line B will indicate by a thickening of this line immediately the steel begins to stretch across the narrow central part. The tension at which the steel begins to stretch is then noted, and this is known as the elastic stress. Further pressure is applied, and the stretching continues. At a certain point the steel begins to expand at a rate which neutralises the application of further tension, for the steel gives way exactly as fast as the steel is pulled out. This is shown on the indicator by its ceasing to move along the scale during the continued turning of the wheel which pulls out the steel. This degree of tension is called the ultimate stress, for it shows the point at which the metal can no longer sustain increased tension, the result being that it gives way just as fast as the handle is turned to put on greater tension. Up to this point the steel has been gradually "necking" at some point along the narrow part, and finally it breaks away, and the test is concluded.

The results of such a trial are then recorded on a table similar to the one of which we give a reproduction. This table records some very interesting trials with different brands of gun and rifle steel. The first two columns of figures give the measurements of the specimen of steel at the narrow part between the shoulders. The diameter is ·146 of an inch, which works out as ·0168 of a square inch. In the columns dealing with the elastic stress, we have the number of pounds tension which produce the first stretching. This is arithmetically worked out in the adjoining column into the equivalent in pounds per square inch. In other words, the

number of pounds which produce the stretching is multiplied by the number of times that a square inch is greater than the sectional area of the specimen tested. Pounds are converted into tons in the next column, and these are averaged so as to give the means when a number of identical specimens of the same metal are tested together, such means being more reliable as indications of the quality of the steel than the results obtained from a single specimen. Of course, such means must be considered side by side with the individual values from which they are derived, in order to determine the uniformity of the metal. The three columns showing the ultimate stress are worked out in the same way as in the case of the elastic stress. The ratio of elastic and ultimate stresses shows the percentage comparison between the tension in tons per square inch which produced the first stretching and that which produced the final fracture or ultimate stress. In the columns dealing with the fracture after ultimate stress, the micrometer is used for taking the diameter of the specimen piece of steel at the place where it has fractured. The area of this fractured part is then worked out arithmetically, the values for which are shown in the next column. The third column shows the percentage comparison between the original sectional area of the specimen and its area at the point of fracture. The last two columns show what is described as the ultimate extension in six inches. The first of these two columns shows the distance between the dot punch A and the scribed line B, when the two broken parts of a specimen piece of metal are placed together. The original distance between these marks, viz., the distance between the points of the dividers when the scratch was originally made, was ·6 of an inch. The ratio between these two is worked out in percentages, and their values are shown in the final column.

In the following table we have shown in black type the figures which represent the results of the test, the other figures being merely the ground work of these results. In the case of the four first trials it will be seen that the mean elastic stress was 21·8 tons per square inch, and that the ultimate stress was 42·4 tons per square inch. The column entitled ratio of elastic and ultimate stress shows that the elastic stress represents 52·2 of the ultimate stress, and that the length of the narrowed portion of the metal specimen after fracture, was 17·5 per cent. greater than its original length. The next set of tests with steel for revolver cylinders gives a higher elastic stress than in the case of the previous specimen, viz., 19·2 tons per square inch, and a lower ultimate stress, viz., 32·7; but, on the other hand, the ratio between these two is 57·9, as compared with 52·2 in the previous specimen. The extension before fracture is 29·9 per cent., as compared with 17·5 per cent. in the previous case. It will be seen, therefore, from these figures that, while the second set of specimens are not as hard as the first lot, their ratios work out more favourably. From this we may assume that, if it is possible to use a suitable amount of metal to make up for the slight deficiency in actual strength, we shall have a more reliable metal for making revolver cylinders, since there is a greater margin of safety between the first stretching and the final fracture. This does not take into account the workability of the metal, but for argument's sake we may conclude that the second specimen of metal is of milder and more workable steel, and that the operation of boring the cylinder holes is thereby rendered easier.

We will not follow out in similar detail the lessons to be learned from the other specimens of steel dealt with in the table. We have shown in a general way the lines upon which the results must be compared, and when the tables have once been compiled it is a question for the practical gunmaker to balance the advantages and disadvantages of each type of steel, as regards the relative ease with which they may be worked, the nature of the stresses the metal will be called upon to resist, the margin of weight available for allowing a proper factor of safety, and finally, the cost of the metal itself. As is well known by all practical experimentalists, skill is not so much required in making trials, and recording their results, as in applying the results obtained to practical use, and deriving from them their true import, which may at first appear to be somewhat obscure.

We will conclude this article by calling special attention to tests Nos. 32 and 33 with ·303 rifle steel, which show exceptionally high elastic and ultimate stresses. Though the ratio

No. of Test.	Description of Steel.	Original Size.		Elastic Stress.			Ultimate Stress.			Ratio of Elastic and Ultimate per cent.	Fracture after Ultimate Stress.			Ultimate Extension in 6 in.	
											Diam. at Fracture.	Contraction at Fracture.		ins.	Per cent.
		Diam in.	Area. sq. ins.	Totl. lbs.	sq. ins. lbs.	sq. ins. tons.	Totl. lbs.	sq. ins. lbs.	sq. ins. tons.			Area.	Per cent.		
19	Webley Service Revolver body and barrel Steel	·146	·0168	800	47619	21·2	1650	98214	43·8	48·4	·115	·0065	36·6	·705	17·5
20	Ditto	·146	·0168	850	50595	22·5	1550	92261	41·1	54·7	·115	·0065	36·6	·705	17·5
21	Ditto	·146	·0168	800	47619	21·2	1550	92261	41·1	54·7	·115	·0065	36·6	·705	17·5
22	Ditto	·146	·0168	850	50595	22·5	1650	98214	43·8	51·3	·115	·0065	36·6	·705	17·5
23	Four sample specimens of cast Steel received from Messrs. Firth and Sons, Sept 22, 1898, Diam. 1⅞ in. for Revolver Cylinders	·146	·0168	725	43154	19·2	1200	71422	32·3	58·5	·095	·007	41·6	·8	33·3
24		·146	·0168	725	43154	19·2	1250	74397	33·1	57·4	·095	·007	41·6	·77	28·3
25		·146	·0168	725	43154	19·2	1200	71422	32·3	58·5	·098	·0075	44·6	·775	29·1
26		·146	·0168	725	43154	19·2	1250	74397	33·1	57·4	·098	·0075	44·6	·775	29·1
27	Four sample specimens of cold rolled polished Steel received from Messrs. Seebohm & Dieckstahl, 1⅞ in. round for Revolver bodies, Barrels or Cylinders	·146	·0168	1000	59523	26·5	1100	65476	29·2	90·7	·094	·0069	41·0	·725	20·8
28		·146	·0168	750	44642	19·9	1200	71422	31·8	62·5	·095	·007	41·6	·725	20·8
29		·146	·0168	950	56547	25·2	1100	65476	29·2	86·2	·095	·007	41·6	·725	20·8
30		·146	·0168	700	41666	18·6	900	53571	23·9	77·8	·090	·0063	37·5	·725	25·8
31	Steel used for Barrel & Cylinder of small solid frame Revolver	·146	·0168	600	35714	15·9	850	50594	22·5	70·6	·081	·0051	30·3	·835	39·1
32	Webley & Scott ·303 Rifle Steel	·146	·0168	1200	71428	31·8	2100	125000	55·8	50·7	·112	·0098	58·3	·710	18·3
33	Ditto	·146	·0168	1350	80358	35·8	2050	122020	54·4	65·8	·110	·0095	56·5	·715	19·1
34	Webley & Scott Shot Gun Barrel Steel	·146	·0168	650	38690	17·2	1350	80358	35·8	48·0	·100	·0078	46·4	·780	30·0
35	Ditto	·146	·0168	750	44642	19·9	1350	80358	35·8	55·5	·100	·0078	46·4	·775	29·1

between these two, viz., 50·7 per cent., is exceeded in the three previous specimens of metal, it must be remembered that 50 per cent. is an ample margin, and that it is a wonderful ratio to obtain from steel having such high elastic and ultimate stresses. The ultimate extension is again not quite equal to the previous examples; but, on the other hand, we must once more remember that, while the margin is ample, the strength of the metal is so very great as to render highly remote the possibility of arriving, in actual use, anywhere near the elastic and ultimate stresses of such steel. The great trouble of ·303 rifles has been their liability to bulge a few thousandths of an inch in the chamber, or thereabouts, when submitted for proof. The metal might never actually give way to the extent of a burst, for these expansions of the chamber are due to a softness of the metal which causes the layers adjoining the cartridge to take an undue proportion of the stress. No matter how much the external diameter of comparatively soft steel barrels might be increased, the chambers would still bulge. Such bulging upsets the alignment between the chamber and the rifled part of the barrel, and there is no alternative but to reject such barrels. By the use of a harder steel the internal layers of the barrel are better supported by the external layers, and the entire strength of the barrels from the inside to the outside is brought into play to resist the tendency to expand under the influence of high gas pressures in the ammunition. A steel capable of giving the readings shown in tests Nos. 32 and 33 must, if used for the manufacture of rifle barrels, also be of a quality suitable for boring and rifling without an undue blunting of tools, and without an undue making of "scrap." One need not be surprised that such a specimen of steel should cost £40 per ton, as compared with half the price for less satisfactory results.

CORRESPONDENCE.

EARLY TESTS OF MINING EXPLOSIVES.

To the Editor of *Arms and Explosives*.

Sir,—Your reference to incidents that occurred some thirteen to fifteen years ago recalls memories which I had well-nigh forgotten.

Certain experiments that had been carried out by one of the members of the Royal Commission on Accidents in Mines appeared to have proved that a dynamite shot did not ignite an explosive mixture of gas and air. I was asked to repeat them, and did so.

The experiment consisted in erecting a tarred canvas chamber constituting five sides of a cube four feet high upon a light wooden frame of such a height as to allow the edges of the open side to touch the ground; introducing the quantity of gas calculated to make the air in the chamber explosive; waiting for a little; and then firing a dynamite cartridge in a hole two inches in diameter by three feet deep, bored vertically downwards in the soft ground under the centre of the cube.

The first few shots showed me that the dynamite expended its force in the ground; that the flame never came anywhere near the gas; and that the experiment proved nothing.

This was the beginning. After this I conducted all the shot-firing experiments recorded in the Report of the Royal Commission on Accidents in Mines, extending over a period of four or five years, including those made at Bute Docks, at Pwllypant Quarry, at Penygraig Colliery, in various coal mines, and at Dowlais Ironworks.

In the experiments made on the surface the cubical form of the chamber was preserved, but, apart from that, all the additions to the apparatus, such as the means of fixing the gas and air, testing the inflammability of the mixture immediately before and after firing the shot, providing the chamber with sheet iron sides (retaining only the canvas top), and finally firing the shots from a hole in a steel block, were made by me.

When I first proposed to use a steel block it was suggested that the explosion of nitroglycerine could not be confined in a barrel made of any known substance. I expressed the opinion that it could. I then obtained leave to make the experiment, and carried it out successfully.

One of the objects of the experiments was to test the efficacy of a water-cartridge. Some years previously Mr. Macnab had patented the use of a cylinder filled with water to be placed in front of the charge, with the object of preventing the flame from being projected into the workings of a mine when a blasting shot was being fired. This arrangement was modified by enclosing the charge in a waterproof bag, and placing it inside the cylinder amongst the water.

The gentleman to whom you refer came to see the experiments when the steel block was being used.

W. Galloway.

Cardiff, March 3, 1899.

THE MARS AUTOMATIC REVOLVER.

To the Editor of *Arms and Explosives*.

Sir,—I notice in your current issue a paragraph *re* the Mars Automatic Revolver. Please be good enough to insert the following corrections and disclaimer in your next number.

1. The Mars revolver has not, nor has it had any existence.

2. I am not entitled to the rank of Captain, whether honorary or otherwise, nor do I assume it.

3. The excellent revolver to which you presumably allude is the invention of Col. Fosbery, V.C., though I have reason to believe that it has been considerably modified by Messrs. the Webley and Scott Co., Ltd.

Your obedient servant,

Hugh W. Gabbett-Fairfax.

Leamington, March 7, 1899.

[We much regret the mistake to which our correspondent refers.—Ed. *A. & E.*].

THE "SNAFFLE" PAPERS.

To the Editor of *Arms and Explosives*.

Sir,—Whilst thanking you sincerely for your long and flattering notice of my book with the above title, I really must ask you to allow me to claim at least sufficient technical knowledge to enable me to understand the difference between nitro-compounds intended for shot guns and those made for rifles. There is really not the slightest reason why your reviewer should say "that the author considers that shot-gun powder would do for rifles." The reason he gives is, that I named 42 grains of smokeless powder as a charge, not for my rifles, as he says, but for a very powerful rifle intended for the biggest game. Quoting, as I did, from memory, I am not prepared to say that I gave the charge correctly, but that is approximately the amount of "Rifleite" powder used in Jeffrey's ·400 - 400 rifle. The exact passage runs: "I have no

doubt the ·400 - 400 rifle, with a charge of 42 grains of smokeless powder, would give excellent results." I think this passage is clear enough. My rifle is a ·400 - 120 - 280, and is intended for medium game, the game of Europe and America, but not for elephants, rhinoceros, buffalo, or bison; and it is designed for black powder, which, in my opinion, will remain the powder in general use in wild and out-of-the-way countries.

Yours obediently,

Nimrod Club, S.W. SNAFFLE.

[We commented upon the paragraph in "Snaffle's" letter as it read to us. We are pleased, however, that, with the assistance of the detailed exposition given by "Snaffle" in the above letter, it is now possible to apply a more reasonable meaning to the passage, which, in its original form, led us to make certain critical observations.—ED. *A. & E.*].

REVIEWS.

Electric Blasting, being a reprint of a series of four papers read by Mr. William Maurice before the Chesterfield and Midland Counties Institution of Engineers. Published by Andrew Reid & Co., Ltd. Price 11s. 3d.

Last month we referred to the exceptionally able series of lectures on electric blasting which Mr. Maurice had delivered during the past eighteen months, and which are reproduced in four of the volumes of the Transactions of the Institution of Mining Engineers. Since then we have received a copy of this series of lectures bound in book form with stiff paper covers.

Regarding the lectures in volume form we can only repeat our opinion that they are the most able, and at the same time the most exhaustive, treatment with which we are aware of the important subject of electric blasting. The text is supplemented by a large number of plates, showing the actual arrangement and working of the electric and other apparatus for the firing of blasting charges. Not only does the book contain, so far as we can see, the whole of the available information on the actual subject of blasting, but it deals with allied questions, such as the strength of detonators required for various explosives. Electric batteries and exploders also receive very careful attention, and the relative suitability of each form of electric generation is considered with reference to the number of shots and other conditions of the work to be done.

A clear index very much increases the value of the book for reference purposes, so that, taking the volume as a whole, we have no hesitation in recommending it to the careful notice of our readers.

Mémorial des Poudres et Saltpetres, 1897-1898. Official document compiled by the French Government Service Department of Explosives. Published by Gautier-Villars, 55, Quay des Grandes-Augustines, Paris.

After the long interval of two years we get another of the highly interesting technical reports of the French Government Explosives Department. The series of papers which appear in the book are, as usual, of a very technical character, as befits the distinguished authors who are responsible for their production.

Among the more interesting papers we notice one dealing with the temperature developed in firearms, and before we have reached the third page of the paper, a law governing the chilling of the barrel is set forth in an algebraical formula. Particulars of experiments upon which the laws propounded have been based are given with the aid of illustrations, and they show that a rifle is fired under special conditions suitable for recording the heat evolved. This is effected by fitting a series of five chambers on to the outside of the barrel. These are made water-tight, and the interior space is filled with liquid. The temperature is taken by means of thermometers, and in this way a record is obtained of the rise and fall of the temperature at different points along the barrel during the course of firing. The data so obtained forms the ground work of the mathematical calculations which follow, and these will be of great interest to many who are working in this direction.

A chapter on nitric acid manufacture, with special reference to its use in the explosives factory, will appeal to those works managers who make their own acid. An interesting report on the clearing of virgin land with dynamite is contributed by *M.* M. G. Coutagne. The experiments were carried out with a view to determining whether dynamite could be economically used for the land-clearing operations around Tunis, and generally the opinion seems to be expressed that the use of dynamite provides a comparatively simple and economical means of preparing rough land for cultivation.

The official report of the Commission of Explosives for the years 1896 and 1897 gives in detail the main particulars of the official matters which have been dealt with during the period under review, and the report is signed by the President, *M.* Berthelot, and bears the date of February 10, 1898.

A number of other official reports, together with notes and further papers, completes a large volume, from which the careful student will no doubt pick up very useful hints for his future guidance. It is rather a pity that so much time appears to have been lost in the issue of this book. A publication issued once every two years is apt to become somewhat out of date if it is issued fifteen months after the termination of the period covered in the reports. Our own Explosives Department gets out a well-arranged and valuable report within four or five months from the turn of the year. Of course this could equally well be done in the case of the *Memorial;* but probably traditions of some years standing will prevent any change in the direction of greater punctuality and the more frequent appearance of the volume.

Notes on the Literature of Explosives, by Charles E. Monroe. Reprinted from the Proceedings of the United States Naval Institute.

Mr. Monroe is one of the most careful students of explosives literature, and in the past he has contributed some very valuable summaries of books dealing with this somewhat intricate science.

His book opens with various extracts from the Report of H.M. Inspectors of Explosives for the year 1896, and of course this is a little out of date, considering that one report has been issued since then, and another is well on the way. A reference to the career of the late Sir Vivian Majendie appears in the notes, and it is just as well that a life of such usefulness should be referred to in a country where the conditions of manufacturing explosives could, in the case of a

good many factories, be much improved by a suitable Explosives Act. The natural tendency to recklessness may easily lead to a big disaster, and of such the American explosives trade has not been so free as one might be entitled to expect.

A useful chapter reproducing the specification issued on August 22nd of last year by the U.S. Naval Department for its smokeless powder is of considerable interest. The powder is described as an ether-alcohol colloid of soluble nitrocellulose, with or without metallic nitrates. Under the headings of ingredients, solvent, method of manufacture, and finished powder, full details are given of the explosive, though they are not in all items sufficiently definite for one to form a clear idea of powder without the specifications which are issued to the manufacturers.

We have great pleasure in calling attention to the request of the author to the effect that publications dealing with gunnery and explosives should be addressed to him at the Columbian University, Washington, D.C., as he proposes to continue at intervals his contributions regarding this class of literature to the proceedings of the Naval Institute.

Banks and their Customers, by the Author of "The Banks and the Pubic." Second Edition. Published by Effingham Wilson, London. Price 1s.

This little handbook will be of great use to those who are not yet versed in the wiles of the banking fraternity. The motives underlying the policy of banking institutions are ruthlessly exposed, and the best way of getting satisfactory terms from one's bankers is carefully explained. Such information is of considerable value, since banking charges and accommodations do not follow any exact rule, but are based upon the good-nature of the individual customer.

A very interesting chapter on how to obtain an advance may be disappointing to those who think that a special knowledge of banking customs will enable them to get credit in the absence of the power to deposit valuable securities.

Though somewhat outside the ordinary course of reviewing undertaken by this paper, we still feel justified in referring to this book as one which may well be worth a niche in the office book-case.

APPLICATIONS FOR PATENTS.

FEBRUARY 20TH—MARCH 18TH, 1899.

3,708. Single-trigger Double-barrel Gun. A. Dean.
3,755. Firing Mechanism for Breech-loading Ordnance. A. T. Dawson and G. T. Buckham.
3,800. Hammerless Guns. N. Pieper.
3,848. Method of Firing Guns and Rifles. J. W. Frazer.
3,926. Mechanism for the Direction and Propulsion of Torpedoes. R. L. Crawford.
3,952.* Firing Mechanism for Small Arms. A. E. Lord.
4,010. Mechanism for the Direction and Explosion of Torpedoes. F. O'C. Prince and C. E. Monkhouse.
4,020. Projectiles for Rifled Guns. F. Stubbs and L. Burrows.
4,157. Breech Mechanism for Automatic Guns. W. A. Burns.
4,338. Breech Mechanism of Guns. Sir W. G. Armstrong, Whitworth & Co., Ltd., and A. G. Hadcock.
4,426.* Projectiles for Firearms. H. W. Gabbett-Fairfax.
4,502. Percussion Fuses for Projectiles. J. Wetter. *(Agent for Eduard Rubin, Switzerland).*
4,507. Manufacture of Explosives. G. Beneké.
4,586. Single-trigger Gun Mechanism. F. W. Cole.
4,587. Hinged Joints and Adjustments for Try or Measuring Guns. F. W. Cole
4,617. Improvement in Apparatus for raising Projectiles to Turret Guns. A. T. Dawson and J. Horne.
4,623. Magazine Rifles. J. Formby.
4,624. Magazines for Magazine Rifles. J. Formby.
4,798.* Percussion Fuses for Shells. A. T. Dawson and G. T. Buckham.
4,844. Single-trigger Small Arms. J. Carter and H. Bruntnell.
4,900. Gun Mountings. Sir W. G. Armstrong, Whitworth & Co., Ltd., and R. T. Brankston.
5,005. Means for Fastening the Doors of Torpedo Tubes. Sir W. G. Armstrong, Whitworth & Co., Ltd., and E. W. Lloyd.
5,017. Single-trigger Double-barrel Gun. E. C. Hodges.
5,087. Single-trigger Double-barrel Gun. T. Southgate.
5,557. Disappearing Targets. H. Doerr and R. Arens, Liverpool.
5,674. Laying and Firing of Ordnance. H. H. Lake *(Agent for T. M. Foote, U.S.A.).*
5,707. Electric Fuses. G. Smith and D. Corrie, Glasgow.
5,753. Manufacture of Explosives. J. Ross, J. C. Cook, and W. A. Mason, London.
5,760. Explosives for Use in Dangerous Coal Mines. W. J. Orsman, Liverpool.
5,773. Sights for Ordnance. J. W. Giltay, London.
5,835. Guns. C. A. McEvoy, London.
5,885. A Cycle and Field Gun. F. R. Sims, London.
5,959. Cleaning Rods. T. Glover, London.

* These Applications were accompanied by complete Specifications

SPECIFICATIONS PUBLISHED.

FEBRUARY 25TH—MARCH 18TH, 1899.

27,754 (Nov. 25, 1897). R. A. Hadfield, Sheffield. A modified process of manufacturing projectiles of great strength and penetrative power, by casting an alloy of iron, carbon, chromium, and nickel with aluminium or silicon, or both, in moulds of the desired shape and size, and hardening the cast projectiles. Accepted Feb. 25, 1899.

27,755 (Nov. 25, 1897). R. A. Hadfield, Sheffield. A process for manufacturing projectiles by forging an alloy composed of iron, carbon, chromium, and nickel with aluminium or silicon, or both, into projectiles of the desired shape and size. Accepted Feb. 25, 1899.

28,096 (Nov. 29, 1897). M. Gledhill, Manchester. A form of breech mechanism for ordnance which is designed to afford means for readily closing and opening the breech. Accepted Jan. 28, 1899.

30,931 (Dec. 31, 1897). A. Vickers, London, and L. Silverman, Crayford. Improvements in the breech mechanism of automatic guns, particularly those of the "Maxim" class, in which the breech mechanism is operated by the pressure of the gas escaping from the muzzle when the gun is discharged. Accepted Feb. 25, 1899.

3,303 (Oct. 28, 1898). Hotchkiss Ordnance Co., Ltd., London. A mounting for automatic machine guns, fitted with a collapsable bullet-proof shield which provides for the better protection of the operators. Accepted Feb. 4, 1899.

4,527* (Feb. 23, 1898). E. W. Bland, London. The Bland single-trigger gun.

5,285 (March 3, 1898). A. T. Dawson and G. T. Buckham, London. A breech-loading light field, mountain, or boat gun, designed to facilitate the separating and assembling of the several parts of the gun. Accepted Feb. 4, 1899.

5,286 (March 3, 1898). A. Luck, Dartford, and C. F. Cross, London. The treatment of nitrocellulose with a diluted solvent for the purpose of rendering it more or less structureless, and for freeing it from impurities. Accepted Feb. 25, 1899.

5,627 (March 8, 1898). L. B. Taylor and E. H. Parsons, Birmingham. A form of safety bolt adapted for use with the Lee-Metford and similar rifles, which is operated at the back of the action on the grip, and is automatically set in the locking position by the movement of the breech bolt in reloading the rifle. Accepted Feb. 4, 1899.

5,713 (March 8, 1898). A. T. Dawson and T. Thackeray, London. A means of charging turret or barbette guns, consisting of a special arrangement of the hoists, the object of which is to simplify and facilitate the operations involved in charging the guns. Accepted Feb. 11, 1899.

6,446 (March 16, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., and A. G. Hadcock, Newcastle-on-Tyne. An improvement in the sighting of ordnance whereby the sights can be aligned on the object, irrespective of the elevation of the gun, the gun being subsequently adjusted to the correct

elevation for the range of the object. Accepted Feb. 4, 1899.

6,756* (March 19, 1898). C. H. Curtis, D. J Metcalfe, and A. C. Pearcey, London. A safety gunpowder cartridge.

7,380 (March 26, 1898). A. T. Dawson and T. Thackeray, London. A duplex hoist for ammunition, having two tracks or tubes leading by a hinged flap at the top into an inclined mouthpiece which revolves with the turret. Accepted Feb. 25, 1899.

7,562 (March 29, 1898). H. R. von Dahmen, Germany. The use of acetic acid, tartaric acid, citric acid, or their salts and compounds, for producing safety explosives. Accepted Feb. 4, 1899.

8,364 (April 7, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., S. W. A. Noble, and C. H. Murray, Newcastle-on-Tyne. An improvement in mechanism for loading heavy guns, whereby the mechanical rammer and the hoist for bringing up the ammunition are so arranged that the gun can be charged at any angle of elevation. Accepted Feb. 18, 1899.

12,760 (June 7, 1898). E. A. G. Street, Paris. A means of substituting for ordinary oil a sulphurated oil, or a sulphurated mineral fat, or a sulphurated fatty acid, with or without the addition of ammonia, in cases where explosives are manufactured by means of nitro- or azo-derivatives dissolved in animal or vegetable oil with the addition of chlorate of potash. Accepted Feb 18, 1899.

12,761 (June 7, 1898). E. A. G. Street, Paris. A process of manufacturing explosives in which nitro-glycerine is dissolved in an animal or vegetable oil, dissolution being rendered possible by the use of nitro-napthalene or nitro-benzene, the solution thus prepared being finally mixed with pulverized chlorate of potash, or with an alkaline perchlorate. Accepted Feb. 18, 1899.

16,953 (Aug. 5, 1898). O. Imray. *(Agent for F. W. Slack, South Africa).* A method of manufacturing explosives by mixing together chlorate of potash, paraffin wax, and wood charcoal. Accepted Feb. 11, 1899.

21,296 (Oct. 10, 1898). J. P. Elliot, California, U.S.A. A device for discharging projectiles containing high explosives, in such a manner, that the initial impulse of the projectile will not be accompanied by such a shock as will tend to explode the bursting charge before the shell leaves the gun. Accepted Feb. 4, 1899.

24,544 (Nov. 21, 1898). J. F. Meigs and J. A. S. Hammar, U.S.A. An improved breech-loading gun, in which the breech mechanism is automatically opened and closed by power derived from the pressure of fluid taken from the recoil cylinder. Accepted Feb. 11, 1899.

26,529 (Dec. 15, 1898). F. A. Halsey, U.S.A. A smokeless powder for use in firearms, which consists of a compound made up of picrate of ammonia, bichromate of potash, and nitrate of barium. Accepted Feb. 11, 1899.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

THE BLAND SINGLE-TRIGGER GUN.

4,527 (Feb. 23, 1898). E. J. Bland, Birmingham. This patent is for a single-trigger gun mechanism. It is of the swinging arm type. The arrangement for preventing the accidental discharge of the second barrel due to the recoil of firing the first, is of the type usually described as consisting in the projection of a stop into the plane of motion of the swinging arm. Various contrivances for bringing this stop into action at the right moment, and for automatically withdrawing it after the involuntary pull has occurred, have been described

In the accompanying illustrations Fig. 1 shows an elevation of the trigger mechanism as mounted on the trigger plate of an ordinary double barrelled gun, and Fig. 2 shows a plan of the same parts in the same position. The essential feature of the mechanism described in the patent is the sliding piece *a* at the rear of the trigger plate. This piece is so mounted as to be capable of longitudinal movement within a small limit of distance. Its movement is controlled by pins sliding in small slots as will be seen in Fig. 2. Fig. 1 shows a spring *b* mounted on this slide, and a stop *c* mounted on the trigger plate, which together serve to maintain the sliding piece in either the foremost or the rearmost position. It is the relative movement of this slide, in conjunction with the working of the swinging arm, which controls the operation of the mechanism.

The specification professes to explain the action of the mechanism, and if, in our attempt to express the same thing in ordinary language, we inadvertently fall into error, we must be excused on account of the extreme difficulty of our task of translation.

The switching arm *d* mounted on the trigger blade *j* is normally held in the right-hand position by the small spring *e*. On pulling the trigger this arm is raised and releases the right-hand sear. During the raising of the swinging arm, its side projection *f* (Fig. 1) bears against the hook-shaped extension *g* of the sliding piece *a* and in its upward movement it drags the sliding piece forwards. On falling, the tumbler comes into contact with the rear end of the spring *m*, and its pressure puts the forward portion of this spring into tension. This spring *m* tends to throw the swinging arm over to the left, and being stronger than the small spring *e*, which acts in the opposite direction, it overcomes the latter. Therefore, after the right-hand tumbler has fallen, the tendency of the swinging arm to occupy the right-hand position is reversed, so that it tends to

Fig. 1.

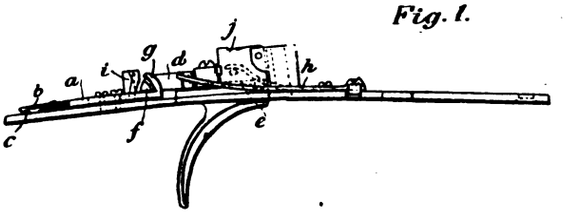
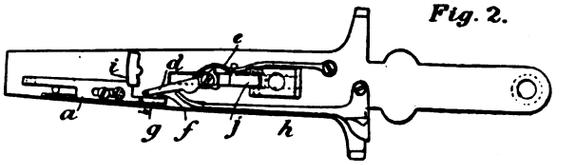


Fig. 2.



move over to the left. The arm accordingly responds to the pressure of the spring *m*, and moves to the left. But it is checked in its movement about mid-way in its course by the stop *i*. It should be remembered that this stop *i* was dragged forward into the path of the swinging arm by the first pulling of the trigger. Things are now arranged ready for the involuntary pull, and it will be noticed that the second or involuntary pull is essential to the subsequent release of the second sear. The second pull is utilized to remove the obstruction to the swinging arm caused by the stop *i*. In Fig. 1 it will be seen that the end face of the swinging arm is bevelled, and that the adjoining surface of the stop *g* is correspondingly bevelled. The involuntary pull, in raising the swinging arm, causes these two bevelled surfaces to come into engagement, with the result that the sliding piece *a* is bodily thrust backwards into the position it occupied before being dragged forward by the first raising of the swinging arm. This backward movement of the sliding piece *a* withdraws from the path of the swinging arm the stop *i* which had previously held the arm in the central position. This allows the swinging arm to pass over to the left, where it comes into engagement with the left sear, so that the second barrel will be fired when next the trigger is pulled.

When the breech of the gun is opened for the insertion of fresh cartridges, the tumblers are re-cocked in the ordinary way. The re-cocking of the right-hand tumbler takes the spring *h* out of tension. This gives free play to the small spring *e* on the opposite

side of the arm, with the result that the latter swings over to the right-hand position ready for firing the right barrel. Accepted Feb. 11, 1899.

A SAFETY GUNPOWDER BLASTING CARTRIDGE.

6,756 (March 19, 1898). C. H. Curtis, D. J. Metcalfe, and A. C. Pearcy, London. The arrangement described in this patent provides a means for extinguishing the flame or incandescent particles of a charge of gunpowder or blasting explosive not requiring detonation. It also serves to lower the temperature of the explosive charge when it is used for blasting purposes in such places as dangerous coal mines.

The cooling material may be used in a separate compartment in the cartridge from that which contains the explosive, thus making the cartridge available for easy transport, and also for immediate application when needed for use. If it be impracticable or undesirable to combine the explosive charge and the cooler in the same cartridge, the cooler may be used outside the explosive cartridge, either loosely packed in a separate cartridge or made up into the form of a pellet.

The material to be used for cooling purposes in this patent is bicarbonate of soda ($NaHCO_3$).

The patentees mention that they are aware of a previous proposition to use for this same object a material consisting of carbonate of soda combined with a certain amount of water of crystallization, the volatilization and cooling action of the water being relied upon to attain the end in view.

The material used in the present patent is the bicarbonate of soda, which consists of anhydrous carbonate of soda (Na_2CO_3) combined with carbonic acid (H_2CO_3). This material on being heated evolves carbonic acid, which immediately splits up into carbon dioxide and water vapour.

$$2\,(NaHCO_3) = Na_2CO_3 + H_2CO_3$$

Bicarbonate of Soda — Carbonate of Soda — Carbonic Acid

and this H_2CO_3 splits up into

$$CO_2 + H_2O$$

Carbon Dioxide — Water.

The evolution of carbon dioxide and water vapour, produced from the cooler by the heat of combustion of the explosive charge in the cartridge, aids in extinguishing the flame and sparks, and exerts a powerful and cooling action. This material possesses this cooling influence in a marked degree, owing to its readily evolving at a moderate temperature a large volume of carbon dioxide, which has a special power of extinguishing flame as compared with other gases, which are also non-supporters of combustion, and it is further aided in this respect by the water vapour.

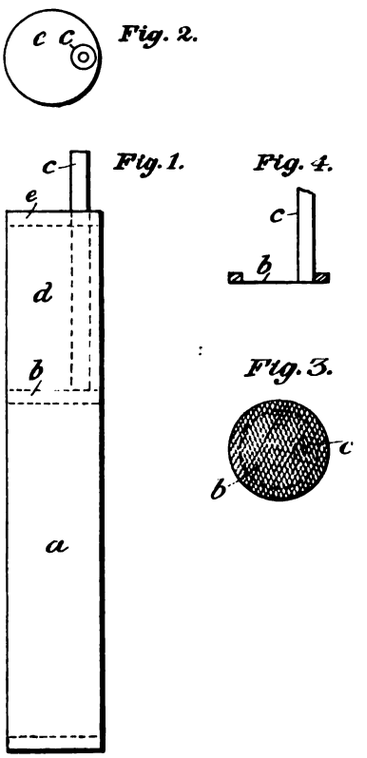
A further advantage of using bicarbonate of soda is that, although it splits up at a moderately elevated temperature, it is perfectly stable at ordinary temperatures, and is unchanged with long storage, and always reliable. This material is claimed to possess advantages over ordinary carbonate of soda when combined with water as water of crystallization, in other words, crystallized carbonate of soda or soda crystals. With the latter material no evolution of carbonic acid occurs on its being heated, while under storage the water of crystallization not only varies, but it is efflorescent, and, owing to this instability, the liberated water of crystallization would pass to the explosive and render it more or less useless.

This patent may also be used in connection with the cartridge which forms the subject of Patent No 232, 1898.

It is found that one part of the cooling material by weight to two parts by weight of the explosive is a good proportion, but either greater or lesser proportions may be used. The cooling agent, which may be used in various forms, is believed to be most efficient in a coarsely granulated form, leaving plenty of space between each grain, thus facilitating complete decomposition.

In the accompanying illustrations, which were published in connection with Patent No. 232 (1898), referred to above, Fig. 1 shows the cartridge, Fig. 2, the end piece through which the fuse passes, Fig. 3 the diaphragm or disc which separates the explosive from cooling agent, Fig. 4 a sectional view of the same, and Fig. 5 is a sectional view of the cartridge. A is the portion of the cartridge which contains the explosive. B is the disc or diaphragm constructed, as shown, in the form of a cardboard ring supporting a membrane of muslin, paper, or other suitable separating material. C is the channel or passage for the reception of the fuse. D is the receptacle for the cooling material charged with bicarbonate of soda in a coarsely granulated condition. E is the end piece placed placed on top of the cooling material to complete the cartridge, which may be made of paper or any other suitable material.

Following the same principle as that which we adopted in describing the former patent relating to a similar system of blasting, we give in full the claims which appear with the complete specification.



1. The employment in connection with gunpowder or other blasting charges of a like kind of a cooling agent for extinguishing flame and incandescent particles consisting of bicarbonate of soda applied in the manner hereinbefore described.

2. A blasting cartridge charged with gunpowder or other explosive charge of a like kind, and with a cooling agent for extinguishing flame and incandescent particles, such cooling agent consisting of bicarbonate of soda, preferably granulated and placed in a separate compartment within the cartridge, as hereinbefore described.

3. The employment in connection with gunpowder or other explosive blasting charge of a like kind of a cooling agent for extinguishing flame and incandescent particles, such cooling agent consisting of bicarbonate of soda compacted into a pellet, as hereinbefore described.

4. A blasting cartridge containing the materials hereinbefore mentioned, and arranged as hereinbefore described and shown by the accompanying drawing. Accepted Feb. 11, 1899.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Liquid Air Explosives.—We are hearing a good deal at the present moment in the public press regarding the value of liquid air as an oxygen carrier for explosives. The trials which have been made on the Continent are said to show that explosives made with hydro-carbon and liquid air are very powerful. Such explosives are likewise expected to prove particularly safe in fiery mines, in consequence of the low temperature of the gases evolved, due to the refrigerating effect of the liquid air. The difficulties which have been met with are, in the first instance, that of preserving the air and keeping the explosive. The tendency which the liquid air has to revert to its original condition makes it obvious that explosives of this kind have to be used almost immediately after their preparation; and as they cannot be made underground, it will be necessary at all times to take them down into the mine, where they will be subject to higher temperatures, which must influence their condition and make them less effective. The most serious drawback to these explosives is, wonderful to say, their extreme sensitiveness. They do not burn like other explosives when ignited in the open air, but the slightest spark causes instantaneous explosion. and they are likewise said to be very sensitive to shock. The technical difficulties in the way of the application of such explosives are such as to make their ultimate introduction very questionable; and, in addition to this, there are questions of cost which will have to be considered very carefully. As far as we have been able to learn, the probability of our seeing commercial explosives containing liquid air introduced and used in the immediate future is very remote. At any rate, it seems premature to form anything like a definite opinion regarding the practical value of this certainly very interesting new departure.

Price of Cartridges.—Since the time of our last issue the Gunmakers' Association have had under the most careful consideration the returns which were received from the members regarding the possibility of adopting minimum prices for best cartridges throughout the trade. Unfortunately, the Association have been forced to come to the conclusion that the conditions of competition in different parts of the country, and in London as well for that matter, are such that any hard and fast line of minimum prices cannot be fixed. Such minimum prices must, of course, be as near as possible to the actual selling prices, and the minimum prices suggested at the general meeting of the Gunmakers' Association fit in with this requirement in so far that they are the prices in force by the bulk of the trade, though some sell rather dearer for special loading, etc. But minimum prices are of no value for the protection of the trade if here and there gunmakers are forced to go below them, on account of price-cutting by some general dealer, who wishes to try an experiment in the direction of small profits and quick returns. For this reason, the Gunmakers' Association have been forced to the conclusion that nothing of any real advantage will follow from the fixing of theoretic minimums when there is no security for their general observance. One might have thought that there was nothing unreasonable in fixing as minimum prices the rates which were generally charged last year, since when the wholesale prices have been raised roughly by five per cent. for paper cases and thirteen

per cent. for ejectors. The law of competitive supply must work out to its practical conclusion. Let us hope that there will be some possibility of remedying one of the greatest of the present evils in the cartridge trade, which is one of the most potent causes of low prices. We refer to the many bogus co-operative societies and so forth who manage to supply sportsmen with ammunition at actually the best wholesale prices.

The Transvaal Dynamite Monopoly.—A very important statement was made in the House of Commons by the Colonial Secretary, when he admitted that a communication had been made by the English Government to the President of the South African Republic declaring the dynamite concession to be a breach of the convention, and that a reply on the subject had been received from President Kruger. He further stated that papers on the subject would be laid before Parliament. Without the papers it would be very difficult to know how far the dynamite monopoly has been treated as an infringement of the convention. Free entry for sea-borne merchandise is specified in the convention. On the other hand, there is a large explosives factory in the Transvaal, and a heavy import duty would still enable the local factory to sell dynamite at considerably higher prices than are charged in other countries. The whole question, therefore, turns upon whether or not the breach complained of is a technical one which can be set right without materially affecting the conditions of the trade, or whether the protest which has been lodged strikes at the very root of the monopoly. Matters between the South African Republic and the English Government wear a very threatening aspect at the present time, and it would be curious if the dynamite monopoly were selected as the particular issue upon which the rights of this country under the convention are to be argued, not to use a somewhat more drastic phrase.

Re-Arming the Irish Constabulary.—The answer to a question in the House of Commons, in reply to one of the members for Dublin, supplies us with interesting information that at last the Irish constabulary are to be armed with a carbine somewhat more modern than the Snider. It seems rather a farce that a body of men should up to now have been armed with a rifle about as useful for shooting as the property weapons of a provincial theatre. We are seriously told by Mr. Gerald Balfour that owing to the incrustrations of rust and other defects these arms are rendered a source of danger to the men. One would think that few things could be more demoralizing to a force of armed police as to realise that their weapons are only for parade purposes, and are better not fired unless the shooter is effectually screened. The possession of a rifle surely implies a certain amount of firing practice, but one would think that the members of the Irish constabulary would not be either very enthusiastic or very successful in target shooting. The proposal to supply the constabulary with Martini-Henry carbines seems to us rather a short-sighted piece of policy, since to do so casts a slur upon the force, and impresses upon them that the officials regard them as a second-rate force. The traditions of the Irish constabulary are surely worthy of greater recognition, for although the force is not a fighting one, there would be no harm and a great deal of good in encouraging proficiency in shooting. Ireland is proud of its constabulary, and the *esprit de corps* of the force would be increased if they were, for instance, in a position to send a crack team to Bisley each year, and to take part in the shooting organized by the Irish Rifle Association. The cost of Lee-Enfield carbines should surely not debar the authorities from supplying the force with a modern weapon shooting the service ammunition. Every efficient shooter in the three kingdoms is of definite value in our military organization, and although the Irish force only fire their arms in the quelling of riots, this should not debar them from being armed with a modern weapon. Lee-Enfield bullets are not the ideal thing for quelling a riot, though no doubt suitably-charged cartridges, like those worked out for shot range firing, would serve the required purpose. Perhaps the authorities would have liked to have adopted the American idea of Winchester buck-shot guns for the Irish constabulary. If this is so, probably the Martini-Henry carbine is as near as public opinion would allow them to go. In the meantime the various rifle factories in the country are in a semi-disorganized state owing to want of work.

The Late Mr. J. Abraham.—We regret to record the death on the 15th ult. of Mr. John Abraham, who was the original founder of the Birmingham Small Arms and Metal Co., Ltd., of which he was a director from its formation in 1873 until the time of his death. His first work in the ammunition trade was in the manufacture of percussion caps. From this he passed on to the manufacture of Snider cartridges. Subsequently the operations were carried on at the Adderley Park rolling mills, which have within the past two years been acquired by the Nobel Dynamite Trust Co., Ltd., and are now known as the Birmingham Metal and Munitions Co., Ltd. The head-quarters of the Birmingham Small Arms Co., Ltd., which are at Small Heath, Birmingham, have been the main source of the Company's large revenues during recent years. Mr. Abraham's experience in metal work of various kinds led him to take up the manufacture of military rifles, and the close touch which he has maintained with the Birmingham Small Arms Co., Ltd., since its incorporation has enabled him to reap the benefits of his enterprise. Mr. Abraham was in his eightieth year at the time of his death.

SALE OF CURTIS'S AND HARVEY SHARES.—A notice appears in our columns giving particulars of a special sale of ordinary shares of the Company of Messrs Curtis's & Harvey, Ltd. The ordinary shares of this Company, not having been offered to the public for subscription, and not, therefore, being subject to market quotations, cannot very well be sold on the ordinary system. It will be remembered that the total number of ordinary shares in this Company was 450,000, at £1 each, out of an authorized total of 600,000. These shares were issued in part payment of various gunpowder manufacturing firms for the businesses which were taken over. The remaining capital of the Company consists of £400,000 in 4½ per cent. debentures, which are now quoted at a premium. The block of shares now on sale consists of 10,000 £1 fully paid ordinary shares, which will be sold by auction by order of the executors of the late Mr. W. Shippery Hall. The shares will be divided into 200 lots, each consisting of 50 shares. The conditions of sale give the purchaser of any lot the option of taking the next following lots, not exceeding nine in number, at the same price. The sale will take place at the Auction Mart, Tokenhouse Yard, on Friday, the 26th inst., at two o'clock in the afternoon. The sale will be conducted by Messrs. G. A. Wilkinson & Son, of 7, Poultry, E.C.

DISPUTE IN THE POWDER TRADE.

A DISAGREEMENT has occurred in the powder trade, about which we shall probably hear a good deal for some time to come. On the one side we have Messrs. Kynoch, Ltd., and on the other the Schultze and E.C. Companies and Messrs. Curtis's & Harvey, Ltd. The dispute has arisen in connection with the new Kynoch smokeless powder. Messrs Kynoch have for many years past done a very large trade in ammunition of their manufacture loaded with the leading smokeless powders of the various powder companies. Last year Messrs. Kynoch placed upon the market a smokeless powder of their own manufacture, which, of course, has entered into competition with the previously existing powders. The other powder manufactures have taken the line that as ammunition manufacturers Messrs. Kynoch should not have entered into competition with a trade which has hitherto been treated as separate from that of the case maker. Of course they realise that the Kynoch Co., in selling cartridges loaded with their own powder, can sell at lower prices since they have an extra profit on the turnover of the complete case. Messrs. Kynoch have already adopted this principle, and their cartridges work out somewhat cheaper than similar cartridges of their make loaded with other powders. Further, there are rumours that it is intended to bring out a very cheap case loaded with Kynoch smokeless powder, which will compete even with black powder ammunition. The other powder manufacturers consider that the excellence of their products has in many ways been instrumental in enabling the Kynoch Co. to build up their present large trade in sporting ammunition, and they now fear that the natural result of the new development will be that Messrs. Kynoch will gradually modify their trade in ammunition loaded with the older powders, so that Kynoch powder will be more and more used, and in time Kynoch ammunition will, as a matter of course, contain Kynoch powder.

This is an eventuality against which the three powder manufacturers have decided to fight in its initial stages, and they have opened the proceedings by offering Messrs. Kynoch the choice of two alternatives. One is that they should drop, or at any rate modify, the conditions of selling their new powder, or else that they should cease to have anything to do with any but their own powder. The Kynoch Co. instantly determined to fight the matter out to the bitter end, and to enforce their right to sell their powder under just what conditions they please. The other manufacturers thereupon gave notice that they should cease all supplies of powder to Messrs. Kynoch, and would at the same time take suitable precautions to prevent delivery of indirect supplies. This is now the position in a nutshell. Messrs. Kynoch will issue manifestos to the trade inviting them to support the Company in its attempt to break down monopolies and rings. The powder manufacturers, on the other hand, will be equally ready for the fray, and they will take the line that, having constantly protected the gunmaker by giving him terms equally as favourable as to the very largest wholesale buyers, the gunmaker should support them by continuing to sell their powders to the exclusion of Kynoch sporting powder. This fight, it will be seen, is purely a commercial matter. Messrs. Kynoch, wishing to extend their business, enter into the powder trade, which, owing to their position in the ammunition trade, introduces competition of a very serious character. The powder firms appreciate the seriousness of the attack which is being made upon them, and have met together for the purpose of fighting their common competitor. A powder company is just as entitled to refuse to supply its goods in a particular direction as the other company is entitled to extend its trade by adding a new product to those already manufactured. Both, therefore, are acting upon their legal and moral rights. The issue is, of course, one of great importance. The enormous development of smokeless powders since their first introduction has been largely due to the somewhat large relative profits which it has been possible to make on a considerable turnover. This profit has only been partially spent upon dividends, and the balance has in consequence been largely used for improving the methods of manufacture and generally advancing the trade. Were the present prices to be reduced to anything approaching a cutting rate, it is quite possible that harm might follow, and we therefore trust that this, at least, will not be one of the outcomes of the present dispute. The actual dimensions of the conflict are probably not quite so great as one would at first suppose. If we place the purchases of Schultze powder by the Kynoch Co. roughly at 20 tons per annum, we may assume that this at the outside is the immediate extent of the present fight as regards the Schultze Company. Other companies would be affected in proportion to the amount of their powders loaded by Messrs Kynoch. As regards the trade of the latter company, we may assume that a number of gunmakers and dealers, who have been in the habit of buying Kynoch cartridges, ready loaded with Schultze powder, may do more of their loading while the present dispute lasts, and in this way Messrs. Kynoch would continue their cartridge trade and the Schultze Co. their powder trade. What proportion this would make of the 20 tons we cannot say, but certainly it would be considerable. Then we have the case of those dealers who would purchase the Schultze cartridges from one of the other ammunition manufacturers in the ready loaded form. This would be to the advantage of the Schultze Co. and to the detriment of Messrs. Kynoch. On the other hand, we must balance this last condition by the dealers in loaded cartridges who would transfer their orders for Kynoch cartridges from Schultze to Kynoch powder. Of course, there is a very much larger question of the remaining trade in powder. Naturally now that war is declared, Messrs. Kynoch will make a move to secure a share of this trade, while, on the other hand, the whole energy of the powder companies will be thrown into the work, not only of maintaining their trade, but of continuing the large increases which recent years have shown. The sportsman will be the deciding factor in this last phase of competition. Having accustomed himself to the use of a powder with which he is thoroughly familiar and well satisfied, he will not be likely to be in a hurry to adopt the new powder. In the same way the very cordial relations which exist between the powder trade and the gun trade will tend to keep the relative consumption of the different powders at much about their present proportion, though, of course, the Kynoch Company has also very many friends in the trade who will be placed in the somewhat awkward position of having to choose between the two. The consumption, which is mainly affected by price, will in this way be one of the

chief scenes of the competition. For our part we look upon the contest as so clearly marked out that we should regard it as quite futile to express regret that the difference should have occurred, or in any way to put forward councils of peace and to suggest the finding of a *modus vivendi*, when the two effected by the controversy have deliberately settled upon a trial of strength.

THE INGRAM FALLING-BLOCK RIFLE.

WE have received particulars of a falling-block rifle designed for use with ·303 service ammunition, which has recently been brought out by Mr. Charles Ingram, of 18B, Renfield Street, Glasgow.

The ordinary ·303 service and other magazine rifles of military type, even in their sporting forms, are in several respects unweildly weapons, this disadvantage being especially apparent when the magazine action is not required. For many classes of shooting a single shot weapon serves all necessary purposes, and its advantages in the way of increased lightness, and consequently better handling qualities, render it a superior weapon. For running deer competitions, for instance, such as those carried on at Bisley, the shooter, only requiring single shots, is at a great advantage if he has a weapon which comes readily up to the shoulder, and which has a smooth and sharp trigger action. What applies to running deer competitions applies in a similar way, though perhaps not to an equal extent, to target-shoting for which single-shot rifles would be eligible according to the rules. For practical hunting purposes there are also numerous conditions under which a light-handling single-shot rifle would be superior to the more umbersome magazine arm.

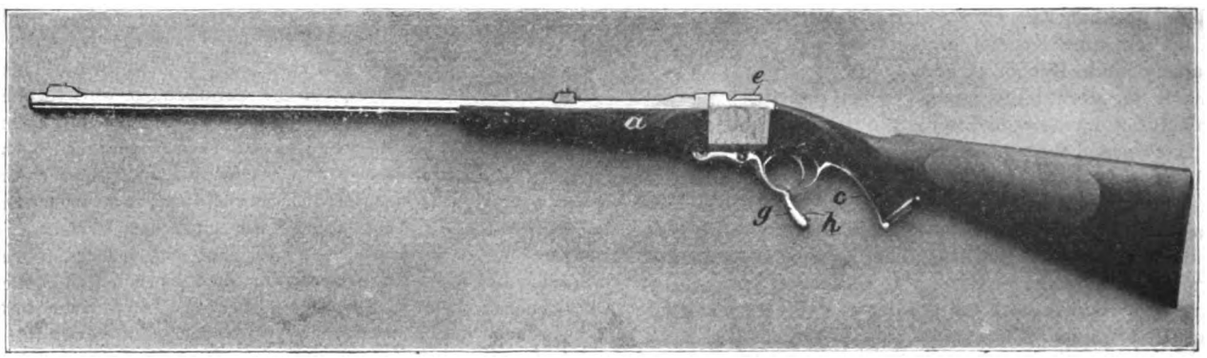


FIG. 1.—THE INGRAM ·303 FALLING-BLOCK RIFLE.

We have examined one of Mr. Ingram's rifles, and its balance is so perfect that it comes up to the shoulder with all the readiness of a shot gun. The rifle is extremely well-made, and we are assured that every part of it has been made in Mr. Ingram's own factory, even to the rifling of the barrel. Mr. J. Coster, works manager to Mr. Ingram, is responsible for the design of the weapon, including a patent system of rebounding hammer, which will be referred to in detail later on.

Our first illustration shows the entire rifle, while another shows the lock work, the whole of which is contained on the trigger-plate, detached from the stock and barrel. The lock parts are removed in a very simple manner, and the sportsman is thereby enabled to keep the mechanism thoroughly clean and in good working order. The detachment is effected by taking off the fore-end *a* in the ordinary manner. This exposes the lever *b*, which is turned sideways in the same manner as the top lever of a shot gun. Another lever *c*, which is situated beneath the pistol grip, is similarly turned to one side. The whole of the lock mechanism, as shown in our second illustration, may then be withdrawn.

The general working of the lock mechanism may be clearly understood from our second illustration, while that of the rebounding hammer is separately shown in the diagram Fig. 3. The hammer *d* is shown in the cocked position in Fig. 2, and in the condition after firing in Fig. 3, The falling-block *e* is operated by the pivoted links *f*, shown in Fig. 2. The up and down movement of the block is effected in the ordinary manner by the under lever *g*, which, in its closed position, is fastened to the trigger-guard by the small catch *h*. On opening the rifle the under lever is drawn downwards, the block carrying with it the hammer *d*, which is thereby cocked.

The extraction and ejection of the empty cases is effected by the extractor lever *i*. This extractor is operated in two ways. The descent of the block upon the short arm *j* of the extractor causes the latter to rotate slightly upon its pivot, so effecting the extraction of the cartridge. The extractor spring *k* presses upwards against the extractor immediately below its pivot. There is a small extension on the underside of the extractor, which is immediately below its pivot, so forming a dead centre. The end of the extractor spring is so arranged as to press on one side or the other of this extension. When the block descends the extractor is slightly turned, so that the end of the spring acts on the extractor beyond the dead centre, and gives it a sudden flip, which ejects the empty case. In this way, however slowly the lever may be worked, the extractor ejects the cartridge by the impulse of the spring *k*. In case a cartridge should stick, or under any similar conditions whereby the spring ejector might fail to work, the descent of the block upon the arm *j* of the extractor lever *i* would give the latter sufficient impulse to eject the spent cartridge. In this way it will be seen that the removal of the empty cases is provided for in a thoroughly reliable manner.

In order to avoid all liability of jamming, or otherwise giving trouble, the hammer has been made separate from the striker *n*, as shown in Fig. 3. The rebounding principle, upon which the hammer has been constructed, leaves the striker perfectly free after discharge. In this way the subsequent descent of the falling block is unlikely to be hampered by the firing pin sticking in the cap. The system of rebounding hammer used in this rifle was described in the patent columns of our issue of August last year, and we have reproduced the illustration then used, viz., Fig. 3. From this it will be seen that the top arm of the hammer spring has two projections *l* and *m*, which bear upon corresponding recesses on either side of the hammer pivot. When the hammer is in the cocked position the end *l* of the spring presses against the hammer and tends to throw it upwards. When the sear is released the hammer flies upwards, and its impetus causes it to hit the striker, in spite of the fact that, at the last part of its movement, the end *l* has ceased to press against the hammer, the end *m* having taken its bearing upon the opposite side of the hammer pivot, tends to retard the movement of the hammer. As before mentioned, the impetus the hammer had attained in the first part of its stroke enables it easily to overcome this resistance. When, however, the hammer has hit the striker, and has in consequence lost its momentum, the end *m* of the mainspring then causes the face of the hammer to rebound, thus allowing the point of the striker to be withdrawn flush with the face of the block.

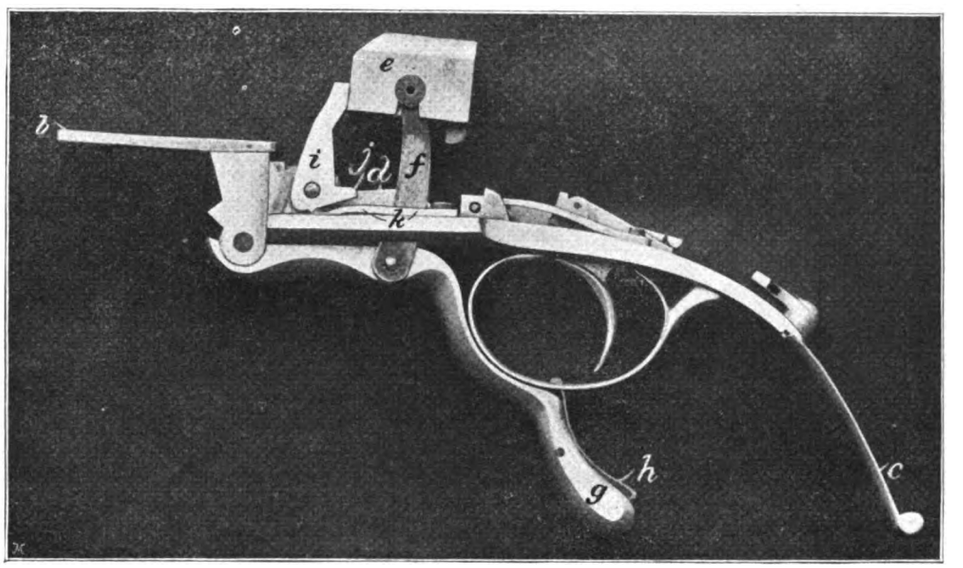


FIG. 2.—MECHANISM OF THE INGRAM RIFLE.

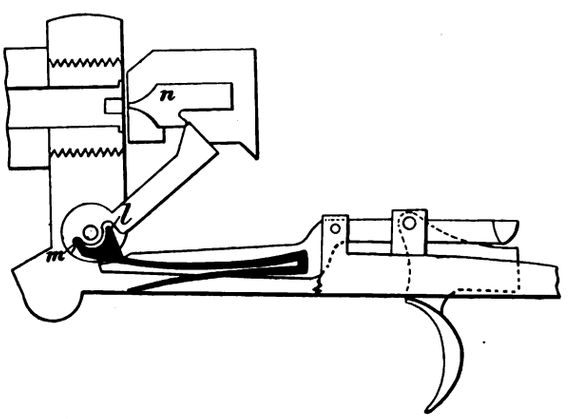
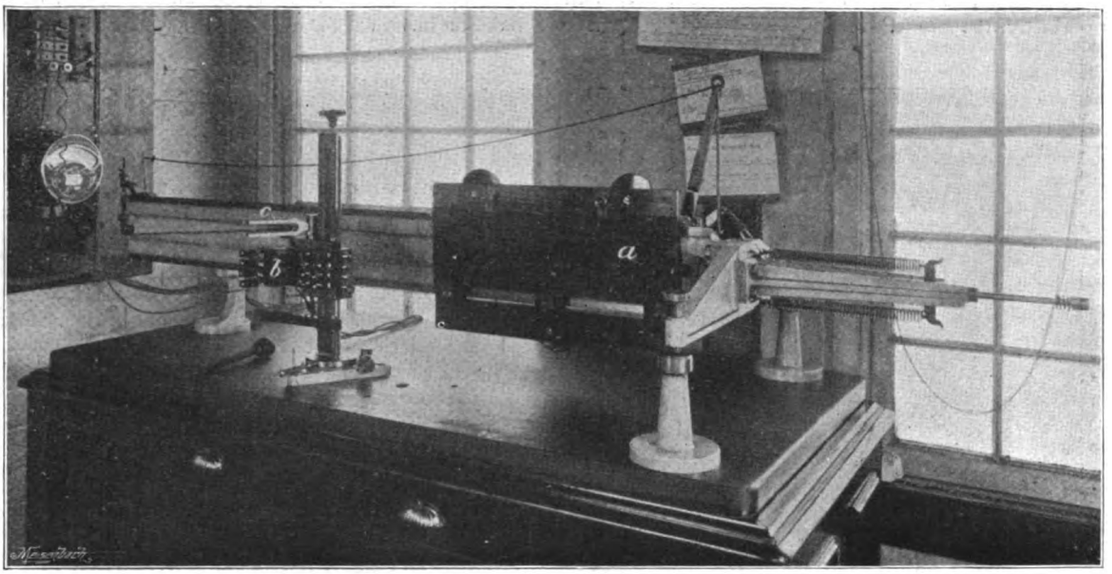


FIG. 3.—DIAGRAM SHOWING REBOUNDING HAMMER MECHANISM.

Many gunmakers are viewing with increased alarm the wholesale adoption of foreign weapons in preference to those which have hitherto been exclusively manufactured in this country. We are pleased that Mr. Charles Ingram is in a position to offer his clients a small-bore rifle of home manufacture—home manufacture in his case meaning Scotch manufacture.

EXPLOSIVES MONOPOLY IN SPAIN.—According to the *Manchester Guardian* representations have been received by the Manchester Chamber of Commerce as to the prejudicial effect upon the iron and steel industry of the United Kingdom of the monopoly of the sale of explosives in Spain, granted by the Spanish Government to a private syndicate. The President reported that a letter had been addressed by authority of the Correspondence Committee to the Secretary of State for Foreign Affairs, in which it was stated that, while the Chamber was not unmindful of the straitened condition of the Spanish national finances, nor of the jealousy with which all Governments preserve their right to manage their own fiscal affairs free from interference from other States, the Chamber nevertheless desired Lord Salisbury to consider the propriety of impressing upon the Spanish Government the injury inflicted upon the Spanish iron ore industry by the present unsatisfactory mode of raising revenue from it, and the desirableness of substituting therefor a direct tax, either upon the mineral extracted, or upon the explosives employed. A reply was laid before the Board to the effect that the question of the monopolies established by the Spanish Government had been already carefully considered by Her Majesty's Government, with special reference to the monopoly in explosives, and that it had been decided that there are no proper grounds at present for any official action.

THE SMITH CHRONOGRAPH.



PROF. JERVIS-SMITH'S CHRONOGRAPH AS INSTALLED AT THE ARDEER FACTORY.

IN the account we gave in our July, 1896, issue, of the address Mr. Griffith delivered when the gun trade visited the Schultze Works, we included a description of Professor Jervis-Smith's chronograph which had been used there for some years for velocity testing and other measurements of small periods of time. The general attention which this lecture drew to the tuning-fork system of chronograph, has led to other manufacturers interesting themselves in the apparatus. The special advantage which this chronograph has, as compared with other forms of apparatus for similar purposes, lies in its capacity to take several simultaneous measurements. In the ordinary system of falling weight chronograph only a single time measurement can be made, whereas with Professor Smith's chronograph any number of observations can be taken, though four is usually found to serve all ordinary requirements.

Some time ago the Schultze Company had an improved chronograph on the same principle made by Messrs. Elliot Bros., of St. Martin's Lane; and we give an illustration of one of these new instruments, as fitted up at the works of Nobel's Explosives Co., Ltd. The improvements in the new instrument are not so much in principle as in mechanical details, the apparatus being still made under the patent of Professor Jervis-Smith, of Oxford. It is, therefore, unnecessary for us to go into any long detailed description of the chronograph.

Generally speaking, it consists of a frame standing upon three legs, the whole suitably adjusted to allow for variations in temperature. The main portion of the apparatus consists of a pair of rails upon which a sort of tramway runs. The tramway is caused to travel from one end to the other of the rails by means of a spring. The tramway carries a smoked glass plate *a*, and the tuning fork *c* describes upon the smoked surface during the passage of the tram a series of waves representing periods of time corresponding to the ascertained number of vibrations of the tuning fork per second. Four small indicators *b* are arranged below the tuning fork. These have needle points which scribe a line along the plate of glass. The needles are held by small magnets, which are operated electrically.

When making a series of measurements, electric currents are connected up so as to be interrupted, say, by the passage of a projectile; when a circuit is broken, the corresponding scribing needle is no longer supported by its electric magnet, and it is jerked from its previous position by springs. One needle may, for instance, be connected up with a wire passing across the muzzle of a gun, and another needle may be arranged five yards in front of the gun. The fracture of the first wire causes a deflection of the line drawn by the corresponding needle on the smoked plate, and the fracture of the second wire causes a subsequent deflection of another line on the smoked plate. The number of waves described on the plate in the interval elapsing between the movement of the two needles are counted, and the velocity of the shot is worked out from the time interval so obtained.

While equally convenient for simple measurements of velocity or time, this instrument is especially useful in the more complicated measurements involved in observing the accelerations in the velocity of a projectile or charge of shot during its travel along the length of a gun or rifle barrel. With four points of measurement much more accurate results are obtainable than where the velocity in each section of the barrel's length is separately obtained by a single pair of indications.

In ordinary velocity testing three or four measurements would, in many cases, be extremely useful. From the sports-

man's point of view, for instance, the velocity of his powder is represented by the time occupied from the pulling of the trigger to the arrival of the charge of shot at a given distance beyond the muzzle. Yet velocities, as ordinarily published, deal only with the flight of the projectile beyond the muzzle, and no account is taken of the relative time taken by one powder as compared with another in reaching the muzzle. With the Smith chronograph a simple little attachment could be arranged to record the interval between the pulling of the trigger and the arrival of the shot at the muzzle, in addition to the ordinary test of mean velocities beyond the muzzle. Any tendency which a powder or the method of its loading has to "hang fire" could easily be observed and measured. In taking mean velocities on this system, the values could be given so as to allow for the time occupied between the pulling of the trigger and the arrival at the muzzle; for, as before mentioned, it is the combination of these two measurements which vitally affects the sportsman, and also to an equally important extent the powder and ammunition manufacturers.

INCIDENTAL JOTTINGS.

War Office Contracts.—The greater part of the annual contracts for the supply of war material for the Army and Navy are now tendered for by various competing firms, and many are anxiously awaiting the results, whilst the War Office considers their offers, but, as a rule, there is not much trouble in selection since the lowest price is generally automatically accepted for the bulk—and why not? The goods have to pass certain tests, and come up to a standard stipulated by the specification, and the inspecting officers are deputed to see that the conditions are rigidly complied with at the cost of—not the contractor—but the War Office. This seems to be reasonable enough, for no firm could afford to contract for an indefinite cost of inspection, which may include proof with other appliances and components over which he has no control; and one would reasonably expect every firm to send only the best material they can manufacture, and pass no other from their works. But, when inspection is free, and the quantity great, we should think there is a temptation to take advantage of this arrangement, as the carriage of goods is cheaper than a thorough inspection at the company's works, thus allowing the material to be produced at a cheaper rate. To remedy this we should certainly commend to the officials the advisability of keeping the cost of proof and inspection of every contract separate from the others. It would then soon be discovered that material 10 per cent. lower in price and costing considerably more in inspection is hardly the cheapest article to purchase, and the system puts a premium on bad work. To lump together the cost of inspecting good and bad supplies of material is obviously unfair.

Machine Guns and the U.S.A.—So the American authorities are thinking of giving up the use of Colt and Maxim machine guns because they cannot be relied upon in emergencies. Certainly in Samoa they seemed to have proved their case—but why blame the guns? Our Maxim guns do not jam for the reason that we use proper cartridges. We have never yet seen an American small bore cartridge constructed to stand the strain of a machine gun. Let them turn their cartridges into pencil cases or other equally useful products, and start again to make a cartridge case capable of resisting the special strain of firing and extracting which is indispensable to the use of machine guns. There are several firms in England who would supply cartridges to comply with these conditions whom the United States have probably never tried. We do not say the rumoured action of the United States is unique in its way. Many of our English sportsmen are just as bad. They buy an expensive ·303 rifle with the latest improvements in sighting, as perfect weapons as a gunmaker's skill can produce. Then they buy cartridges which are probably rejected by government, or cartridges too bad to send the government, which flood the market, and which cannot be relied on to a couple or three feet on a target at 500 yards (if the bullets do not strip before they arrive). They at once blame the gun and buy a foreign small bore, obtaining their cartridges from the maker or some other reliable source. Possibly one day the Gunmaker's Association will acquire a range and instruments to test cartridges which they can confidently recommend as suitable for use in the guns upon which so much wasted time and labour is spent.

Waltham Abbey Grievances.—The Waltham Abbey Cordite factory workpeople want a special Parliamentary Commission to enquire into the despotism of the officials in maintaining law and order, and have fled to their trades unions to protect them. Perhaps they don't like paying rates for that trim little cemetery adjacent to the works when they don't use it. Some people never know when they are best off. In spite of all the care, a black powder incorporating mill "went up" last week, but fortunately no one was injured. It might, however, serve to remind the dissatisfied ones and the trades unions that it is a dangerous thing to meddle in the management of a high explosive factory.

Royal Ordnance Factories' Workpeople.—Anyone familiar with the Ordnance factories as employers of labour would hardly have much sympathy with any complaints from their workpeople. Surely in all this world no man ever expects to get an easier job or more considerate masters. But somehow we feel that the gun factory men are deserving of pity on this occasion, as it is hardly their fault that the work of their department is leaving the arsenal for the home of its birth. We refer to the new six inch guns. Messrs. Vickers certainly deserve to get the contracts for these guns, or to reap some advantage for their inventions. Woolwich must try to think of some better scheme for itself, or take care not to let officers who have inventive genius leave the department. The War Office does not encourage inventors much in the ordinary way, and still less among their own employees, and many a good thing goes begging which might be acquired for a few pounds, or in terms of royalty, which is certainly a means of payment by result. Invention is a disease which comes, during a lifetime, to every one, and requires a careful diagnosis; perhaps this will come into the field of the new "Chief Mechanical Engineer," who, we understand, is a most eminent innovator. Whilst on this subject, surely, when the authorities were casting round for a post for the late D. A. D. G. O. F., they missed sight of an office tucked away in the corner of the arsenal, which, in a quiet way, is gradually absorbing all the functions of mechanical and civil engineering, architecture, electrical engineering, and everything else

which comes within its octopus grasp. Surely it is time this "Works Department" was set in order. What engines, boilers, dynamos, clocks, electric power transmission, etc., have to do with "Building Works" we cannot see, especially when each department is so capable of knowing its own individual wants. By all means let the "Works Department" stick to bricks and mortar, and let the Chief Superintendent cater for the engineering wants of his own workshops.

CYCLOPS.

CARTRIDGES AND CHAMBER GAUGES.

It will probably interest our readers to hear that we have taken an opportunity of inviting expressions of opinion from various leading gun and cartridge manufacturers throughout the world regarding the proposed gun chamber and cartridge gauges which were described in an article in our last issue. We have already received some very interesting particulars of the gauges used by various manufacturers, and we trust that our returns will be sufficiently complete by the time our next issue goes to press for us to give some interesting comparisons between the proposed gauges, as described in in our last issue, and those at present in use by foreign manufacturers.

In order to show the importance of carefully considering the gauges used by foreign manufacturers, we may quote one single instance among several which have already come before us. The Winchester Repeating Arms Company make their chambers for 12-bore guns ·809 of an inch in diameter, while the maximum size allowed for English cartridges in these gauges, as set forth in our last number, was ·811 of an inch. Other differences are in much the same proportion, so that it will be seen that the English cartridge made according to the proposed new standard would not enter the chamber of a Winchester gun. On the other hand Winchester cartridges would be a very loose fit in guns bored according to the new standard. The largest gun chamber allowable in the new standards has a diameter under the rim of ·813 of an inch, while the Winchester cartridge is ·8045 of an inch at the same place, this showing a difference between chamber and cartridge of ·0085 of an inch, which is evidently a very much looser fit than expert authorities would care to sanction.

We do not say that discrepancies such as this do not already exist as between gun chamber and cartridge of different origin, but what we do say is that in selecting a series of gauges to govern both the chambers and cartridges it is highly desirable that the new standards should, as far as possible, lie midway between extremes, in the hope that various foreign manufacturers will see their way to make the slight alterations which are necessary, so that 12-bore guns throughout the world shall be, in fact as well as in name, of the same size in that essential place, the chamber. In the same way it is to be hoped that 12-bore cartridges, the sizes of which have less excuse for variation than gun chambers, should also conform to a uniform standard. Neither ammunition manufacturers nor gunmakers can do justice to their work so long as the present wide variations exist, and whatever may be the trouble of arriving at a settlement it is to be hoped that something satisfactory may be done. Of course, as in all cases of altering gauges, the difficulty will lie with the weapons already on the market; so that, while one set of manufacturers may be able to conform to the new standards without rendering existing weapons obsolete, there may be others who will find great difficulty in harmonizing new standard sizes of cartridges with existing guns. It is useless to go further into the matter at the present moment, though, as before mentioned, we hope in our next issue to be able to show how variations occur in comparing the standards of one manufacturer with those of the others.

NOTES.

WINCHESTER ·303 RIFLE.—We understand that the Winchester Repeating Arms Co. have issued a new form of their Model—1895 rifle, the difference consisting in its having been bored and chambered to suit the ·303 English service cartridge. In all other respects the features of the Model—1895 rifle have been preserved. It is an under-lever rifle, having a vertical magazine, which carries five cartridges. The original model was made to take the American ·300 U.S. army ammunition. The mechanism consists of an under-lever, working in combination with a sliding bolt, as distinguished from the ordinary turn-bolt breech mechanism of the military type of arm. The rifle is listed at £5, this amount being subject to trade discount.

AMERICAN E. C. & SCHULTZE GUNPOWDER CO., LTD.—We have received a copy of the balance sheet and report of this Company. The profit and loss account for last year shows a gross profit of £14,284, and after the deduction of administration and other expenses of the American and English offices, other than the actual manufacturing expenses, there is an available balance of £4,820, which it has been decided to carry forward, rather than declare a dividend. The amount of undistributed profits now shown on the balance sheet is £7,914, and this, added to £5,827 for creditors, makes with the issued capital of £75,000, a total of £88,741. On the opposite side of the balance sheet this total is mainly accounted for by £57,261 for purchase of property account, £806 for debtors, £5,614 in cash, and £24,159 for stocks in hand, other small items making up the requisite total. The directors express the opinion that, in spite of severe competition and loss of trade on account of the American War, the Company is in a sound and prosperous condition, and that there is every reason to anticipate an expansion of sales and an increase of profit in the near future.

WOLVERHAMPTON GUNWORKERS' UNION.—The Wolverhampton branch of the National Gunworkers' Union held a dinner in Wolverhampton last month, and in the course of the proceedings it was stated that there were many adverse trade conditions which it was hoped the Union would be instrumental in having remedied. In reply to the toast of "Prosperity to the Gunworkers' Union," Mr. Wakeham, the President of the Society, stated that they were making substantial progress, both numerically and financially. He stated that the officers were thorough believers in conciliation for the settlement of disputes with employers, and up to now they had been very successful in avoiding strikes. Possibly we may be allowed to congratulate the Gunworkers' Union

upon the moderation which it has no doubt observed. It is perhaps somewhat of a pity that trade unionism has gone so far that the Union chiefs treat the absence of strikes as a thing sufficiently remarkable to be worthy of special notice at a celebration of this kind. Manufacturers are not so busy as they were some time ago, and gunworkers do not find quite such an attractive prospect in the cycle trade as they did while the boom was on. It would be a pity if the prosperity of the Birmingham gun trade were attacked at some future period by the Gunworkers' Union in order to ameliorate trade conditions. Possibly, however, we may rely upon the moderation of the Union chiefs and the present unfavourable conditions for a strike for peace in the immediate future.

THE EXPLOSIVE KAMMERUNG.—We have received particulars of the new explosive Kammerung, which have been reproduced from an article contributed by Professor Birk to an Austrian technical paper. The explosive is one which appears to have given great satisfaction in Austria, the Austrian Government having to a large extent interested itself in its production. The explosive is described in the English Patent No. 25,568 (1898), Count Gustav Geldern-Egmont, the chief of the Austrian Technical Committee, being the patentee. The patent was published last February, and it describes an explosive consisting of nitrate of ammonia combined with naturally carbonised cellulose, such as wood-meal, decayed leaves, broken flax, etc. These ingredients may be supplemented by various oxygen-carrying ingredients. One is naturally careful over adopting the favourable views entertained with regard to an explosive by those responsible for its production; but, on the other hand, we have the fact that the Austrian authorities attach great importance to this explosive, and in other ways competent experts have expressed favourable views with regard to it. The Austrian Government is not, however, an absolutely trustworthy guide in such matters, if we take as an example the manner in which it spoke of M. C. III. powder; for we know that it now admits that its safety is only one-fifth of that of the new powder. On the other hand, practical users of the new blasting explosive speak very highly of its efficiency and of its general safety under practical conditions of use.

NATIONAL EXPLOSIVES CO., LTD.—At the annual General Meeting of this Company, Mr. Athol Thorn, who presided, stated, in referring to the reserve fund, that the directors considered it highly desirable to add substantially to it in any year when the profits will reasonably admit of such a course being adopted. This course should be continued until the reserve fund has accumulated to such an amount as would be quite sufficient for all exigencies. In establishing the nucleus of a substantial reserve, it is not the policy of the Board to contemplate using this fund in any way at any time for the equalisation of dividends. The idea is that it should be strictly kept under all circumstances for strengthening the business of the company, and that the dividends of each year should only be paid out of the profits of that year. By the adoption of this policy it is hoped not only greatly to increase the company's power and stability, but also to avoid any possible disagreement between the various classes of shareholders which might arise in the event of the reserve fund ever being utilised for the equalisation of dividends. The Board hoped the shareholders would fully understand and agree with this proposition, so that in the future no doubt can ever arise as to what was the original intention. In reference to the item in the accounts for a payment on account of a new steamer, he explained that it became necessary to order a new steamer, as the old one was quite incapable of dealing with their increased trade, and the company had frequently to charter vessels at considerable cost for bringing their goods round to the Thames. He regretted to say, however, that the builders of the new vessel are very behindhand with their work. They are informed that this is the case with all branches of iron business throughout the country. Considerable additions are being made to the factory with the view of an increased output and lowered cost of production. He stated that he could think of little further to add to his remarks, as the period under review has been one of uneventful but steady progress, except to say that the thanks of the company continue to be due to Mr. Perks and to the staff for their unremitting zeal in carrying on the company's operations.

THE ELEY CATALOGUE.—In the present season's issue of the catalogue of Messrs. Eley Bros., Ltd., the final prices for cartridges are now given in accordance with the previously issued notices of an advance in prices due to the state of the metal market. The catalogue will be carefully studied by gunmakers in framing their prices for this year. Whatever may be done in the way of facing the loss in paper cases due to the raising of prices, it seems almost certain that 12-bore ejectors at 14s. per 100 gross will have to be advanced as compared with last year's prices. We notice that a page is devoted to the Repautrap and to "Eley's Targets," but prices are only to be obtained on application.

MESSRS. F. JOYCE & CO., LTD.—We understand that at the recent annual meeting of this Company Sir John Maxwell, Bart., Chairman, and Col. Ricardo, both resigned their seats on the Board.

EXPLOSIVES SIGNAL FOR SHIPS.—A red flag with a yellow crown has been adopted by the Government as a signal to be carried by vessels having explosives on board. How far the use of this flag will be extended to vessels carrying explosives in small quantities is not yet clear. As an optional signal there may no doubt be cases where its use would be an advantage, but the nervousness which exists with regard to explosives, in spite of the small proportional number of accidents which occur in their transport, would likely to be increased by such a regulation, were it to be enforced in all cases. The result would be explosives firms would find still more difficulty than ever in securing transport, even for the most innocuous of explosives.

COLT AUTOMATIC RIFLE.—In our issue of February, 1896, we gave a short description of the Colt automatic gun, at the time when its adoption by the United States navy brought it into special prominence. A number of these guns have since been purchased by the United States Ordnance

Department, and they appear to have done excellent service in the recent campaign. Arrangements have for some time been under consideration for the formation of a small syndicate or company to work the gun in this country, and we believe that at the present time there is a likelihood of something definite being arranged. In the meantime one of the Colt guns is in this country, and it can be inspected at the premises of Messrs. John Rigby & Co., 72, St. James's Street, S.W. The gun is operated by means of gas, which is liberated from a port-hole in the barrel, the gas passing into a piston, with which is connected the various oscillating parts which affect the automatic operations for reloading the gun. The parts are simple in construction and few in number. There is no water jacket for keeping the barrel cool, but as the barrel contains a large weight of metal, it would be some time before sufficient heat would be accumulated to give trouble. Among the special features of the rifle is an air-blast arrangement, which sends a puff of air into the chamber of the gun for the purpose of clearing away any grains of powder or other foreign bodies that might clog the mechanism. The special points in the gun, which it is thought will materially recommend it for military and naval use, are, first, that the system of automatic working by means of a gas piston enables the gun to be used with service ammunition of the smallest bore, so obviating the difficulties due in recoil-operated guns to the very small amount of power which is available; and, secondly, that the gun can be supplied at far cheaper prices than the Maxim gun, which is of course the standard weapon of its class. The cartridges are fed into the gun by means of a woven belt, which is very neatly formed. It consists of two bands of canvas-like material, which are interwoven at intervals during manufacture, so that the pockets are made of the correct shape to grip the cartridge with the required firmness. We hope in an early issue to be able to give more detailed particulars on the subject, though in the meantime we understand that Messrs. John Rigby & Co. will be happy to show the gun to those interested.

A NEW MEXICAN RIFLE.—The Mexican Government has recently placed an order for 32,000 rifles with the Remington Arms Company of New York. The new Remington rifle is a single loader, and only differs from the old Remington military pattern weapon, with which several countries have been supplied, in the bore, and in various minor details which aim at giving the new rifle greater durability. It is sighted up to 2,300 yards, and weighs 8½ lbs. without the bayonet, the barrel being 30 ins. in length. Several different models of this rifle are made by the company to take the different kinds of ammunition used in various modern magazine rifles. The action of the rifle has been specially strengthened to stand the high pressure of smokeless powder, as compared with that of the black powder for which the rifle was originally designed. The bore adopted is 7 mm. (·276 in.), so that the cartridges of the Mauser rifles of this calibre will fit the new rifle. The Mauser cartridges, as used in the model 1895 Mauser rifle, adopted by the Mexican Government, are loaded with 37 grains of smokeless powder, and a jacketted bullet of 175 grains, which has a muzzle velocity of 2,230 foot-seconds. The reasons given for the adoption of a non-magazine rifle are that the recent Spanish-American war is alleged to have proved that magazine rifles are liable to get out of order, and that they are too complicated for military purposes.

AIR-IMPACT INDICATOR FOR TESTING VELOCITIES.

Particulars have been sent to us of a new form of apparatus for use in the testing of velocities by means of the chronograph. The apparatus is intended to take the place of the wire screens which serve to register on the chronograph the interval of time occupied by the bullet in passing over a measured distance.

In the ordinary way, the arrival of the bullet at a given point in its track is registered electrically by the bullet fracturing one or more of the series of wires arranged on a screen through which the bullet is directed. As in the case of nearly every kind of apparatus, the wire screen, while serving the purpose for which it is intended, has defects or disadvantages which one would like to see remedied. The chief of these defects is that the fractured strands in the wire screen require to be rejointed or replaced after every shot. These rejoinings require to be skilfully performed in order not to cause a variation in the electrical resistance in the chronograph circuit, of which the wire screen forms a part. Further, time is lost in this work of re-establishing the circuit, and what all who engage in this class of testing would like to see, is an automatic wire screen which would rejoint itself up immediately after the fracture had communicated its reading to the chronograph. This, of course, would be out of the range of mechanical invention in cases where the indication is obtained by the breaking of a wire.

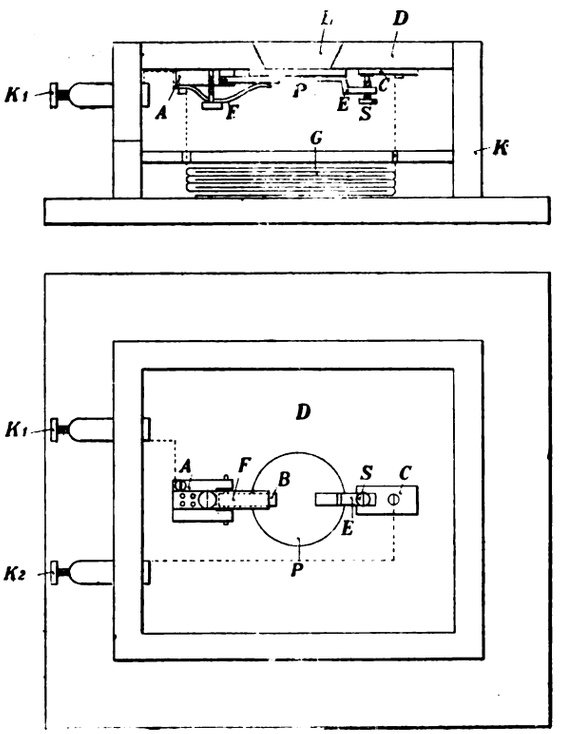
The new indicator works on a system which enables it to re-establish the electrical circuit immediately after the interruption has been caused by the passage of the bullet. It is not the bullet itself, but the wave set up by the flight of the bullet through the air which operates the indicator. This wave, as is well known, has sufficient force to operate suitable mechanism within reasonable distance from the line of flight of the bullet.

Obviously this indicator could only be used in the case of projectiles, the velocity of which is greater than that of sound; because the "front-wave" of compressed air flies forward in advance of a projectile when the latter is travelling at a slower speed than that at which wave impulses pass through the air. The only records which would be obtained if the indicator were used with projectiles travelling at such slow speeds would be the velocity of sound, the velocity of sound being the speed at which such air waves are propagated. Taking the velocity of sound as 1,115 feet per second, it follows that this apparatus would only be of use in the case of projectiles having a mean velocity well above this limit. In the case of high velocities, there would be no chance of the sound-wave overtaking the projectile, and affecting the indicator before the projectile had actually arrived.

The indicators are placed at about one yard to one side of the track of the bullet, and they are fixed at distances corresponding with the points at which measurements are to be taken. It is reckoned that the time occupied by the wave in travelling from the bullet to the first indicator, is balanced by the corresponding delay in the case of the second indicator. In order that these errors shall neutralise one another, it is necessary that the indicators should be accurately placed at an equal lateral distance from the line of flight of the bullet.

To insure this correct adjustment, not only must the indicators be correctly aligned, but special precautions must be taken to cause the bullet to adopt the same line of flight in every case. The obvious way of correcting errors which may occur from incorrect alignment of the rifle, is to have a second pair of indicators connected with a separate chronograph. Any difference in the two sets of readings may be averaged arithmetically, or, if extreme accuracy is desired, by means of a trigonometrical equation based on the measured angular divergence from the theoretical line of flight.

We reproduce two drawings showing respectively a sectional elevation and a plan of the indicator. It is mounted on an ordinary base, upon which is fitted the box K, which has a



PROF. WOLFF'S AIR-IMPACT INDICATOR.

lid D. This lid is provided with a round opening L, which is closed by the plate or diaphragm P. This diaphragm is pivoted to the block A, and is pressed by means of the spring F against the opening in the lid of the box. On the free end of the plate P is fixed the crank-shaped piece of metal E, which carries the screw S. This screw is provided with a platinum point for making electrical contact with a corresponding platinum surface on the metal block C, the latter being separately mounted on the lid of the box. The two electrical terminals K_1 and K_2, are connected with the wires to the chronograph, similarly to the terminals on an ordinary wire screen. The terminal K_1 is connected to the block A, and the current passes from there through the diaphragm P, and finally arrives at the end of the screw S. The other terminal K_2 is connected with the block C.

It will now be understood that the making and breaking of the circuit takes place between the point of the screw S and the platinum surface on the block C. The screw S is adjusted so as to make contact with the block C when the diaphragm P is pressed closely against the lid of the box by the spring F. When the air wave strikes the diaphragm P, it forces it against the resistance of the spring F, away from the lid of the box. The circuit is broken between the screw S and the block C, or in other words, between the terminals K_1 and K_2. The electrical contact between the two terminals is re-established immediately the air wave has ceased its compression against the diaphragm P, the spring F being then free to carry the contact surfaces back into engagement. The use of the condenser G is not absolutely essential, but it serves to diminish sparking at the point of interruption, with the result that more exact measurements are obtained.

In considering the applicability of this instrument to ordinary velocity testing at ammunition works and other places, where such trials are habitually carried on, there are a number of points to be reviewed. In the first place, the indicators must be used in pairs, otherwise there is no means of neutralising the error due to the time occupied by the air wave in travelling from the projectile to the indicator.

We are informed that one indicator in advance of the gun may be used in combination with a wire at the muzzle, provided that allowance be made for the difference in time between the arrival of the bullet opposite the indicator and the subsequent interruption of the circuit. Even if this error were constant and expressible in fractions of a second, it would add materially to the labour of velocity testing. In many, if not most cases, however, the chronograph readings are directly translated by curves or scales into velocity. Seldom is the time first ascertained, and the velocity subsequently worked out from the distance over which the projectile has travelled. In cases where the readings are directly converted into velocities, the velocities would require to be arithmetically converted into time; then the time error would be deducted, and the corrected velocity would be worked out. It would not be possible to subtract a constant number of feet from the velocity worked out directly from the chronograph readings, because the error in foot seconds would vary with the speed of the projectile. Taking the distance of the indicator as two feet from the path of the projectile, and the distance over which the velocity is tested as 30 feet, the error would be one-sixteenth of the nominal foot-seconds with a projectile velocity equal to that of the air-wave, while with a projectile velocity double that of the air wave, the error would be equal to one-eighth. It therefore follows (even apart from any delay due to the time occupied between the arrival of the air wave at the indicator, and the interruption of the indicator current) that nothing short of the arithmetical processes described above would permit the use of a wire at the muzzle working in combination with an indicator further along the range. As the indicator is put forward as a time-saving instrument, these arithmetical processes would more than counterbalance the saving of time due to an automatic circuit-closing indicator as compared with a wire screen. We may, therefore, ignore the use of a single-indicator in combination with a wire at the muzzle, at any rate for ordinary velocity testing.

We ought to make it quite clear that we have assumed that the air wave travels laterally from the bullet at the ordinary velocity of sound. Of course, if it could be shown that the

air wave travels laterally from the tract of the bullet at the same speed as the bullet, then the necessary correction could be made by bringing the indicator nearer to the gun by the distance that the indicator is removed laterally from the track of the bullet. This, however, we cannot admit, for we must treat the bullet as a disturbing agent in the air which propagates air waves travelling at the velocity of sound. The compresssd air immediately in front of the bullet of course travels at the same velocity as the bullet so long as the bullet is travelling faster than sound. The front wave, however, is quite different from the true wave which is propagated laterally from the track of the bullet, and which, of course, has a velocity equal to that of sound.

In the description which has been handed to us, 25 and 75 metres are named as examples of the distances from the muzzle of the gun at which the pair of indicators might be fixed. If 25 metres represent anything approaching the minimum distance from the gun at which the first breaking of contact can be reliably effected by the indicator, then, of course, the velocity readings would require a large correction to arrive at muzzle velocities. As it is frequently considered desirable to deal with the mean velocity over a certain distance measured from the muzzle of the gun, it follows that readings taken at the above quoted distances would be difficult to compare with those obtained where there is a wire contact-breaker immediately at the muzzle of the gun and a wire screen further along the range. It is, however, stated that satisfactory results are obtainable when the first indicator is placed immediately at the muzzle. We are informed that the error proceeding from the complication of the air wave by the rush of gases from the muzzle is a matter of no consideration, and does not amount to ·1 per cent.

The description supplied to us recommends that the indicators should be placed on standards fixed into the ground at the side of the range. This, of course, means that a separate standard, if not separate indicators as well, would be required for every distance over which velocities might require to be tested. This does not compare favourably with the light wire frame which may be picked up and carried from one muzzle distance on the range to another. With reference to this criticism we are informed that there would be no objection to the use of movable standards, though to this we should add that special precautions would require to be adopted, at any rate in cases where only one pair of indicators is used, to ensure that the indicators are properly aligned with the track of the bullet.

The particulars of this new indicator have been supplied to us by Mr. H. Pynegar, of 5, Dowgate Hill, Cannon Street, London, E.C. We understand that enquiries relating to their supply should be addressed to him, as he is acting as agent to the continental firm who manufacture them. It is stated that these indicators are used with considerable success on the continent, though whether their utility is chiefly confined to tests of ordnance or of small arms, or whether they are equally convenient for use in either department of gunnery, we are not informed.

We took an opportunity of submitting the first draft of this article to those interested in the new indicator, and though we have not been able to adopt all the suggestions which were made for the alteration of the article, we have endeavoured to set out the arguments in reply to our criticisms as fairly as possible.

REVIEWS.

Balistique Extérieure, by E. Vallier. Published by Gauthier-Villars et Fils, 55, Quai des Grands-Augustins, Paris. Price 2 francs, 50. Balistique des Nouvelles Poudres, by E. Vallier. Published by Gauthier-Villars et Fils, 55, Quai des Grands-Augustins, Paris. Price 2 francs, 50.

Résistance des Bouches à Feu, by P. Laurent. Published by Gauthier-Villars et Fils, 55, Quai des Grands-Augustins, Paris. Price 2 francs, 50.

Déculassement des Bouches à Feu, by P. Laurent. Published by Gauthier-Villars et Fils, 55, Quai des Grands-Augustins, Paris. Price 2 francs, 50.

These four volumes, which have been sent to us by the publishers of the *Memorial des Poudres et Salpêtres*, in Paris, form part of an engineering series of technical works written by leading authorities on each subject. The works in all cases deal very largely with the mathematical consideration of explosives, guns and projectiles. The various laws, with which the artillerist requires to be familiar, are explained in detail, and, where necessary, tables are given for facilitating rapid calculation. For those who require to go into such matters as are dealt with we feel sure that the manner of exposition will enable the principles to be fully grasped.

The fact that the manufacture of explosives is in France a Government monopoly, means that the chemists and other experts have passed through the highly technical and mathematical courses of the military colleges. The result is that when introduced to the practical work of dealing with explosives and guns, the early mathematical training is brought into play. To ordinarily educated mortals, the mathematical consideration of explosives phenonema is rather beyond the range of understanding, with the result that much of the good practical work in this country is carried out without mathematics. On the other hand we can always appreciate the advantages on the side of those who can consider explosives from the mathematical point of view. One need only call to mind Vieillé's brilliant researches on pressure testing by means of crushers, to realize the advantage of such knowledge. The present volumes explain some of the groundwork of such calculations.

APPLICATIONS FOR PATENTS.

MARCH 20TH—APRIL 15TH, 1899.

6,178. Ammunition Hoists for Ordnance. J. A. Harvey.
6,215. Machine Guns. F. M. Garland.
6,429. Telescopes for Sighting Ordnance. A. A. Common.
6,445. Cartridges for Small-arms. A. J. Blanch.
6,456. Double-barrel Drop-down Guns. W. H. Brighton.
6,523. Manufacture of Gunpowder. C. H. Curtis, C. L. W. Smith, D. J. Metcale, A. C. Pearcy and A. F. Hargreaves.
6,557. Solution of Cellulose. M. Fremery and J. Urban.
6,566. Cartridge Bells or Carriers. R. C. Pudney.
6,567. Rifles. R. C. Pudney.
6,656,* Material suitable for the Manufacture of Dynamite. P. H. Justice *(Agent for the Marsden Company, U.S.A.)*.
6,694. Fuses for Explosive Projectiles. H. P. Hurst.
6,701. Arrangement for Deadening the Report at the Discharge of Fire-arms. J. Börresen and S. Sigbjörnsen. (Date applied for 5th Sept., 1898, being date of application in Norway).
6,735. Process for Treating Cellulose Products. M. Fremery and J. Urban.
6,803. Winch Gear for Ammunition Hoists. Sir W. G. Armstrong, Whitworth & Co., Ltd., and L. Newitt.

6,880. Manufacture of Projectiles. J T. M. Hircock.
6,881. Penetrable Targets. T. B. Burns.
6,900. Traps for Shooting Purposes. E. Harrison.
7,018.* Annealing Furnaces for Gun Tubes, etc. J. Turton.
7,026. Percussion Primers. A. T. Dawson and J. Parker.
7,059. Hand-mountings for Carrying Machine Guns. M. E. Carthew-Yorstoun.
7,123. Device for Holding Fire-arms on Cycles. F. W. H. Miessner.
7,249. A Device for Controlling the Sights of Fire-arms. A. H. H. Mahn.
7,257. An Appliance for Stacking Rifles. A. Milne.
7,302. Ejectors for Drop-down Guns. A. Wilket.
7,352. Explosives. W. Roos.
13,334a* Torpedoes. C. Möller. 6th April (Date claimed under Patents Rule 19, 15th June, 1898).
7,362. Projectiles for Ordnance. H S. Maxim.
7,451. Modified form of Grooving and Grooving Tools. H Nevill.
7,514. Manufacture of Detonator Tubes. O. Williams.
7,592. Targets. W. D. Trick.
7,602.* Projectiles. M. C. Lisle and F. A. Simonds.
7,620.* Cartridges. F. K. Young.
7,637. Modified form of Cartridge Case. G. Watkins.
7,688. Trigger Mechanism for Small-arms. G. Ross.
7,698. Ordnance. H. V. Simpson.
7,712. Gun Carriages and Ammunition Wagons. W. H. Wright.
7,737. Shrapnell Shells Sir W. G. Armstrong, Whitworth & Co., and A. G. Hadcock.
7,860. Breech-loading Ordnance. P. M. Justice *(Agent for F. J. Haeseler, U.S.A.)*.
7,887. An Electrical Percussive Apparatus. S. R. Skellorn.
7,906. Breech-Blocks and Breeches for Breech-loading Guns. G. C. Marks.
7,930. Single-trigger Double-barrel Guns. H Greener.
7,931. Running Gear and Steering Gear Applicable to Torpedoes. C. Bullock.

* These Applications were accompanied by complete Specifications,

SPECIFICATIONS PUBLISHED.

MARCH 25th--APRIL 22nd, 1899.

28,946. (Dec. 7, 1897). Captain C. B. Simonds, R A., London. An adjustable sight for rifles which, it is claimed, can be altered so as to give correct elevation according to the particular velocity of the powder or ammunition used. Accepted March 7, 1899.

5,184. (March 2, 1898). Kynoch, Ltd., and G. Hookham, Birmingham. A method of cooling the barrels of automatic guns by means of a combination of heat-radiating ribs attached to the barrel, and a mechanical air draught induced by each discharge of the gun. Accepted March 2, 1899.

6,753. (March 19, 1898). A. Orling, and C. G. G. Braunerhjelm, Sweden. An electrical guiding apparatus for torpedoes, operated by the rays of a searchlight on the ship from which the torpedo is fired. The electrical apparatus is such that any divergence from the direction of the rays of light causes electrical currents to be induced, which correct the deflection of the torpedo and re-establishes its travel in the required direction. Accepted March 11, 1899.

7,134 (March 24, 1898). G F. Fitzgerald and F. T. Trouton, Dublin. A method of automatically firing guns or exploding charges from a distance by means of electro-magnetic waves. Accepted March 24, 1899.

7,759 (March 31, 1898). C. C. Curtiss, London. A means of firing high explosive shells consisting of a combustion chamber for containing the propelling explosive. The combustion chamber is so arranged relatively with the bore of the gun that cool air of ordinary temperature is carried into the bore in advance of the high pressure gases which propel the shell. Accepted March 4th, 1899.

8,169 (April 5, 1898), Sir W. G. Armstrong, Whitworth & Co., Ltd., S. W. A. Noble, and R. T. Brankston, Newcastle-on-Tyne. A mechanism for dismounting heavy guns by means of two endless belts of balls, which rest on side flanges of a runner rail. Accepted March 4, 1899.

9,545. (April 26, 1898). L. Davies, Argyleshire, and C. W. Curtis, London. An explosive composed of a mixture of nitrate of potash and carbon in the form of lignite or brown coal. On account of its inexpensiveness and flameless combustion, it is claimed to be specially suitable for blasting in coal mines, while, in addition, it is stated to be suitable for use in fire-arms. Accepted March 25th, 1899.

10,520. (May 7, 1898). The Hotchkiss Ordnance Co., Ltd., London *(Agent for L. V. Benét, Paris)*. An arrangement for enabling gas-operated automatic guns to work with blank ammunition, which consists of a pierced plug attachable to the muzzle of the gun. This plug checks the passage of the wad and gases from the muzzle, so that there is sufficient pressure in the barrel to enable the gases passing through the port-hole to operate the automatic mechanism. Accepted March 4th, 1899.

11,616. (May 23, 1898) A. Reichwald, London *(Agent for Fried. Krupp, Germany)*. A manner of forming the explosive charge for quickfiring and other forms of ordnance ammunition to provide for the effective ignition of the entire charge. The explosive is made up in a plate-like form with a hole in the centre, these plates being built up in a pile so that their simultaneous ignition may be effected by the passing of the flash from the primer through the holes in the centre of the plates. Accepted March 18, 1899.

14,640. (July 2, 1898). C. Von Hanneken, Berlin. Various modifications relating to automatic ordnance of large calibre, which include, among other things, the reciprocal working of twin-guns, and in the case of single guns, an arrangement for storing up the energy of recoil in an accumulator providing the power for effecting the reloading operations. Accepted March 11, 1899.

14,780. (July 6, 1898). G Beneké, Southport. A method of preparing a special carbon carrier for use as an ingredient in the manufacture of explosive compounds, consisting in bringing a carbonaceous material or a hydrocarbon to a liquid state, and mixing with it in a finely powdered form bichromate, chlorate, or permanganate of potash, and carbon, the product being used either in a liquid or in a powdered state. Accepted March 11, 1899.

26,081. (Dec. 9, 1898). L. Gathmann, Chicago, U.S.A. A form of shell for carrying high explosives so designed as to provide the required strength with a minimum weight of metal, the object being to provide for a maximum of explosive charge. Accepted March 4th, 1899.

26,801. (Dec. 20, 1898). C. B. Bender, Dulwich. A means of utilizing smokeless gunpowder for operating the pistons of rivetting, punching, shearing, and other machines. Accepted March 11, 1899.

27,340*. (Dec. 27, 1898). T. Mauser, Germany. The Mauser Self-loading Rifle.

1,338. (Jan. 19, 1899). G. A. Nahnsen, Germany. The manufacture of a safety explosive composed of 30 parts of nitroglycerin and a powder mixture of 38 parts of cellulose and 32 parts of chili-saltpetre. Accepted March 25, 1899.

* This Specification is more fully described under "Selected Patent."

SELECTED PATENT.

THE MAUSER SELF-LOADING RIFLE.

27,340 (Dec. 27, 1898). P. Mauser, Germany. The object of the rifle mechanism described in this patent is to afford increased rapidity of shooting by means of a rifle which may be used either for single firing or as an automatic self-loading weapon. It is constructed so that the ejecting of the empty cartridge case, the cocking of the firing mechanism, and the various other reloading operations are effected by the re-coil, which causes the barrel, the breech bolt and certain other parts, to slide backwards in a longitudinal direction.

The patentee explains that in designing the parts and arranging the movements of this rifle, he has adopted, as far as possible, those features which practical experience has shown to be the most reliable in the working of the Mauser automatic pistol. The designing of an automatic rifle suitable for military work involves, in many respects, the satisfying of requirements different from those of automatic pistols; and it is where the conditions of the two classes of arm are different that the new mechanism departs from the lines of the Mauser automatic pistol.

In the accompanying illustrations, Figs. 1 and 2 show longitudinal sections, vertical and horizontal respectively, of the rifle with the breech closed and the hammer down; Figs. 3 and 4 show corresponding views of the same parts when the breech is open ready for the insertion of cartridges.

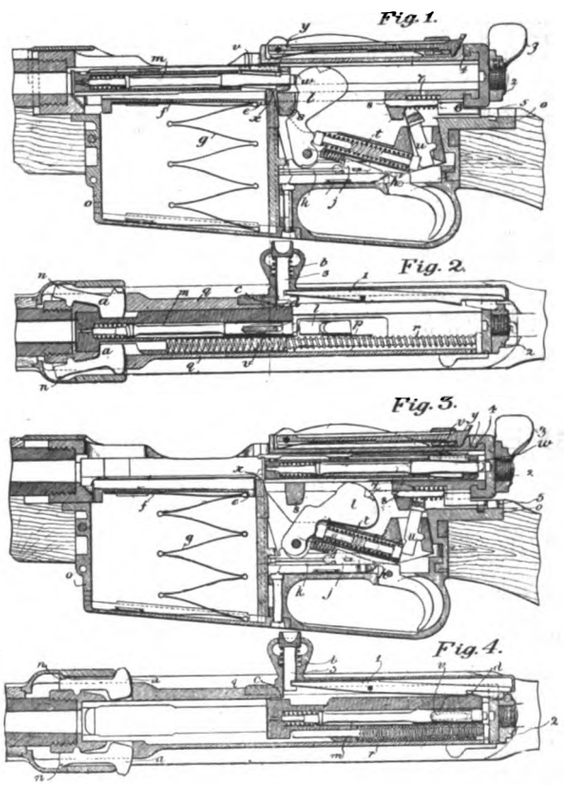
In studying the action of this mechanism, it will be seen that the two levers or clutches *a* play an important part in the series of operations. They serve as a connection between the breech case and the barrel, which are united together, and the breech bolt which slides in the breech case, and this connection is made or severed according to the longitudinal position of the barrel and breech case. During the first part of the recoil, the barrel, &c., and the breech bolt, being united by these levers, recoil together. After they have travelled together a certain distance, the levers are automatically thrown out of action, after which the barrel ceases to recoil, and the bolt continues its rearward movement. After ejecting the spent cartridge, and bringing a fresh one into the chamber on its return movement, the bolt again comes into contact with the barrel, so that the levers or clutches are once more put into action, and the two combined pass forward into the position ready for firing.

To load the rifle the bolt handle *b* is drawn back, so that its projection *c* engages with the nose *d*, and carries the breech bolt back. The breech bolt is locked in its rear position by the part *e* of the cartridge lifter *f*, which is forced into the front of the bolt by the spring *g*. The bolt handle *b* is then pushed back to the position from which it started. A clip containing any number of cartridges up to ten is then inserted, and the cartridges are stripped into the magazine. By this operation the cartridge lifter is thrust downwards away from the front end of the breech bolt, so that directly the empty clip is removed, the bolt flies forward, in so doing unlocking the barrel and carrying a cartridge from the magazine into the chamber. At this stage the parts are in a position ready for firing. Upon the trigger being pulled, the nose *h* pushes the trigger catch *j* and the trigger bar *k* forward, thus releasing the hammer *l*, which strikes the firing pin *m* and fires the cartridge. The recoil due to firing causes the barrel, together with the breech bolt to which it is locked, to be driven backwards until the points *n* of the levers or clutches *a* engage with inclined surfaces, and are forced into the position shown in Fig. 4. The breech bolt is now freed from the barrel, and the impetus of its recoil carries it to its rearmost position, as shown in Fig. 4. In so doing it ejects the empty cartridge case.

The catch *p* (Fig. 2) serves to retain the barrel in its rearmost position until the breech bolt has completed its ejecting and reloading operations. This catch consists of a plate which is arranged on a pin pivoted to the lock body, the plate being constantly pressed outwards by a spring. In its backward travel the breech bolt presses the barrel catch into a recess in the breech case *q*, which effectually holds the barrel until the bolt returns to the firing position under the action of its spring *r*. The bolt in its recoil also cocks the hammer, partly by means of the tip or end of the breech bolt and partly by the projection *s* (Figs. 1 and 3). The cocking of the hammer also compresses the spring *t*, which turns the "pusher" *u* over to the right. When the parts are in this position and the rifle is adjusted for rapid firing, the bolt starts travelling forward again under the impulse of the spring *r*. As soon as the bolt has passed over the barrel catch *p*, the "pusher" *u* is caused by the spring *t* to push forward the barrel together with the whole of the breech case, the catch *p* being released in the process. To prevent premature ignition of the cartridge, which might be caused by the momentum of the firing pin, an arrangement *v* (best seen in Figs. 2 and 4) for locking it is provided. This catches behind *w*, and is only released when the breech is moved so far forward as to allow the inclined under-surface of *v* to slide over the points *x*, thus putting the parts *y* and *w* out of engagement, as shown in Fig. 1.

The barrel in being pushed back into its place drags the levers or clutches *a* with it, the inclined planes of which cause them to slide in towards the centre, so locking the breech to the barrel as before. The parts are then in position for firing, and the same series of operations may be repeated until the whole of the cartridges in the magazine are exhausted.

Should it be required to adjust the rifle for single firing instead of automatic firing, the locking lever *z* has to be turned completely to the right, so that the projection at the end of the "pawl" *1* falls into a slot in the disc *2* attached to the locking lever. After firing a shot, the breech bolt is thrown back in the usual way, but it is retained in its back position by the projection on the pawl *1*, which catches the nose *d* on the breech bolt, as seen in Fig. 4. To



prepare the weapon for firing again, the pawl must be disengaged from the breech bolt. This is accomplished by pressing the pin *3*, which forces the back end of the pawl outwards, thereby releasing the bolt, which again moves forward and carries a cartridge from the magazine into the barrel in the usual way.

To lock the action and put the rifle at what is ordinarily known as "safe," the locking lever *z* has to be turned over to the left. The turning of the locking lever causes a projection attached to the curved disc *2*, to slide across the inclined plane *5* of the hammer catch *6*. In so doing the hammer catch *6* is pushed forward against the action of the spring *7*, so that the oblique front end *8* slides on the corresponding oblique surface of the hammer (shown in dotted lines in Fig. 3), which is pressed back so as to set free the trigger bar. In this position the lock is "safe." To return the mechanism to its original position for rapid firing, the cocking lever has to be turned to allow the pawl *1* to fall into a shallow groove midway between the groove for single firing and the locking groove. The breech bolt has to be manipulated by hand when blank cartridges are used. Accepted March 25th, 1899.

Arms & Explosives

A TECHNICAL AND TRADE JOURNAL.

EDITED BY MAX BAKER

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CONTENTS.

CURRENT TOPICS.

The Transvaal Dynamite Question.—From the communications which have passed between Mr. Joseph Chamberlain and the Transvaal Republic, which we print elsewhere in this issue, it is clear that the British Government has decided to take the matter up energetically. The facts connected with the granting and carrying on of the monopoly are recapitulated in detail by the Colonial Secretary, and arguments are set forth to the effect that the monopoly is inconsistent with the terms of the Convention. Further, it is indicated that the concessionaires have not observed the terms of their agreement, so that it is open for the Transvaal Government to take measures for cancelling the concession, or for so modifying it as to bring it into line with the requirements of the Convention. The reply of the Transvaal Government is simply and solely a refusal to enter into the discussion, or in any way to admit the right of Mr. Chamberlain to act in the matter. Of course, in the face of such a reply as this, the matter cannot be advanced further unless the British Government decides to back up its protest with something in the nature of a threat which it will be prepared to execute should the necessity arise. This, of course, raises the entire question as between the British Government and the Transvaal Republic. Franchise and a number of other points in dispute are involved; and if the Transvaal Republic is firm in its refusal to deal separately with the dynamite question, then the latter question must be treated as part and parcel of the larger dispute, which is rapidly obtaining the dimensions of a crisis. The question is then one which will follow the ordinary routine of international disputes.

The Late Mr. J. R. Watson.—We very much regret to hear of the death, on the 28th ult., of Mr. J. R. Watson, the well-known explosives merchant, who has carried on business at 35, Queen Victoria Street for a good many years past. His death was due to a carriage accident. When being driven in his brougham the horse ran away, and Mr. Watson made what in the light of subsequent events must be regarded as a mistake. He leaped clear of the carriage, but falling upon his head, he was instantly killed. Mr. Watson was a many-sided man, of keen sporting instincts. He took the greatest interest in trotting horses, and his fearless driving has frequently led to apprehensions that he would one day pay the penalty for his temerity. Yet it was not in a trotting buggy, but in an ordinary brougham, that the accident on the 28th ult. occurred. Besides being a successful city merchant, Mr. Watson was also the proprietor of the Bear Hotel at Esher, and its proximity to the Sandown Park racecourse no doubt had much to do with his interest in horses. Mr. Watson was, however, a very keen and shrewd business man. When the Transvaal Dynamite Concession was being organized he managed, as the result of a trip to the South African Republic, to obtain a substantial share of the good things that were going. We understand that his business will be carried on until further notice by Mr. R. J. Harmer, who, besides being one of the executors under his will, has been actively engaged for many years past as manager in the business.

MULLERITE SPORTING POWDER.

SAMPLES of cartridges loaded with Mullerite No. 1 and Mullerite No. 2 were recently delivered to us for trial and report. These powders are stated by the manufacturers (Messrs. Muller & Cie., of Liège) to be made of thoroughly gelatinized guncotton. The powders in no way differ from one another as regards composition, and both are green in colour. Mullerite No. 1, however, which is the type recommended by the manufacturers, is granulated in the leaflet form, while Mullerite No. 2 is formed into small grains very uniform and hard. The powders are what is known in this country as "condensed," this term serving to distinguish them from the "bulk" nitros, which load volume for volume equal with black powder.

We do not profess to be a paper having an installation of testing apparatus, but, on the other hand, there are a number of excellent installations which are at our disposal for the asking, together with the services of competent experts for whose authority and good faith we can vouch. We have in this instance taken advantage of such assistance, and in order to be quite sure of our ground we have had the trials repeated with different apparatus and by different experimentalists so as to check off one set of results with another. The figures, therefore, which we are publishing can be taken as reliable, and concordant with other tests which have been made and which we shall not specify in detail.

Fifty cartridges loaded with each kind of powder were delivered to us. They were loaded in cases manufactured by Gevelot and Gaupillat, of Paris, the chief peculiarity of which is that the cap itself is fitted into a sort of outer case, so that the blow from the striker has to act through two thicknesses of metal. The cartridges were of ordinary 12-bore gauge with flat bases, and were delivered to us ready loaded on the system adopted by Messrs. Muller. The turn-over is square, and possibly not quite so long or so fully turned over as we in this country consider desirable.

Five cartridges of each kind were cut open for examination, and the results are given in the following tables :—

MULLERITE No. 1.—LEAFLET FORM.

Powder Charge.	Shot Pellets, VI½	Weight of Shot.	Wad over Powder.	Felt Wad.	Wad under Shot.	Wad over Shot
33·70	336	1oz. 61grs.	·064 in. Waterproof card	7/16 in. 2nd qual. v. soft with v.little grease	3/16 in. paper covered felt.	·064in. name card
33·90	339	1oz. 61grs.				
33·50	338	1oz. 56grs.				
34·00	336	1oz. 58grs.				
33·75	340	1oz. 59grs.				
33·77	338	1oz. 59grs.				

MULLERITE No. II.

Powder Charge.	Shot Pellets, VI½.	Weight of Shot.	Wad over Powder.	Felt Wad.	Wad under Shot.	Wad over Shot.
33·80 grs.	339	1oz. 50grs.	·064 in. Waterproof card.	7/16 in. 2nd qual. v. soft with v. little grease	3/16 in. paper covered felt.	·064in. name card.
33·50 grs.	340	1oz. 50grs.				
33·85 grs.	342	1oz. 50grs.				
33·85 grs.	340	1oz. 50grs.				
33·50 grs.	340	1oz. 52grs.				
33·70 grs.	340	1oz. 50grs.				

It will be seen that the size of shot works out at No. 6½. The standard number of pellets in 1⅛ oz. of No. 6 shot is 304 pellets. The average in the above cartridges shows an excess of 36 pellets in the charge, which must be borne in mind in considering patterns. The shot used in these cartridges corresponds exactly with the standard size of pellets known in this country as 6½.

In the tests conducted with these powders the number of pellets in a 30-inch circle was taken at 40 yards from a choke barrel; the mean velocity was taken over ten yards range; the recoil was taken in foot-pounds; while finally the pressures were measured in a standard pressure gun with Eley leads translated by the Eley table, the points of measurement being at one inch and 2½ inches from the breech-face. We give in tabular form the results of these tests with the two kinds of powder.

MULLERITE No. I.

No. of Pellets in 30 inch Circle.	Mean Velocity over 10 yards.	Recoil ft. lbs.	Chamber Pressure in tons per sq. inch.	
			At 1 inch.	At 2½ inches
226	1,200	29·92	3·250	3·031
212	1,215	29·92	3 093	3·000
225	1,209	29·92	2·812	3·000
217	1,209	29·92	3·062	2·969
217	1,215	29·92	2·781	2·843
231	1,200	29·92	3·031	2·429
206	1,235	28·27	3·062	2·394
Total 1,534	8,483	207·79	21·091	19·666
Mean 219	1,212	29·68	3·013	2·809

REMARKS.—A pattern of 219 with 6½ shot will correspond with 198 pellets of No. 6.

Highest Pressure at 1 inch = 3·250 tons. Lowest, 2·781. Difference, ·469.

Highest Pressure at 2½ inches = 3·031 tons. Lowest, 2·394. Difference, ·637.

MULLERITE No. 2.

No. of Pellets in 30 inch Circle.	Mean Velocity over 10 yards.	Recoil ft. lbs.	Chamber Pressure in tons per sq. inch.	
			At 1 inch	At 2½ inches
227	1,153	26·10	3·550	2·552.
211	1,153	26·10	2·812	2·214
242	1,171	26·10	3·600	2·843.
164	1,162	23·92	3·600	2·264
233	1,127	26·10	2·624	2·874
257	1,155	26·10	2·624	2·781
227	1,145	25·37	3·445	3·093
Total 1,561	8,066	179 79	22·255	18·621
Mean 223	1,152	25·68	3·178	2·660

REMARKS.—A pattern of 223 with 6½ shot would correspond with 200 pellets of No. 6.

Highest Pressure at 1 inch = 3·600 tons. Lowest, 2·624. Difference, ·976.

Highest Pressure at 2½ inches = 3·093 tons. Lowest, 2·214. Difference, ·879.

It will be seen that Mullerite No. 1 gives a rather lower average pressure at the one-inch plug than Mullerite No. 2, and further, that the variation is less in the case of the first powder between the extremes of pressure than in the second. In the case of the pressures at 2½ inches Mullerite No. 1 gives a rather higher average pressure than No. 2, which is, however, accompanied with a smaller divergence between extremes. The general characteristics of the two trials, as here recorded, show that Mullerite in both cases gives high velocities, while, as regards pressure, the records, though not dangerous, reach a limit which should not be passed in ordinary practice with game guns, especially when we remember the extra liability of condensed powders to be overcharged. While on the subject of pressures it is necessary for us to point out that the combustion of the powder in these cartridges is by no means perfect, as a large amount of unburnt grains are left in the barrel. This is always a fruitful source of liability to irregular pressures; for if an extra strong cap should ignite the whole of the charge, including the proportion ordinarily blown out unburnt, or sticking to the sides of the barrel, then we should expect an excessive pressure surpassing ordinary limits of safety. Experimentalists who have investigated this matter advise us that such excesses of pressure, due to the complete combustion of a charge of powder, the amount of which is based upon the assumption that only a portion of it will be burnt, may reach as much as an additional one-third over and above the pressure of the service charge.

The capacity of the powder to absorb moisture from a damp atmosphere was tested by exposing it for 120 hours with the following results:—

Mullerite No. 1 absorbed 2.67 per cent. of moisture.

Mullerite No. 2 absorbed 2·5 per cent. of moisture, both of which are considerable.

Dealing with these powders generally we cannot see our way to recognize either of them as subjects for special recommendation. Mullerite No. 1 is better than Mullerite No. 2; but the defects of ignition in both of them in cases which we are entitled to assume represent them at their best are such as to require further experiment before they could be put forward for general sale.

We cannot, of course, ignore the fact that our contemporary, the *Field*, gave a very favourable notice of these powders, especially Mullerite No. 1, in its issue of April 22nd last. It stated that No. 1 powder gives superior results to any shotgun powder that it had hitherto tried and reported upon. Our contemporary used the same cases as those referred to in our own trials; but the powder charge was 33 grains, with English wadding, as against 33½ to 34 in the Company's own loading. Its results showed an average pressure over seven shots of 1·77 tons per square inch in the case of Mullerite No. 1, with a highest pressure of 2 tons, and a lowest of 1·58 tons. In the past we have had a good deal to say with regard to the methods adopted by our contemporary for pressure testing, but in its reply to our criticisms it stated that it found that the results of its tests approximated very closely with the results obtained with the Eley leads and tables, which are the standards in ordinary use. The slight difference in load would not account for the wide divergence between our own figures and those of our contemporary; and we have taken such careful precautions to check off our own results before setting them down in print, that we cannot budge an inch from the position we are taking up. The *Field* has publicly stated that Mullerite powder is the best it has ever tested and reported upon, as shown by its own figures. We now invite our contemporary to prove that its own figures are the correct ones according to recognized standards of testing. If they are, Mullerite is a good powder. If ours are correct, Mullerite is by no means extraordinary in some points, and bad in at least one very important one.

As the guide, philosopher, and friend of the sportsman, our contemporary gives him much advice; but in the case of our contemporary's article upon Mullerite we have reason to believe that authorities equally as competent, and certainly not less practical, are in serious disagreement with the opinion so strongly expressed by the *Field*. In the ordinary way our contemporary discourages anything in the nature of public tests, and this is carried so far that even the person most interested is ordinarily not present at the trial, though possibly his wishes may be met by being allowed to see the results after they have been taken, and before their publication. In an exceptional case, like the present, we think our contemporary would be well advised if it once and for all publicly demonstrated the theoretical and practical correctness of its own methods of testing, and we have not the slightest doubt that a committee, consisting of six of the most competent men in this work in the country, would be willing to give their assistance in the matter. The tests with Mullerite would form an excellent groundwork for such an investigation. The *Field* declares the mean pressure at 1·77 tons, we declare it at about 3 tons, and there is not sufficient divergence in the matter of the load to account for any substantial part of the difference.

The samples of this powder were brought to us by Monsieur H. Hilgers, who has introduced the powder in this country on behalf of Messrs. Muller. We informed him that we should have the trials made by persons for whom we could vouch, and that, having satisfied ourselves as to the correctness of the results, we should publish them, whether good, bad, or indifferent, and the cartridges were left with us upon these conditions.

INCIDENTAL JOTTINGS.

SERVICE BULLETS.

THE singularly erroneous impression which so many people (even military, and especially volunteer officers and men) have about the identity of the Dum-dum bullet is astonishing. The Dum-dum bullet has never been accepted as an English service bullet, except partly in India in a few small expeditions. The small arms projectile now employed is a hollow nosed bullet known as the "Mark IV.," which we understand owes its inception to the genius of Col. Bainbridge and the staff of the Royal Laboratory. Its effect is very similar to that of the old Sinder bullet; but the service bullet, the weight of which is only 215 grains instead of 450, is exceedingly dangerous at longer ranges with its increased accuracy obtained with the more up-to-date arms and explosives now used. Beyond these facts it cannot be considered by the "Peace Conference" an innovation of any startling character. The Mark II ·303 was in its effect undoubtedly retrograde to the Martini; but this hollow nose just brings the lighter and smaller diameter bullets up to the wounding efficiency of those of the larger bores.

MOTOR WAGONS.

UNDER which head would motor cars be catalogued? From small arms to bicycles is only a step, as from bicycles to motor cars. Therefore, it will be interesting to see whether the Royal Small Arms Factory at Enfield will assume the manufacture of the long-expected experimental motor carriages for field and army service equipments. The Carriage Department at Woolwich is most likely to make a success of this venture, owing to their experience of wagon building. This is too radical a change in which to expect much progress, and, like electrical power on the Metropolitan, will be under consideration for many a long year.

PROGRESS AND GUNMAKERS.

THE Chairman of the Gunmakers' Association struck the right nail on the head when he advocated more up-to-date methods and proofs for guns and ammunition. The question is one of great importance to the courtly members of this antique trade. There is no time like the present, and the shadow of the "allied trades" is a warning of the coming events. The dear old grey-bearded workman now leaning on the wooden bed of the barrel boring machine, and straining his well-trained eye upon such ignominious details as the number of bits of paper his drill is packed with, will soon be as venerated as the Caxton Press, whilst youths with (we trust English) automatic machinery will reel off component parts by the thousand, to be retailed to the gun trade in sets like bicycle fittings.

BLANK AMMUNITION.

WANTED, a good blank for ·303 calibre, must be cordite, must fire in Maxim gun. The inventor to be solely prompted by patriotic feeling, no remuneration to be expected! Oh, let us have anything but this shedder cordite. We blow 10 or 20 per cent. unburnt out of the muzzle, and we don't get more pop than the cap with charge omitted. How can a volunteer be expected to sham fight with such odds against him? No smoke to see, no telephone to hear if the enemy is 200 or 300 yards off firing under cover, and no Maxim to fire unless we buy ourselves a special cartridge constructed by that enterprising gunmaking firm.

CYCLOPS.

MEETING OF THE BIRMINGHAM GUN TRADE.

The yearly meeting of the members of the Birmingham gun trade was held on the 2nd ult. at the Proof House, Banbury Street. Mr. J. W. Ward, the newly-appointed chairman, presided, and there was a large attendance. In referring to the finances of the past year, he explained that the increased receipts had arisen principally from the African barrels proved. Unfortunately, however, this did not represent an increased trade to the gunmakers, for he supposed half of the 120,000 of such barrels proved were exported to Belgium, and a good many were made up into guns at a less cost and of inferior quality than if made in England, and were sold as English-made guns. The making of so large a quantity of African barrels was good for the barrel-makers and the Proof House, but it was bad for the gunmakers.

The decrease in proofs was principally in the definitive department, where a shrinkage of about £700 had occurred. This arose from the stoppage by the Government of the transport of guns to the Persian Gulf. He had not much to add to what was said at the last annual meeting upon this subject, but he thought that it seemed hard that a trade which had been carried on openly and legitimately for 16 years should be suddenly stopped without any notice, and arms seized by the authorities. The Government had been challenged to show that the guns ever found their way into the hands of the Afridis or any other of the Queen's enemies, and they had failed to do it. He hoped something might be done soon to revive that trade, for it had caused a serious loss to the Proof House as well as to members of the trade.

Mr. E. W. Wilkinson seconded the motion, and referring to certain comments in a London newspaper, which suggested that the English gunmakers were neglecting the Egyptian gun trade, he stated that the competition was very severe, the class of trade was a poor one, and the long hours of labour in Belgium had practically placed English makers out of the market.

The Chairman, in answer to Mr. C. Greener, stated that the number of gunmakers who used the ranges was about 25. As regarded profit or loss upon the ranges, he did not think there was profit, and the probability was that there was a loss, but the ranges were not provided for the purpose of making a profit. They existed for the convenience of the trade.

Mr. G. Lewis asked what the Guardians proposed to do with the balance in hand, and whether it would go towards the reduction in the price of proofs. He thought the price charged for nitro proofs was excessive.

The Chairman answered that he was unable to state at present what would be done with the surplus. He had hopes that it might result in the reduction of the charge for proofs.

Mr. S. B. Allport (Proof Master) stated that the nitro proof was the most expensive they had, and replying to a query of Mr. Lewis anent the proof of barrels which had been in use for some years, and had been sent for alteration to a maker, he stated that if a maker altered an old barrel and did not have it proved before sending it back to the customer, he was contravening the Act, and was liable not only for such offence, but was responsible for any accident which might occur through the use of the gun.—The report was adopted.

Three Guardians—Messrs. W. Cashmore, T. M. Tait, and W. P. Jones—retired in the ordinary course, and a vacancy created by the death of Mr. Playfair had to be filled. The three retiring Guardians offered themselves for election, and the other candidates were Messrs. T. C. Bentley and C. E. Greener. The three retiring Guardians were re-elected, and Mr. T. C. Bentley was appointed a Guardian. Mr. Frederick Williams was appointed auditor and a member of the Registry Board.

Upon the proposition of Mr. W. L. Powell, thanks were voted to Mr. Ward for his efficient conduct in the chair.

MESSRS. KYNOCH, LTD., have recently received an order from the Government for 100,000 six-pound high explosive shells. The "Peace Conference" does not appear to be interfering with the work of the War Office in this respect.

GUNMAKERS' ASSOCIATION.

THE ANNUAL GENERAL MEETING.

THE Annual General Meeting of the Gunmakers' Association was held at Effingham House on Tuesday, May 9, 1899, and there were present—Messrs.

John Rigby (in the chair),

Charles Ingram Annan,	C. E. Greener,
E. Harrison,	A. H. Gale,
F. Beesley,	W. R. Leeson,
Herbert H. Reilly,	R. T. Woulfe.

MINUTES.—The Minutes of the last Annual General Meeting were duly read and confirmed.

MESSAGES OF REGRET.—Messages of regret for non-attendance were read from Messrs.

H. W. Holland,	H. A. A. Thorn,	J. Tisdall,
E. C. Green,	C. H. Maleham,	W. H. Monk,
C. Playfair,	W. Golden,	S. E. H. Chambers,
T. Horsley,	W. L. Powell,	P. Small,
J. G. Benbow,	H. Tilney,	J. Anderson.

ELECTION OF NEW MEMBERS.—The following gunmakers, who had applied for membership of the Association, were unanimously elected:—Messrs.

Herbert H. Reilly, E. M. Reilly & Co., London;

J. H. Mountstephen, Torquay;

E. C. Slingsby, Slingsby Bros., Boston, Lincolnshire.

PASSING OF ACCOUNTS.—The balance-sheet for the year ending March 31, 1899, as passed by the official auditor appointed by the Association, Mr. A. H. Gale, was then submitted for the approval of the meeting, and it was approved and passed by a unanimous resolution. The favourable balance on the year's transactions amounted to £31 6s. 6d., which leaves the Association with a cash balance of £89 17s. 11d. to be carried forward. The financial report attached to the balance-sheet was then passed, and it was decided that the Executive should issue, in addition thereto, a summary of the various questions which had occupied the attention of the Association during the period under review, and that in future years a similar report should form part of the printed balance-sheet, and that the Executive should approve of the same prior to its issue to the members.

ELECTION OF OFFICERS.—The election of officers was then proceeded with.

EXECUTIVE.—A letter was read from Mr. H. A. A. Thorn, expressing his desire to be relieved of his position on the Executive, and the following resolution was unanimously passed, and the Secretary was instructed to communicate the same to Mr. Thorn:—

"That the General Meeting of the Gunmakers' Association receives with much regret Mr. Thorn's letter of resignation of his seat on the Executive Committee, and it feels that Mr. Thorn's withdrawal, after so long a period of valuable service, will seriously impair the efficiency of the Committee, and the General Meeting has, therefore, unanimously re-elected him, hoping that he will be influenced by the wishes of his fellow members, and will continue to give his assistance to the Committee."

This resolution was proposed by Mr. F. Beesley and seconded by Mr. C. E. Greener.

The members present thereupon unanimously re-elected the Executive who held office last year.

SOLICITOR.—Mr. R. T. Woulfe was unanimously re-elected Solicitor to the Gunmakers' Association. A resolution was unanimously proposed, seconded, and specially supported by several others of the members present, thanking Mr. Woulfe for the very valuable services which he had rendered to the Association, and for his unfailing attendance at the meetings, which gave the members the advantage of his legal assistance in the many technical points which were frequently arising. Mr. Woulfe acknowledged this vote of thanks, and in thanking the members for this mark of their appreciation assured them that his best services would be at the disposal of the Association in the future as in the past.

HON. TREASURER.—The re-election of Mr. H. W. Holland as Hon. Treasurer was accompanied by a resolution thanking him for his valuable services during the past year.

OFFICIAL AUDITOR.—Mr. A. H. Gale was re-elected to the office of Official Auditor to the Association, and his services were acknowledged by a unanimous resolution of thanks.

SECRETARY.—Mr. Max Baker was re-elected Secretary of the Association for the coming year.

ARMORIAL BEARINGS.—An enquiry had been received from one of the members of the Association, asking to be supplied with an electro of the armorial bearings of the Association for use on his business letter headings. This matter had previously been brought before the Executive, and had been referred to the present meeting, the Secretary having meanwhile communicated with the Inland Revenue authorities, who had replied, informing him that "On the understanding "that Armorial Bearings Licence Duty is paid by the Gunmakers' Association, the Board will not require further payment of duty by members of the Association using the device in question on note paper appropriated to, and used solely for business purposes." The Association regularly pays the amount due for the use of these bearings, and the meeting thereupon decided that any members desiring electros of the device should be able to obtain the same on application to the Secretary on the strict understanding that such members should state in writing that, should they at any time cease to be members of the Association, they engage to cease using the bearings, and to return any electros of the same that they may have in their possession.

CONCLUSION OF MEETING.—The meeting concluded with a vote of thanks to the Chairman for presiding.

THE GUNMAKERS' ASSOCIATION ANNUAL DINNER.

GUNMAKERS, to judge by their recent annual dinner, are not apparently in love with functions of this character. If one judged the activity and alertness of the trade by its attendance at the Kynoch factory last year, one would marvel at their energy and interest in their business. It is fortunate that one is not obliged to judge either the gun trade or the Gunmakers' Association by the annual dinner which took place on the 9th

ult. There were present Messrs. John Rigby (chairman), C. Ingram Annan, F. Beesley, A. Billyeald, F. C. Borer, A. T. Cocking, W. Cullen, R. Fryer, A. H. Gale, C. E. Greener, E Harrison, W. R. Hillsden, S. R. Hollick, J. C. Irvine, J. F. P. Lewis, Col. Macdonald, E. G. Mackenzie, D. J. Metcalfe, H. W. Newton, T. C. Osborne, T. Rigby, E. Rigby, J. Robertson, Melville Smith, J. F. Smythe, E. H. Stone, H. A. A. Thorn, H. G. A. Thorn, T. W. Webley, H. Whitfield, and Max Baker (secretary).

After the toast of the Queen had been received with musical honours, Mr. J. C. Irvine proposed the toast of the Gunmakers' Association, and in the course of his remarks he dwelt upon the cordial relations, which he hoped would always continue, between the gunmakers and the allied trades. The interests of the two sections of the industry were closely akin, and he put forward the pious hope that this would be adequately recognized by the two working in complete unison.

Mr. John Rigby in his reply referred to the work of the Association and the fact that many of its deliberations were frequently such as not to appeal at all times to the members, even though the ultimate results of such work tended to the ultimate benefit of the trade. In many ways the Association was limited in its endeavours by want of funds to carry out the work which ought to be done. But, on the other hand, by persistent and steady endeavours, much was being accomplished in the interests of the trade. He referred with considerable emphasis to the fact that the London Proof House made a heavy tax upon the trade, and yet did practically nothing to advance the scientific information for the gunmaker—work which laid properly within the scope of proving operations, and to which the surplus funds of the Proof House should be applied.

Mr. A. H. Gale proposed the toast of the visitors, among whom were included members of the allied trades and the press. Col. Macdonald replied on behalf of the visitors in general, Mr. A. T. Cocking on behalf of the allied trades, and F. C. Borer replied for the press in the capacity of a contributor to the *Field*. Towards the close of the proceedings Mr. John Robertson made an excellent speech in proposing the health of the Chairman, and he referred to the great pride of the gun trade that one of their members, in the person of Mr. John Rigby, had not only been chosen by the Government to assume the responsibilities of the office of superintendent of the Enfield rifle factory, but that throughout his career in that department his work had been characterized by a scientific thoroughness which more than justified his appointment.

MR. J. F. BARKER.—We have received a circular notice to the effect that Mr. J. F. Barker has taken offices at 4, New London Street, Mark Lane, where he has commenced business as a general merchant, especially concerned with most of the things appertaining to the industry of small arms and explosives. Curiously enough Mr. Barker was upwards of thirteen years at this same address during the time when he acted as co-manager for Messrs. Hay, Merricks and Co., Ltd. Mr. Barker has our very best wishes for his success in his new enterprise. We feel certain that his considerable experience in explosives work, a trade with which he has been intimately connected all his life, will be of very great use to him. A valuable knowledge of, and connection with, the largest buyers, coupled with an extenstve knowledge of the intricate regulations concerning the handling of explosives, are such that he will have the very best opportunities for opening up an advantageous trade, with but few of the preliminary troubles which face the ordinary novice.

THE DYNAMITE MONOPOLY IN THE TRANSVAAL.

In the Johannesburg *Star* (weekly edition) of May 6 is published the letter of Mr. Chamberlain on the dynamite monopoly and the reply of the Transvaal Government. The text of the documents is given as follows :—

MR. CHAMBERLAIN'S DESPATCH.

Downing Street, January 13, 1899.

Honourable Sir,—

1. The question regarding the importation of explosives into the S.A.R. has, as is known to you, been brought to my notice by British manufacturers, who complain that their manufactures are refused admission into the Republic, and that thereby they are prevented from trading therewith in the Republic, according to Article 14 of the London Convention.

2. On receipt of these representations it became my duty to give the matter my full and careful consideration.

3. In the present case it is not necessary to do more than refer in passing to the circumstances of the monopoly granted in 1887 to Mr. Edward Lippert, which gave rise to strong representations from the side of her Majesty's Government, and which monopoly was formally cancelled in 1892. The present circumstances are (at least nominally) somewhat different, as the Volksraad in 1893 declared trade in explosives a Government monopoly, the carrying out of which, with the consent of the Executive, could be transferred to other persons, subject to regulations fixed by the Volksraad.

4. Consequently the Government in October, 1893, closed a contract with Mr. L. G. Vorstman, whereby he was appointed exclusive agent for 15 years for the execution of the monopoly. Under this contract the agent was granted the right, for that purpose, to establish a company, and he was allowed to calculate certain *maximum* prices for dynamite, amounting to £4 15s. per case for dynamite No. 1, while he had to pay the Government 5s. per case on the dynamite sold over and above an amount not exceeding 20 per cent. of the surplus which was fixed to be the balance after deducting all expenses, depreciation, the usual writings off, and interest at 8 per cent. on capital. Further, the agent bound himself to erect factories within the two and a half years which were granted him by regulations of the Raad, while the Government, pending such an establishment, would import all necessary materials itself, and place them at the disposal of the agent, who had to hand over the production of the sale to the Government, from which the latter would deduct 5s. per case, in addition to the amount paid for the imported materials, and return the balance to the agent.

5. Her Majesty's Government is advised that the creation of a monopoly in favour of the State is not necessarily inconsistent with Article 14 of the London Convention, even if carried out by the concessionaire, providing the concession is intended in good faith to benefit the State generally and not simply to favour the concessionaire.

6. The question which now presented itself to me was, if the dynamite monopoly as carried out by contract with Mr. Vorstman was to benefit the State generally, or only to benefit the concessionaire.

7. From the report of the Commission of the Raad appointed in February, 1897, to inquire into the execution of the monopoly, of which a translation was to be found among the documents laid before Parliament in April of that year, I gained the following facts:—The Company which the Government was empowered to form was constituted under the name of the South African Factories for Explosives (Limited). It did not complete its factory within two and a half years as stipulated in its contract, but in October, 1896, it alleged it was in a position to manufacture 80,000 cases per year, while the total demand of the country was estimated at 200,000 cases. Whereupon the Executive Council, in conflict with the Volksraad besluit of September, 1894, whereby any departure from the regulations was distinctly forbidden,

granted the company another two and a half years for the erection of factories capable to supply the demand of the country under the most favourable circumstances, and, accepting that the prospects made recognizable by the company were fully realised, the Commission estimated that for the four years 1897 to 1900 it would be necessary to import at least 430,000 cases over and above what the company could produce. The working in the factory of the imported dynamite and blasting gelatine was declared to consist of the simple process of making these into cartridges, while, as regards the comparatively small portion which the company was said to manufacture, it appeared that all the necessary rough materials had to be imported, as these were not produced in the State, and there existed just as little probability that such would be the case in the near future.

In connexion therewith the Commission observed:—"It is therefore clear that the Government Agent has not fulfilled his promise made in the contract—namely, that dynamite and other explosives would be manufactured in sufficient quantities to supply the demand in the South African Republic."

With regard to the profits made by the company on the importation of explosives, apart from the profit on explosives made by it, the report contains the following declarations:—

"This importation gives the company extraordinarily large profits, which are not to be compared with the profits on explosives manufactured by the company. Your Commission finds, from the accounts which the State Secretary laid before it, that the profits of the company on blasting gelatine and guhr impregne imported and paid for by the State amount to £2 per case nearly, of which only 5s. per case went to the Republic. When this calculation is applied to the 430,000 cases, being the *minimum* to be imported in the following four years, we get as the result that if the State imported itself the Treasury would profit to the extent of £860,000, while if the company does it the State only made a profit of £107,500, making a difference of £752,000 to the detriment of the State. The profit which the State would make by importing itself would probably, after 1900, be still greater, owing to increased demand."

8. According to this it appears thus impossible to doubt that the monopoly as then carried out constituted a breach of Article 14 of the London Convention, as it was no monopoly for the general interests of State, and as it served no State interests by making the Republic independent of foreign sources, while financially the result was loss to the State, calculated at hundreds of thousands of pounds.

9. Her Majesty's Government, however, did not make its views regarding this matter known, because, in April, 1897, a Commission was appointed by the Government of the South African Republic to inquire into all matters which obstructed the development of the mining industry, and to make such recommendations as might tend to improvement and alteration. With a view to the circumstances described in the above-mentioned report, her Majesty's Government trusted that any capable commission could not neglect disapproving of the abuse of the system, and it hoped that the Government of the South African Republic would act independently regarding these abuses, and on a proposal from the commission appointed by it.

10. Regarding the recommendations of the Government Commission, the expectations of her Majesty's Government were fully justified. After hearing a number of witnesses, including the most prominent representatives of the mining industry, and Mr. Philipp, Director of the S.A. Factories for Explosives, the Commission reported on July 27 that the price of all kinds of explosives was unreasonably high. "When we take into consideration," it said, "that the increased price from 40s. to 45s. per case sold, brings no profit to the State, but serves to enrich individuals, living chiefly in Europe, the injustice of such a tax on the most important industry stands out more prominently, and demands immediate cancellation." The Commission found, as also did the Volksraad Commission, that not one of the raw materials for manufacture was to be found in the country, or only in such small quantities to make it as good as worthless for the desired purpose (an opinion further confirmed by the technical report of Dr. Loevy, published by the Transvaal Government in July, 1898) and it declared that "such" obstructions to the manufacture of explosives in the Transvaal exist, that it is almost impossible to establish a *bona fide* industry. It was "forced to the conclusion that the factory did not answer the purpose for which it was established, and that there were no sound prospects that it would become so; that good reasons exist for believing that the contractors did not fulfil the obligations of their contract, whereby before or on April 24, 1896, they had to erect, complete, and bring into working order one or more factories for the manufacture of dynamite and other explosives of such nature and quality and such quantity as would meet the demand in the South African Republic."

The Commission continued to report as follows:—"On account of the foregoing reasons, and with a view to the opinion expressed by the Raad Dynamite Commission, that the legal position of the Government against the contractors is undoubtedly strong, your Commission wishes to recommend that the matter be placed in the hands of the legal advisers of the State, in order to ascertain if the contract could be cancelled. Meanwhile your Commission recommends that the Government immediately enforce its right under Article 15 of the regulations—viz., the Government shall reserve for itself (*a*) the right, if the interests of the State demanded, to take the agency for trade in gunpowder, dynamite cartridges, and other explosives out of the hands of the above-mentioned persons, &c., and to take over immediately the importation of dynamite and other explosives for the benefit of the mining industry, subject to an import duty of 20s. per case, or such reduced sum as may be fixed from time to time. This protecting duty, which would increase the State revenue considerably, would at the same time give sufficient protection to any industry of this kind in the Republic."

11. The expectation of her Majesty's Government that the Government of the South African Republic would act in accordance with this regulation has, up to this moment, not been realized. After a lapse of nearly 18 months the monopoly still exists without any alterations. In August, 1897, the Government asked the First Volksraad to appoint another Commission to go through the report of the Government Commission *re* the mining industry, and this was accordingly done. Regarding the report dated October 16, 1897, which was drawn up by the Commission of the Volksraad, I need not say more than that it appeared that the Commission was obviously misinformed regarding the price of dynamite, but the report gave rise to a long and very important debate in the Volksraad, during which General Joubert declared that the monopoly "was indeed no more a State monopoly, but Lippert's monopoly, because he made the most profit out of it." His Honour continued that "the same reasons which existed for cancellation of the contract with Lippert still existed, and he expressed the hope that the Raad would destroy the 'Lippert' *alias* 'Vostman' contract," just as it had cancelled the former Lippert contract.

Indeed, I find in the arguments of those members who supported the monopoly no serious attempt to refute the facts and figures supplied to show that the monopolistic company made an enormous profit without the State benefiting by it.

12. Finally, the following resolution was passed on November 4, 1897, with a majority of one vote:—"The First Volksraad, taking into consideration chapter 7 of the report of the Commission regarding dynamite and explosives, now under consideration and the memorials thereanent; further, considering that in reference to this matter a contract was concluded between the Government and Mr. L. G. Vorstmann; further, considering the report of the Commission, and the explanation and facts produced by different members, that the company has not acted strictly according to the contract; resolved to instruct the Executive Council to lay this matter in the hands of the State Attorney, and other legal authorities, in order to ascertain what steps could be taken in the matter, and in order to supply the mines with cheaper dynamite, either by allowing importation by permits, subject to payment of ordinary import duties, or in such manner as the Executive Council deems desirable."

13. It appears that the Volksraad left this matter to the discretion of the Executive Council. However, all that has been done hitherto is a reduction of 10s. per case in the price of dynamite, the company agreeing to renounce 5s. and the Government likewise 5s. The reduction would be unimportant were it not that the renouncement of 5s. by the Government, being the whole amount of commission to which it is entitled, makes it more difficult than ever to understand in what respect the monopoly can be considered a State monopoly. It is, indeed, true that the Government is entitled to a portion, not exceeding 2 per cent., of the net profits, but, even if a large sum were paid to the Government for this, which, as I understand, is not the case, in consequence of the system of writing off, it can hardly be maintained that an uncertain right to a small portion of the profits of the monopoly makes it a *bona fide* State monopoly.

14. No report has, up to the present, been published by the legal advisers of the Government, although on November 15, 1898, during a discussion of the Volksraad on a memorial from the Chamber of Mines, requesting the cancellation of the monopoly, the State Attorney promised that a report would before long be laid before the Raad.

15. Her Majesty's Government now learns with astonishment that the Government of the Republic requested the Volksraad to extend the monopoly for another period of 15 years in exchange for another small reduction per case of 5s. in the price of explosives, and that it is intended at the same time to amend the concession so that it is in reality outside the Government's power to cancel it on some grounds which now threaten the position of the Company.

16. From figures supplied by the Government Commission, and already quoted, it appears that, even after a further reduction of 5s. per case, the price to be charged by the Company would still be 25s. to 30s. per case more than the same quality of dynamite could be imported, and would cause at Johannesburg on 200,000 cases, which, as was reported to the Volksraad Commission, was the yearly consumption in February, 1897, a loss of £250,000 to £300,000 per annum to the mining industry. The same Commission estimated the average annual consumption for the four years, 1897 to 1900, at 250,000 cases. According to the same rate of increase, the average annual consumption during the past four years of the period for which the concession was originally granted is 350,000 cases, representing a loss of £437,500 to £525,000; while, if the concession was extended for another 15 years, the annual loss at the end of this period would be not less than from £687,500 to £825,000. Even if only the largest portion of this enormous sum found its way into the State Treasury, it can reasonably be supposed that the tax imposed upon the general population would be reduced by that amount.

17. The Volksraad has not thus far accepted the intended proposal, but the consideration thereof has been postponed to the following Session. With a view to the fact that such a proposal has been made, her Majesty's Government feels that it cannot wait longer in making known its opinion regarding the matter to the Government of the South African Republic, and in protesting against not only the extension of a monopoly which it alleges to be inconsistent with the provisions of the London Convention, but against any further delay in taking steps to cancel or reform the concession in such a manner that it can be executed for the benefit of the State.

18. If the Government of the South African Republic should insist in proposing that extension of the period for which the monopoly was granted it must understand thoroughly that her Majesty's Government reserves the right to renew its protest, notwithstanding the granting of such extension, and it must not be understood that her Majesty's Government in any respect acknowledge the legality of the original concession, or of extension thereof.

19. I request that you will instruct her Majesty's Agent at Pretoria to hand a copy of this despatch to the Government of the South African Republic.

I have the honour to be your obedient servant,

J. CHAMBERLAIN.

THE REPLY.

The following is the reply of the Transvaal Government to the foregoing despatch :—

Pretoria, March 9, 1899.

To W. Conyngham Greene, Esq., British Agent,
Pretoria.

Hon. Sir,—I have the honour to acknowledge receipt of your letter of February 6 last, in which was enclosed a letter from Mr. Chamberlain to his Excellency the High Commissioner, dated January 13, 1899, with regard to State monopoly of explosives in this Republic.

2. In paragraph 5 of this missive it is said that her Britannic Majesty's Government is advised that the creation of a monopoly in favour of the State is not necessarily inconsistent with Article 14 of the London Convention even when exercised by a concessionaire, provided that the concession is intended in good faith to benefit the State generally and not simply to favour the concessionaire. Considering the question, viz., if the monopoly as exercised under the existing contract is for the benefit of the State in general or for the benefit of the contractor, her Britannic Majesty's Government comes to the conclusion that the profit is on the side of the contractor, and therefore the said monopoly is in conflict with the London Convention.

3. No grounds have been given as to the manner in which her Britannic Majesty's Government comes to this last conclusion, a conclusion which is not clear to this Government, and which is not in accordance with the advice obtained by it. According to this advice neither the contract for the manufacture of explosives nor the manner in which it is exercised is in conflict with Article 14 of the London Convention. The spirit and tendency of this article is clearly to the effect that foreigners residing here shall enjoy and have the same trading rights and obligations as burghers, which is the case under the existing State monopoly.

4. As Mr. Chamberlain admits, the Republic has its right to create a State monopoly for the manufacture of explosives and to have it exercised by a contractor as long as the manufacture is a "*bona fide*" manufacture (as in the present case), then the Republic is acting quite within its rights, and has itself, and exclusively, the right to fix on what conditions this manufacture shall take place.

5. This Government cannot admit that in this it depends on the question if the concession was intended in good faith to benefit the State generally, and not simply to favour the concessionaire; but, although it depended on this point (which, according to the view of this Government, as said, is not the case), then still this Government can rightly allege that only the Republic itself can and must judge what is best for it, and that, in that judgment, not only financial considerations must be taken account of, but all the circumstances which are, or could be, of interest to the country.

The measure with which the interest of the State in the maintenance of a monopoly ought to be considered is not so much the more or less large sums of money which the Government derives, or can derive, from the monopoly, as the profit and welfare which the State would miss if the monopoly were cancelled. The Government of the South African Republic is entitled to have its own views as to what is of interest to the country in connexion with the monopoly.

6. The monopoly in ammunition and explosives in this Republic has successively arisen from legal conditions which the Grondwet of 1858 contains the first regulation, and on which basis this has been built up. With the Volksraad and Government, other considerations of State interest than mere monetary profit have served. There exist State monopolies which bring in large sums of money to the State, but in the opinion of many in no way tend "to benefit the State generally." For instance, the opium monopoly. But, on the other side, State monopolies are imaginable which supply paltry immediate profit, and yet serve in the highest degree the State's interest.

7. The Government does not mean, in reference to the foregoing to admit that the existing monopoly is financially exclusively of benefit to the contractor. If such were for the Government to do, it could prove that the conclusions of Mr.

Chamberlain are incorrect, and that the financial profits of the State do not compare unfavourably with those of the contractor.

8. It is not clear to the Government to what degree its present of 5s. per case dynamite to the mining industry makes the State monopoly less *bona fide*. Arguing according to the principle laid down in paragraph 5 of the missive now under reply, it can even be contended that this renouncement of 5s. per case takes place "to benefit the State generally." Even though the Government wants to give all its income derived from the monopoly to the mining industry as a present, then it can neither be reproached therefore, nor can it be alleged that it thereby ceases to be a "*bona fide*" State monopoly.

9. In different paragraphs in the said missive under reply quotations are made from the Commission reports. This Government desires to remark thereanent that Mr. Chamberlain himself does not always admit the accuracy of these reports, and in connexion therewith used the strong expression, "singularly ill-informed." Apart from the question whether Mr. Chamberlain always understood these Commission reports well, and whether these reports are not sometimes the result of wrong or insufficient information (questions which the Government does not wish to go into), the Government shall confine itself to remarking that it appears from the letter of Mr. Chamberlain that it is dangerous to accept unconditionally the facts mentioned therein.

Moreover, these reports deal with a condition as it existed formerly, and not as it is at present, and this last alone is here of actual interest. The proposed reformation of the existing contract would be a breach of existing and established rights, and thus directly destined to exercise a prejudicial influence upon the good name and welfare of this Republic.

10. On the above-mentioned grounds, this Government considers that her Britannic Majesty's Government is not justified in protesting, as now formulated by it.

I have the honour to be your obedient servant,

F. W. REITZ, State Secretary.

NOTES.

THE NOBEL DYNAMITE TRUST CO., LTD.—The accounts of this Company for the year ending 30th April last show net profits of £266,612, which, added to £13,159 brought forward, makes a total available profit of £279,771. The directors recommend a dividend at the rate of 12 per cent., which will leave £5,523 to be carried forward. The report states that the profits from blasting explosives have suffered further reduction by reason of keen competition which has extended to all important markets. The auditor's certificate appended to the balance sheet contains the following clause:—"We beg to call the attention of the Shareholders to the fact "that, as Directors of numerous Subsidiary Companies, the "Directors of this Company have received large sums for "their services, in addition to the remuneration stated "above. These payments do not appear to have been justi-"fied." The directors refer to this clause in their report in the following terms:—"With regard to the remarks by the "Auditors in their certificate, your Directors have to state "that, contrary to the view expressed by the Auditors, they "are advised that by the Articles of Association of the Com-"pany, which specially authorise the Directors to occupy "seats on the Boards of the Subsidiary Companies, neces-"sarily imply the payment of fees for the services, continuous "and arduous in character, rendered by the Directors of "these Companies. The question is, however, complicated by "the apprehension that any publication of the sources of income "or profits of the Subsidiary Companies, on which latter the "fees of the Directors of these Companies are based, might, in "view of the exceptional prosperity enjoyed by your undertak-"ings during recent years, considerably prejudice the interests "of the Shareholders for the future. The matter is, however, "having the careful consideration of the Directors with a "view to putting it beyond question at an early date." Of course, this is a subject which it would be impossible to discuss with any degree of fairness until the directors have had an opportunity of making a full statement on the subject. Chartered accountants are bound by very stringent rules regarding the payments which they are entiled to authorise. In the present case they may simply be labouring under a technical difficulty, which can be set right by a vote of the shareholders, or else they wish to raise a much more considerable question to be ventilated in the enquiries which are bound to follow; and as there is no data for entering upon a discussion of the question upon either of these lines, it would be idle to go into vague generalities regarding the relative positions of auditors and companies which have very little bearing upon the actual points at issue.

NORMAL POWDER.—We recently took the opportunity of visiting the works of the Normal Powder and Ammunition Co., Ltd., at Hendon, for the purpose of examining the operations of loading Normal powder into cartridges on the Erskine system. An ordinary Erskine cartridge loading machine was arranged with the 2¼ dram tray, and normal powder was loaded into the cartridges on the ordinary system. We tested a series of cartridges which had been loaded in this manner, and we found that the standard charge of 31 grains had been accurately measured off to within as nearly as possible half a grain. The same measure used for shot loads 1 1/8 oz. bare, and with the cases supplied by the Normal Powder Co., wadded according to the system recommended by them, excellent patterns at 40 yards were produced. We understand that the object of this company, in making known this method of loading their powder, is to enable retailers to purchase their own supplies and do their own loading. The Normal Powder Co., as is well known, have done a large trade in loaded ammunition which has been supplied partly to shareholders and other private sportsmen, and partly to the retail trade. Now that a demand has been created for Normal cartridges, the Company is, we understand, desirous of modifying the conditions of its business so as to reach the consumer *via* the retailer, either by supplying the latter with powder or with loaded cartridges for retailing in the ordinary way.

MESSRS. WESTLEY RICHARDS & CO., LTD.—In consequence of the death of the late Mr. Westley Richards, a new company has been formed for the purpose of taking over this business, and running it on a more comprehensive basis. The conversion of the Company consists in its registration with £100,000 of capital, £30,000 of which is in 5 per cent. cumulative preference shares, and a similar amount in ordinary shares, leaving a further £40,000 of unissued capital for possible future requirements. The purchase price for the concern being taken over is £52,000. The whole of the ordinary shares are issued to the vendors as part payment of the purchase price, while the balance of £22,000 will be payable either in cash, or partly in cash and partly in preference shares. The balance of £8,000 will be added to the assets

taken over in the agreement, and will provide funds for completing the new factory and increasing the working capital. Mr. Leslie B. Taylor has been appointed managing director of the new Company, and his co-directors are Mr. John D. Deeley, Mr. H. Richards, and Mr. G. D. Deeley. The reason for Mr. Deeley's retirement from the managing directorship of the old company to an ordinary directorship of the new company, thus relinquishing the reins of management to Mr. Taylor, is due to his desire to rest somewhat after a life of great activity. He, of course, remains the largest shareholder in the Company, but he may rest satisfied that his interests are in good hands. Mr. A. H. Gale will continue to act under the new Company as manager of the London premises in New Bond Street, and we are pleased to hear that his noteworthy services in the past have been suitably recognised under the terms of his appointment by the new Company. Mr. D. J. P. Haines, the manager of the Corporation Street (Birmingham) branch of the Company's business, has also entered into an agreement with the new Company for a period of years.

CURTIS'S & HARVEY, LTD., v. MACNAB.—This very interesting appeal case came up before the Attorney-General on the 12th April last, resulting in the dismissal of Mr. Macnab's appeal against the decision of the Comptroller, who ordered Curtis's patent for the Elephant Cartridge to be sealed, and upholding Curtis's appeal against the Comptroller's decision allowing oxalate of ammonium to remain in Macnab's patent. The result was, therefore, that Curtis's patent was allowed, and any express reference to oxalate of ammonium in Macnab's patent was ordered to be taken out.

The matters in dispute were of a complicated nature. It appeared that on the 14th April, 1897, Mr. Macnab lodged a Provisional Specification for an improvement in Blasting Cartridges, confining himself to the use of an explosive consisting of dry meal guncotton, which he claimed to render safe for use in fiery mines, by inserting therein a tube containing a charge of ammonia solution, or by using ground rock salt, or similar acting flame cooling salt, or substance as a tamping pellet, placed either in the interior or top of the cartridge.

In the complete Specification filed on the 16th May, 1898, it was found that Mr. Macnab claimed that he might use his process in connection with gunpowder, and also particularly claimed ammonium oxalate, which claims Curtis's and others opposed on the ground, as they alleged, that Macnab had obtained his invention from them, and that they were the first to combine in one cartridge containing gunpowder the cooling medium referred to by them for extinguishing flame or lowering the temperature of same when fired for blasting purposes in fiery mines. They claimed several substances, including oxalate of ammonia.

This is the cartridge known as the "Elephant" Permitted Cartridge, which was the first of the gunpowders to find a place on the Permitted List, and was referred to in the *Colliery Guardian* on the 22nd April, 1898. (*From a Correspondent*).

MESSRS. KYNOCH, LTD.—The report and balance sheet of this Company for the year ending March 31st, 1899, has recently been issued. The accounts show a net profit of £51,006, which, added to £8,445 brought forward, makes an available total of £59,451. £7,375 of this was appropriated for an interim dividend of 2½ per cent. on the preference shares, and a further £5,000 will be absorbed by directors' fees. The balance will be dealt with by a further payment to make up 5 per cent. on the preference shares, and by the distribution of a dividend on the ordinary shares of 10 per cent. for the year. The balance, amounting to £14,701, will be carried forward. The report states:—"During the past year the "continued increase in the Company's sales, combined with "the large capital outlay, required principally by the Thames "and Witton Works, convinced the Directors that an addi- "tion to the Company's Share Capital was needed, and they "were further convinced that they could rely on the profit- "earning capacity of the new departures to pay dividends on "a reasonable increase of Share Capital. They, therefore, "issued 5,000 preference shares of £10 each at a premium of "£2 per share. These were offered to the Shareholders, and "the premium obtained, £10,000, less expenses incurred in "connection with the increase of Capital, carried to the "Reserve Fund, which now stands at £69,566 0s. 8d. At that "time an even larger addition to capital appeared to be re- "required, but the Directors were satisfied that no large "amounts would be needed for works or plant during the "coming year, and they anticipated a considerable release of "capital now engaged under the heads of Stock and Debtors, "Under these circumstances, they determined to wait events "before pledging the Company to any larger addition to the "Share Capital than the 5,000 Preference Shares which "represented an increased charge of £2,500 per annum. The "Works have been fully engaged during the year, orders for "the United States of America and other Governments "adding to the employment usually provided by the British "Government's requirements. The Sporting Season was not "generally considered a good one, but the unqualified success "of the Kynoch Smokeless Sporting Powder made the Com- "pany's business highly satisfactory in this department. In "Smokeless Powder, as in some other businesses, a very large "sale renders possible the employment of first-class experts, "whether as Chemists or as Engineers, and the constant in- "troduction of the latest and best machinery, these being ex- "penses which, in a small business, eat up the profits. In "this way the Kynoch Company have taken advantage of "their immense business in Cordite—the largest in the world "—to apply to their Sporting Smokeless Powder the same "tests of materials and output that they are accustomed to "with their military powders. The Kynoch Estate Company "was formed during the year with a capital of £30,000, and "the shares, with the exception of a few reserved for local "application or special purposes, were offered to the Kynoch "Shareholders at par, and taken up by them. They now stand "at a small premium." The balance sheet shows £545,000 of issued capital, £161,348 of creditors, £12,127 advance on mortgage, and £69,566 reserve fund. These amounts appear on the liability side of the account, and to them is added the sum of £52,076 for undistributed profits at the time the balance was drawn. All these items, with odd shillings added together, amount to £840,117. The assets side of the account shows how these items are represented in the belongings of the Company, and we have summarized the totals as follows:—

Property and Plant, with additions charged to Capital ..			£443,323
Stock in Trade:—Materials	£76,079		
Orders in Progress	61,530		
Stock of Finished Work ..	86,780		
			224,389
Sundry Debtors			170,524
Cash in Hand			881
			£840,117

CORRESPONDENCE.

THE EXPLOSION AT ST. HELEN'S.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—Chemists will await with considerable interest the result of inquiries to be made by the Government officials into the cause of the terrible explosion at St. Helen's.

Previous research does not justify the suggestion that $KClO_3$ is itself an explosive compound, although its decomposition to KCl and O_3 is accompanied by an evolution of heat.

The fact that a fire was raging in the building some minutes before the actual explosion is undoubtedly an important consideration in drawing any deductions as to the cause of the disaster. The building would naturally become filled with volumes of smoke largely consisting of free carbon and the numerous hydro-carbons, meanwhile the chlorate becoming heated to such a degree that decomposition began with evolution of oxygen, the latter would be gradually diffused among the hydro-carbons, and would form an explosive mixture, the explosive force of which would explain the terrible damage done, as those especially who have done research on the explosion of gaseous hydro-carbons with O_2 will admit.

Again, if much unchanged chlorate were found scattered about, this would lend weight to the above view, for the batches of chlorate were in close proximity, and it is unlikely that an "explosion wave" which caused such devastation would traverse a portion of the mass and not be transmitted to succeeding portions.

Yours faithfully,

J. BOWER.

Stowmarket, May 17, 1899.

APPLICATIONS FOR PATENTS.

APRIL 15th—MAY 13th, 1899.

8,033. The Construction of Ordnance. H. C. W. Emery and W. H. Worsley.
8,046. Automatic Guns. A. T. Dawson and L. Silverman.
8,197. Drop-down Breech-loading Guns. E. C. Green and F. Green.
8,223. Testing and Firing Electric Primers. G. C. Frazer and G. K. B. Elphinstone.
8,274. Ejector Mechanism. D. N. Bertram and S. Milne.
8,278. Shells for Ordnance. W. G. Potter.
8,371.* Coin Freed Magazine Shooting Apparatus. A. Archibald.
8,409.* Explosive Substance for Fire-arms. R. F. Leuschel.
8,473. Means for Adjusting Elevation of Ordnance. A. Riechwald (*Agent for Fried. Krupp, Germany*).
8,650.* Apparatus for Teaching and Checking Aiming and Firing in Shooting. E. Stark.
8,679.* Explosives. T. H. Kelley, G. W. Bell, and R. P. Kirk.
8,680.* Explosives. T. H. Kelley, G. W. Bell, and R. P. Kirk.
8,758. Projectiles for Ordnance. A. T. Dawson, L. Silverman and G. T. Buckham.
8,761. Pistol-swords. B. Reyes.
8,967. Single-Trigger Mechanism. H. J. Blanch.
9,003. Blasting Apparatus. W. F. Bennett.
9,040.* Breech-loading Fire-arms. G. Luger.
9,043. Torpedo Boats. Dr. A. E. Bréchot.
9,062. Explosives. C. H. Curtis and G. G. André.
9,125. Recoil-operated Small-arms. H. F. Woodgate.
9,152. Feed Mechanism of Automatic Fire-arms. H. W. Gabbett-Fairfax.
9,292. Means for Closing the Breech of Ordnance. W. G. Potter.
9,315. Apparatus for Steering Torpedo Boats from a distance. J. T. Armstrong and A. Orling.
9,335. Mountings of Turret and Barbette Guns, and Apparatus for Supplying Ammunition. A. T. Dawson and J Horne.
9,341. Field Gun Carriages. Sir W G Armstrong, Whitworth & Co., Ltd., Sir A. Noble and R. T. Brankston.
9,342. Breech Mechanism for Guns. Sir W G. Armstrong, Whitworth & Co., Ltd., A. G. Hadcock and S. M. Murray.
9,411. Eye-pieces for Sighting Telescopes. W. Ottway.
9,415. Mountings for Large Calibre Twin Guns in Barbette or Turret. A. T. Dawson and J. Horne.
9,416. Ammunition Hoists for Turret or Barbette Guns. A. T. Dawson and J. Horne.
9,417. Mountings for Turret or Barbette Guns of Medium Calibre. A. T. Dawson and J. Horne.
9,440. Projectiles. J. Luciani (*Date applied for in France under Patents Act, 1883, Sec. 103, 30th Nov., 1898*).
9,481. Envelope or Packing for the Charges for Ordnance. A. Riechwald (*Agent for Fried. Krupp, Germany*).
9,482. A Rammer for Ordnance. A. Riechwald (*Agent for Fried. Krupp, Germany*).
9,505. Rapid Fire Guns. P. M. Justice (*Agent for the Driggs Seabury Gun and Ammunition Company, United States*).
9,578. Mountings for Quick-firing Guns. A. T. Dawson and G. T. Buckham.
9,718.* Illuminating Projectiles. W. J. Wilson and H. C. Turnbull.
9,760. Automatic Breech-loading Fire-arms. J. L. Copping and G. D. Treece.
9,785. Explosives. R. C. Parsons and D. W. Nightingale.
9,787. A Method of Adapting Small Game-shot Cartridges so that they may be used for Big Game or for Longer Ranges. W. E. E. Lloyd.
9,847.* Cartridges. H. Henneberg.
9,881. Recoil Carriage with Automatic Return-action for Field-guns. The Hotchkiss Ordnance Co., Ltd.
9,891. Double-barrelled Fire-arms. G. F. Whitby.
9,930. Shot-gun Cartridge-wads. F. Greener.
9,934. Guns. J. Hely-Hutchinson.
9,953. Time-fuses for Projectiles. J. Wetter.
9,996. Manufacture of Explosives. A. Luck.
10,071. Manufacture of Explosives. H. S. Maxim.
10,131. Breech-loading Small-arms. T. R. R. Ashton.

*These Applications were accompanied by Complete Specifications.

SPECIFICATIONS PUBLISHED.

APRIL 29TH—MAY 20TH, 1899.

8,189 (April 6th, 1898). J. Milnes, Southport. A means of firing war rockets by enclosing them in shells with an opening at the point through which the rocket escapes. The shell is made in halves, which are afterwards bolted together. The rocket is fired by a time fuse, and is guided by sticks, which are attached to its base. Accepted April 6, 1899.

8,516 (April 12, 1898). James Judge, Walker-on-Tyne. A machine gun, which is discharged by mechanical power, explosives being entirely done away with. The projectiles are discharged by centrifugal force. A disc, which is attached to a shaft, has on its edge several arms or projections, which mechanically pick up and discharge projectiles on being rapidly revolved. Accepted April 12, 1899.

8,707 (April 14, 1898). W. Davis, Enfield Wash. A pull-through for cleaning rifles, consisting of a combination of wire gauze and rough felt. The felt may be compressed by a nut attached to the end of the pull-through, thus expanding the gauze and keeping an even pressure on the bore of the gun from end to end. Accepted April 14, 1899

8,929 (April 16, 1898). H. W. Gabbett-Fairfax, London. A stock which may be attached to a pistol to allow the latter to be used either as a pistol or as a carbine. The stock is hooked on to the pistol butt by an angular movement, and is secured by a thumbscrew. Accepted April 15, 1899.

9,068 (April 19, 1898). H. W. Gabbett-Fairfax, Leamington. A method of locking the breech bolt of a recoil-operated pistol in the firing position by means of a rotative locking head, upon which are projections which engage with corresponding flanges on the breech-end of the barrel. Accepted April 15, 1899.

10,540* (May 9, 1898), H. C. L. Holden, Woolwich. Pressure Gauge for Ordnance.

10,949* (May 18, 1898). J. Robertson, London. The Boss Selective Single-trigger Mechanism.

11,387 (May 19, 1898), E. Müller, Switzerland. A device consisting of a double-armed lever pivotted to the frame of the

cannon, the object of which is to withdraw the spade-brake from the ground and bring the cannon again to its shorting point. Accepted April 29, 1899.

11,468 (May 20, 1898). W. Field, Birmingham. A method of carrying a greater number of cartridges in a rifle by means of a telescopic extension attached to the ordinary magazine, which is always pressed upwards by two spiral springs. Also a system of ejector-mechanism of the type in which a projection flips the cartridge out of the breech after it has been withdrawn from the chamber by the breech bolt. Accepted April 8, 1899.

12,050* (May 27, 1898). C. O. Ellis and E. W. Wilkinson, Birmingham. The Osborne Single-trigger Mechanism.

12,264 (May 31, 1898). O. Imray, London. (*Agent for A. B. Markham, France*). A method of firing a shell by means of a percussion fuse which is screwed into the shell at the side in order to remove the objection of weakening the head of the shell when the fuse is placed at the nose, and to do away with any liability to premature ignition which may arise from firing the fuse in the base Accepted April 15, 1899.

12,311 (June 1, 1898). W. H. Watts and J. Knowles, London. A means of adapting the distance from the trigger to the butt of the stock to suit any particular length of arm. This is accomplished by means of an adjustable trigger plate, which can be moved in a longitudinal direction. Accepted April 29, 1899.

12,404 (June 2, 1898). C. H. Curtis, D J. Metcalfe, A. F. Hargreaves, and A. C. Pearcy, London. A method of increasing the safety of explosives by mixing with the explosive a cooling material, bicarbonate of potash ($KHCO_3$) being used in this case. It may either be incorporated with the explosive in the process of manufacture, or mixed in the form of crystals with the explosive in its completed state. Accepted April 29, 1899.

13,115 (June 11, 1898). The Earl of Dundonald, London. A light ammunition carriage, built with a steel frame, over which is stretched cord netting covered with raw hide, the object of which is to enable ammunition to be rapidly conveyed to the front in action. Accepted April 29, 1899.

15,468 (July 14, 1898) A. Riechwald, London. (*Agent for Fried. Krupp, Germany*). A form of ordnance breech-loading mechanism in which the striker is always uncocked until the trigger is drawn back for firing. This mechanism requires no other spring besides the ordinary mainspring. Accepted April 29, 1899.

23,634 (Date of application in United States, April 13, 1898. First application in United Kingdom, Nov. 9, 1898). L. L. Driggs, New York, and N. Compton, Washington. A modified form of mechanism for operating the breech-block of ordnance, and a method of extracting and ejecting the empty cartridge case. These modifications are particularly applicable to that class of guns in which the breech-block is first lowered, and is then swung backwards and downwards in opening. Accepted April 29, 1899.

27,110 (December 22, 1898). E. R. von Skoda, Bohemia. A method of neutralising the recoil of big guns by the friction of rigid lamellæ, which rotate relatively with one another, and are pressed against each other by a spring. Also a means of running out the gun by compression of elastic devices which effect the running-out without any shock in consequence of the braking of the lamellæ. Accepted April 29, 1899.

27,514 (December 30, 1898). W. S. Sims, New York. A modified form of a powder pneumatic gun for throwing high explosives. Accepted April 29, 1899.

27,527 (December 30, 1898). Dr. A. Zeke and K. Rédl, Hungary. A method of automatically operating Mannlicher rifle mechanism by the recoil. Accepted April 15, 1899.

2,711 (February 7, 1899). W. D. Litchfield, Boston. An electromagnetic device for operating the guiding and propelling mechanism of a torpedo from any distance. Accepted April 8, 1899.

3,247 (February 14, 1899). A. J. Brown, Matlock. The manufacture of an explosive by compouding 4 parts of turpentine oil with 1 part of collodion cotton. These are heated to about 40 degs. C., and 30 parts of nitroglycerine added, and the temperature raised to 75 degs. C. in a water bath. The gelatine thus produced is then mixed with 40 parts of nitrate of potash, 27 parts of Epsom salts, and 1 part of soda. The whole compound is then kneaded. The soda is added to neutralise any acetic or formic acid which may have been formed through the oxidation of the turpentine oil. This explosive is claimed to be flameless. Accepted April 29, 1899.

4,426 (February 28, 1899). H. W. Gabbett-Fairfax, Leamington. A method of increasing the stopping power of projectiles by forming the nose of the bullet with longitudinal slits, so that on impact the nickel casing will open out or expand. Accepted April 29, 1899.

4,798 (March 4, 1899) A. T. Dawson and G. T. Buckham, London. A modified form of percussion fuse fixed to the side of the shell instead of at the top or bottom. Accepted April 29, 1899.

* These applications are more fully described under "Selected Patents."

SELECTED PATENTS.

THE BOSS SELECTIVE SINGLE-TRIGGER MECHANISM.

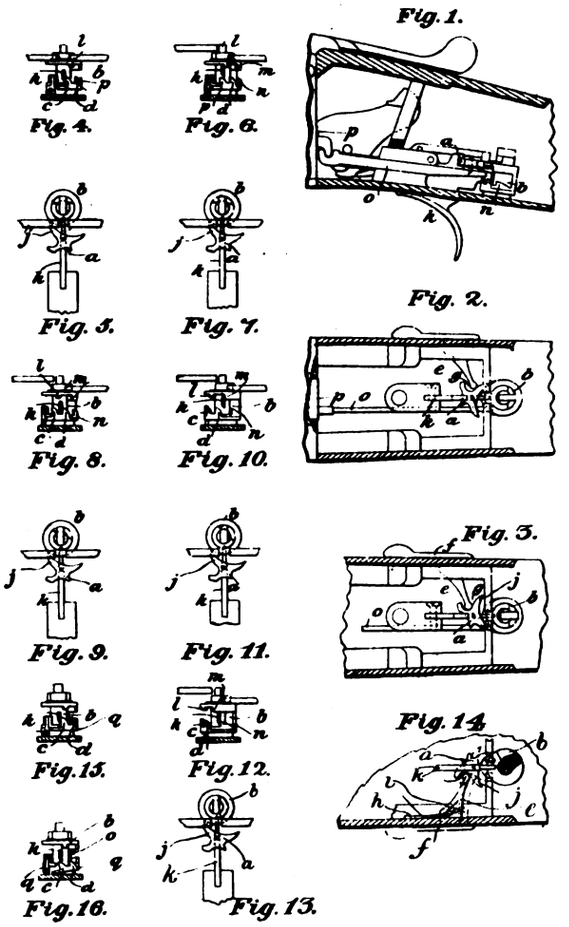
10,949. (May 13, 1898). J. Robertson (trading as Boss & Co.), London. This patent relates to some further modifications to the "Boss" single-trigger gun. The mechanism with which this patent deals allows the shooter to control by a thumb-piece the order of firing the two barrels, viz., right and left, or left and right, respectively. A slide which is attached to the lock plate has an arm attached to it which passes through the lock plate, the end engaging with a recess in a movable part attached to the top of the trigger. The part attached to the trigger is arranged upon a pivot and has two arms, only one of which may occupy a position beneath its corresponding sear. By means of the slide on the lock-plate this movable part, which works on a vertical pivot, may be turned so that it shall engage with the sear which is required to be released first. The first pull of the trigger discharges the barrel, and an interceptor is employed to prevent the premature discharge of the second barrel by the "involuntary pull." The capstan cannot rotate sufficiently to engage with the second sear until after the involuntary pull has occurred.

In the annexed drawings Fig. 1 is a side elevation of the whole of the mechanism, and Fig. 2 is a plan of the same. In both these illustrations the mechanism is shown turned over to the right and ready to discharge the right-hand barrel. Fig. 3 is a plan of the mechanism ready to fire the left-hand barrel first. Figs. 4 to 13 inclusive show the mechanism in the different positions of the parts during the complete series of operations of firing both barrels of the gun. Every position is shown in plan and in elevation. In Fig. 14 a sectional plan is shown, taken from underneath the mechanism, of the part which is employed to turn the piece *a* either beneath the left or right sear. Figs. 15 and 16 are views of the circularly reciprocating capstan *b*, to which is attached the projections *c* and *d*, which intercept the trigger-blade until the involuntary pull has occurred.

The selective mechanism is shown in detail in Fig. 14. The arm *e* which is attached to the slide *f* passes through the lock-plate, and its end *g* engages with the corresponding recess in the movable part *a*, which is pivotted to the top of the trigger-blade. The spring *h* serves to retain the arm *e* in either of its two positions. In the illustration the mechanism is shown in full lines in a position ready to discharge the left-hand barrel. Should the slide *f* be pushed forward, the spring *h* would be compressed by the pin *i* attached to the arm *e*, and the mechanism would assume the position shown by the broken lines. In pushing the slide forward the arm *e* causes the part *a* to rotate upon its pivot, bringing the arm *j* beneath the right-hand sear. Thus it will be seen that the mechanism may be adjusted so that the order of firing the two barrels may be controlled by the movement of the slide *f*.

The following operations take place upon pulling the trigger. The part *a*, which is pivotted to the top of the trigger is, in Figs. 4 and 5, shown beneath the right-hand sear in a position ready for discharging the corresponding barrel. Upon raising the trigger the part *a* is lifted, and by means of its arm *j* which raises the sear

the barrel is discharged. In Fig. 6 the end of the trigger blade *k* is shown in its raised position, and as it is now removed from the front of the projection *c*, the capstan is free to revolve on its pivot until stopped by the projection *l*, Fig. 6; but upon the involuntary relaxation of the trigger, the trigger blade *k* falls back and catches in front of the projection *d*, Fig. 8. The trigger is then raised as seen in Fig. 10, by the involuntary pull, and the capstan is free to revolve once more. The trigger blade again stops the capstan's revolution by catching in front of the projection *m*, Fig. 10; and upon the release of the trigger it falls back into the front of the catch *n*. The revolution of the capstan has, however, brought round the part *m*, the under side of which presses against the top



of the trigger blade, so that upon the trigger being pulled a third time the whole capstan, which has become unlocked in its revolution, is raised, and, being situated beneath the sears, the undischarged barrel is fired. The same series of operations takes place when the left-hand barrel is discharged first except that the right-hand sear is raised by the capstan upon the third pull of the trigger.

Upon opening the gun after the discharge of both barrels the capstan is returned to its normal position by the rod *o* which is attached to the lever bolt *p*. Upon turning the lever to open the breech the rod *o* is pushed in a backward direction. In travelling backwards the end of the rod pushes against the side of the capstan *b* and causes it to rotate upon its pivot against the action of its spring. The end of the trigger blade then falls in front of the projection *c*, and holds the tumbler in its normal position.

To prevent the premature discharge of the second barrel in opening the gun when only one barrel has been discharged, the projections *c* and *d*, which, if rigid, would tend to raise the trigger when turning with the capstan, are made separate from the capstan. These projections *c* and *d* are formed upon a spring collar *q*, Figs. 15 and 16, which surrounds the lower part of the capstan. It will be seen that when the capstan turns, it is the projections *c* and *d* which are depressed, and the trigger is not raised by the projections. Fig. 16 shows this, and it should be understood that the projections *c* and *d* are depressed by coming up against an inclined plane on the under-side of the trigger-blade. Accepted, April 15, 1899.

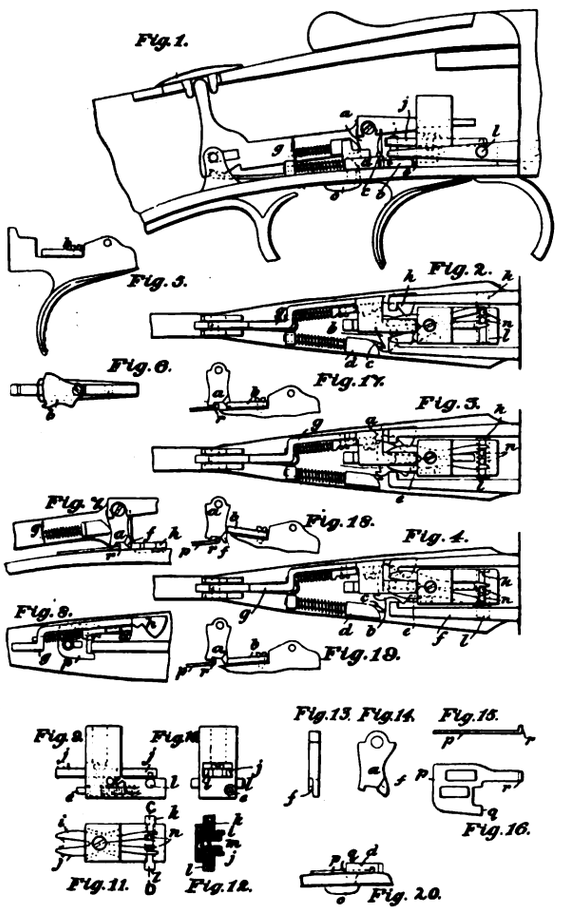
THE OSBORNE SINGLE TRIGGER MECHANISM.

12,050 (May 27, 1898). C. O. Ellis and E. W. Wilkinson (trading as Charles Osborne & Co.), Birmingham. This patent relates to single-trigger mechanism for double-barrel guns constructed on the lines of the particular type in which a switching arm is made to travel from beneath one sear to a similar position on the opposite side beneath the other sear. To prevent the accidental discharge of the second barrel by the "involuntary pull" caused by the recoil, a projection is placed so that it shall intercept the switching arm midway in its movement from beneath one sear to the other, the involuntary pull being essential for the release of the switching arm and for allowing it to take up its final position beneath the second sear. Attached to this mechanism is also a scissor-like arrangement, which automatically locks the left sear when the switching arm is beneath the right sear, and *vice versa*. In the accompanying illustrations Fig. 1 is a side elevation of the whole of the mechanism on the trigger-plate, and Fig. 2 is a plan of the same. Both these illustrations show the switching arm in a position ready for firing the right-hand barrel. Fig. 3 is a plan showing the switching arm in an intermediate position ready for the involuntary pull, which releases the switching arm and causes the mechanism to take up a position ready for firing the left-hand barrel, as shown in Fig. 4. Figs. 5 and 6 show side and plan views of the trigger and switching arm in detail. Figs. 7 and 8 show views of the lever which arrests the movement of the switching arm midway between the two sears; and also a sliding plate, the object of which is to remove the intercepting lever by means of a backward movement caused by a stud beneath the trigger plate, thus allowing the left-hand barrel to be fired first. Fig. 8 is a sectional plan through A B, Fig. 7. Figs. 9 and 10 show side and end views of the sear-locking arrangement. Fig. 11 is a plan of the same, and Fig. 12 is a sectional view through C D, Fig. 11. Figs. 13 and 14 show the intercepting lever in detail. Figs. 15 and 16 are views of the sliding plate, by means of which the left-hand barrel may be discharged first. In Fig. 17 the switching arm is shown in its intermediate position, having been arrested by the lever *a*. Fig. 18 shows the position of the switching arm after the involuntary pull at a point when the arm is free to pass over to the left-hand sear. In Fig. 19 the arresting lever has been withdrawn by pushing the stud back (shown in Fig. 20), to allow the switching arm to pass over from the right-hand to the left-hand sear.

In Fig. 1 the mechanism is shown in a position ready for firing the right-hand barrel, the switching arm *b* being retained beneath the right-hand sear by the catch *c* on the bolt *d*. Upon the trigger being pulled the switching arm is raised above the catch *c*, and having fired the right-hand barrel, is free to fly over to the left under the tension of the spiral spring *e*; but it is intercepted midway by the lever *a* attached to the safety mechanism. The involuntary pull due to the firing of the first barrel causes the end of the switching arm to slide up the inclined plane (Figs. 13 and 14), and thus pushing the intercepting lever out of its path, and so allowing it to continue its lateral travel, and to take up its final position beneath the left-hand sear. Upon opening the gun, after firing the left barrel, the safety

slide *g*, which is automatically pushed back into the safe position, forces the switching arm back to its right-hand position by means of its cam *h*.

A safety locking device is also included in this patent, consisting of a scissor-like arrangement, shown in Figs, 9, 10, 11, and 12. Between the arms *i* and *j* is a projection which is attached to the top of the switching arm. The other ends operate the cross arms *k* and *l*, both of which are pressed outwards by the spring *m* (Fig. 12). The cross bolts are carried backwards and forwards in a lateral direction



by the upstanding pegs *n*, the latter being operated by the ends of the arms *i* and *j*. The sears are provided with holes, so that when the switching arm is carried over to the right-hand position, the cross bolts are carried in an opposite direction by the ends of the arms *i* and *j*, thus locking the left-hand sear by cross bolt *k*, which fits into the hole in the sear made to receive it. Of course, when the switching arm is in the left-hand position the right-hand sear is locked in the same way by the bolt *l*.

A knob *o* beneath the trigger plate is provided for the purpose of allowing the left-hand barrel to be discharged first. The knob is in direct communication with the bolt *d*, so that when the knob *o* is pushed backwards the bolt is also caused to move in a backward direction, pushing with it the slide *p* (Fig. 16), which lies flat on the trigger plate, the point *q* of the slide lying immediately behind the bolt *d*. The slide *p* has another projection *r*, which engages with the bottom of the intercepting arm *a*, so that when the bolt *d* is pushed backwards, the intercepting arm *a* is also pulled out of the plane of motion of the switching arm, this being effected by means of the slide *p*. The switching arm is freed from the catch *c* of the bolt *d* by the backward movement of this bolt, and the intercepting arm having been removed, the switching arm flies over to the left-hand sear ready for firing the left-hand barrel. Should it be required to fire the right-hand barrel after leading off with the left-hand barrel, the safety is moved back to safe, and is then pushed forward again. By this operation the switching arm is pushed over to the right by the part *h*, and is fixed in that position by the catch *c*. Accepted April 22, 1899.

A PRESSURE GAUGE FOR ORDNANCE.

10,540 (May 9, 1898). H. C. L. Holden, Woolwich. This patent relates to a pressure gauge for use in ordnance as a substitute for the ordinary standard crusher gauge. The apparatus consists of a steel box in two parts, the upper of which screws into the lower. These are shown in the accompanying illustrations. In the top part *a* a hole is bored in which a piston *c* works. The bottom of the piston bears upon the top of a volute spiral spring *e*, which is situated in the bottom of the box, so that any pressure which is applied to the top of the piston causes the spring to be compressed. The base of the spring rests upon a disc *f*, separately shown in Fig. 2, in the centre of which is fixed a vertical tube *h*. Through the tube slides a rod *g*, which fits fairly tightly. The rod is adjusted so that its top is flush with the top of the spring and touching the bottom of the piston. It will be seen that directly

Fig. 1.

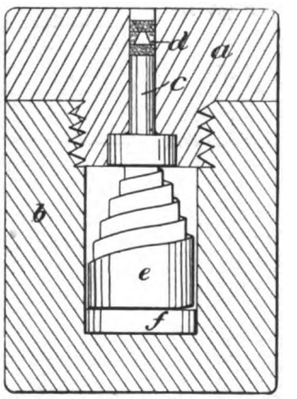
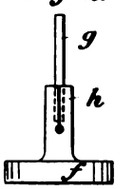


Fig. 2.



any pressure is applied to the top of the piston, the spring is compressed and the rod *g* is forced into the tubular piece *h* to the exact extent that the spring is compressed. The spring returns to its former length immediately the pressure upon the piston is removed, but the rod remains and registers the amount the spring has been compressed. The top of the box is removed, and the difference between the height of the rod in its first position and after it has been pressed downwards represents the amount of compression the spring has sustained. The area of the piston and the strength of the spring being measurable quantities, the pressure per square inch is directly calculated therefrom. The gas check *d*, which is made on a system patented in the past by the same inventor, serves to prevent escape of gas between the piston and the sides of the recess in which it works. Accepted April 8, 1899.

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CONTENTS.

CURRENT TOPICS.

The International Rifle Match.—Probably Major the Hon. T. F. Fremantle regrets by this time that he organized a British team to take part in the International Rifle Match, which was recently held at the Hague. In our opinion his regret does not arise from the fact that the English team were fairly beaten in open competition by all the other teams competing, because Major Fremantle is, to our knowledge, much too good a sportsman to object to a defeat which was fairly administered. Where the cause for regret arises is in the fact that the English team competed under conditions which could offer no hope of success to a body of shooters who were in no way practised in the peculiar form of shooting upon which the proficiency of the various teams was tested. In Great Britain, in fact wherever the British flag flies, the conditions of rifle shooting are based upon the rules of the National Rifle Association, of which Major Fremantle is an active member of the Council. The N.R.A. has invariably drafted its rules strictly with the view of improving rifle shooting under conditions as nearly as possible approximating those of actual warfare. The effect of these rules has been to develop skill in rifle shooting in this country upon definite lines, and it follows therefrom that British competitors will always be at a disadvantage when competing in events, the conditions of which place a premium upon a specialised form of skill not cultivated in this country. The whole of the shooting took place at 300 metres (328 yards) and forty shots were fired in each of three positions, viz., standing, kneeling and prone. Further, no restrictions were placed upon the weight of the trigger pull, with the result that other competing teams used hair triggers and special match rifles. Those who take the trouble to study the shooting made in foreign countries under conditions of this sort will realize the specialized nature of this "tack-driving" form of rifle practice, and how hopeless it would be to compete with it without special arms and prolonged experience. If ever this form of shooting becomes popular in this country, it will be about as separate a sport from ordinary rifle shooting as shooting with a saloon pistol is different from revolver shooting. Shooting under the rules of the N.R.A. is almost entirely a question of judging the wind, the positions of shooting being such that most shooters of experience have no difficulty in holding the rifle sufficiently straight, and pulling it off when in correct alignment. Shooting at 328 yards in the standing or kneeling position is chiefly a question of sympathy between eye and finger, which can only be cultivated in its highest stages by long practice. The finger which is used to pulling off a 6 lb. trigger would be of little use for snapping at the bull at the precise moment when the sights show the correct alignment to be momentarily attained, and even where hair triggers had been fitted it would be some time before full advantage would be taken of the improved conditions. The English team might have done better—it might have done worse—but, unlike some of the writers in the public press, we will postpone our lamentations of British marksmanship until the day when hair triggers are officially adopted by the Service. In the meantime we rely upon the conditions of the N.R.A. shooting to produce practical rifle shots. Our correspondent "Cyclops" takes a somewhat different view from us as to the results of this match. We think that

he has not given sufficient study to the specialized conditions of the shooting. We are, however, with him in his hope that this match will do something to promote "off-hand" shooting, be it well understood under practical conditions, as distinguished from the methods of American Shooting Galleries.

The Persian Gulf Fire-arms Seizure.—It is evidently not intended that the British public shall arrive at the true inwardness of the fire-arms seizure in the Persian Gulf. The proceedings in the case of Fracis, Times & Co., *v.* Carr afford some of the most curious reading that we have ever come across. The plaintiffs take proceedings against a commander in the British Navy, who to all intents is the British Government, for illegal seizure of their property in foreign waters. The alleged authority for this seizure is a proclamation, which the defendant holds to have the force of law in the Sultanate of Muscat, but which the jury are directed to ignore. The judge sums up in favour of the plaintiffs, and the jury follow his lead and bring in a verdict for the plaintiffs. Then the judge proceeds to hear counsels' arguments as the validity of certain proceedings in Muscat, and upholds them under the laws and customs of that country. There appears to be a legal refinement to the effect that, to establish the wrongfulness of an act, it must be wrongful by the law of the country where it was committed as well as by the law of this country. The judge and the jury both agree as to the wrongfulness of the seizure under British law, and the judge subsequently decides that the seizure was justified under Muscat law, and without further assistance from the jury, he decides the case in favour of the defendant. Nothing that we could say could more clearly condemn the attitude of the British Government in this matter than the pleadings of the learned council. Whatever may ultimately prove to be the legal aspect of the case, the political aspect remains in all its peculiar features. The British Government makes use of proceedings by the Sultan of Muscat to secure legal immunity for an act of seizure which is contrary to British law. The case is of the kind which is likely to be carried to a higher court, and consequently we must regard the matters under argument as *sub judice*. But whatever may be argued before the higher courts the circumstance above stated remains among the admitted facts of the case. Comment is needless. As a learned counsel advised the aggrieved parties, there is a strong political case against the Government whatever may be its legal aspects.

CAP EXPLOSION REPORT.—Major Cooper-Key, R.A., H.M. Inspector of Explosives, has recently issued a report regarding the explosion of cap composition which occurred at the works of the Birmingham Metal and Munitions Co., Ltd., on April 11 last. While the evidence at the inquest on a woman fatally injured by the explosion appeared to show that the accident occurred through the dropping of a pile of trays containing percussion caps, which had just been charged with composition, Major Cooper-Key adduces circumstantial evidence which appears entirely to upset the account of the facts as given by witnesses. It is pointed out, in justification of the issuing of a report contrary to the evidence, that in the case of accidents with explosives those in the immediate environment of the catastrophe are frequently unable to give an accurate account of what happens. Judging the whole of the circumstances of this accident, Major Cooper-Key comes to the conclusion that the woman let the trays of caps slip from her grasp, and in so doing spilt some of the composition out of the caps. In attempting to catch the trays they would appear to have struck against her thigh, the resulting shock causing the explosion. This theory accounts for the intensely violent local effect of the explosion on the body of the woman, whereas the view put forward in the evidence that the composition exploded when the trays struck the ground is inadmissible for a number of reasons. The accident incidentally shows that the practice of carrying a number of these trays (in the present instance six, with a total weight of about 36 lbs.), while not contrary to the regulations, is a source of danger which manufacturers should eliminate, either by providing extra carriers, or by the erection of a suitable hatch for passing the trays from one room to the other.

EXPLOSIVES REPORT FOR 1898.

THE Annual Report of H.M. Inspectors of Explosives for the year 1898 has just been issued. Although last year's report was published some months after the death of Sir Vivian Majendie, no reference was made therein to the loss which the Department has sustained. This was because the report dealt with the year 1897, and bore Sir Vivian Majendie's name as Chief Inspector during the period under review.

The present report, which is the twenty-third of the series, deals with the year in which Sir Vivian Majendie died, and the warmest tribute to his unexampled conduct of affairs in this department is placed on record by his late colleagues. Reference is deservedly made to his careful consideration of trade interests in matters where his duties to the State made it necessary for him to take a firm line. The recognition of this important trait in the administration of Sir Vivian Majendie affords welcome evidence that the traditions of the department in this respect will in no wise be altered. One only needs to have dealings with other Government Departments to realise how considerate is the line adopted by H.M. Inspectors of Explosives.

ACCIDENTS.—The records of the past year show that the number of accidents in the course of manufacture is well below the average for the decade. Two deaths, in place of nine in the previous year, contrasts satisfactorily with the average of 4·8 for the decade.

The averages are now reduced to such small limits that the figures of each year are generally accounted for by the unfortunate consequence of one or two fatal accidents, the number seldom reaching as high as five. In fact, they have been so far reduced that we may some day hope for a year where there have been no fatal accidents whatever. Of course there are a number of accidents concerned with the use of explosives, and other small accidents due to the improper handling, through ignorance, of explosives materials; but the main consideration from the point of view of the explosives industry is to maintain the safety of the manufacturing operations. Explosive materials are so safeguarded in their finished form as regards their composition and other properties, that accidents in use are not of a kind reflecting blame upon the manufacturers; though of course the advances of scientific knowledge will probably continue to bring forward such modifications in explosives as will cause an automatic improvement in the records of accidents under the head of storage, transit, etc.

TESTING STATION.—A very useful report on the Woolwich Testing Station forms part of the present volume, and it appears to us to be of such interest that we have reproduced it in another portion of this issue.

IMPORTATION.—As usual the records of detonators imported

during the year show a very large consumption of foreign material, though somewhat less than the corresponding figures of the previous year. In 1897, 10,509,100 were imported as against 10,089,600 for the year 1898. Mr. C. G. Mueller stands at the head of the list with an importation of 4,518,600, and Mr. J. R. Watson, whose death we recorded in our last issue, is second with 3,210,000. Mr. Richter, of Newcastle-on-Tyne imported rather more than 1,000,000, and the remainder is divided up among a number of comparatively small importations.

Other interesting items in the list of importations are as follows:—

Blasting Gelatine	64,500	lbs.
Carbonite	376,000	,,
Cooppal Powder	6,000	,,
Dynamite	27,500	,,
Gelatine Dynamite	184,050	,,
Matagnite Gelatine	25,400	,,
Nahnsen's Gelignite	105,000	,,
Normal Sporting Powder ...	12,000	,,
Rhenish Gelignite	183,150	,,
Sun Gelignite	18,000	,,
Walsrode Powder	5,400	,,
Gunpowder ... ... (value)	£1,597	

The last item is the smallest but one on record since the year 1870, and it compares very favourably with an exportation of gunpowder of home production to the value of £195,056, the average value of which was £2 10s. 6d. per cwt., which is threepence less than the average value of the previous year's consignments. This average value is several shillings less per cwt. than the average prices for the past ten years, and only in one year, viz., 1895, has the average value reached the low price of the past year. The following interesting comparative table appears in the Report. It shows the amount of nitroglycerin explosives for blasting purposes imported into this country during the ten years ending 1898:—

Year.	lbs.	Year.	lbs.
1898 ...	983,600	1893 ...	576,950
1897 ...	1,153,350	1892 ...	856,668
1896 ...	1,259,200	1891 ...	734,100
1895 ...	880,070	1890 ...	899,652
1894 ...	539,802	1889 ...	1,325,950

It will be seen that there is a tendency for the high figures of the year 1896 to be somewhat reduced. This may be largely attributed to the increase of production in this country, which has apparently reduced the consumption from outside sources of supply.

CHEMICAL REPORT.—Dr. Dupré's chemical report is this year of even greater interest than usual. His report opens with a touching reference to the many years during which he has worked side by side with the late Sir Vivian Majendie. It is necessary to appreciate the close touch and sympathy which existed between the Chief of the Explosives Department and its Chemical Adviser in order to grasp the full meaning of Dr. Dupré's generous tribute to his late friend and colleague.

In July 1898, twenty-five years had elapsed since Dr. Dupré became chemical adviser to the explosives department of the Home Office, and he takes the opportunity in this year's report of reviewing the extraordinary developments in the industry of explosives, with which he has had a closeness of touch absolutely unparalleled elsewhere. His chemical knowledge of explosives has enabled him to appreciate the true significance of the developments which have one by one come into view. This review, by Dr. Dupré, of the developments of the industry during the past twenty-five years is a brilliant piece of work, accepting, of course, the limitations of space accorded to the subject, and we have, therefore, reproduced it in full in another portion of our number.

In referring to the new explosives examined during the year, Dr. Dupré draws special attention to an explosive known as Carlsonite. In reference thereto he remarks that "this is an "explosive of considerable interest as it is the first of its kind "submitted to us, and is not unlikely to be the forerunner of "many more. The special character of the explosive consists "in its containing ammonium perchlorate as the sole oxidising agent. The first sample submitted proved to be too "sensitive and was unfavourably reported on. Two further "samples were then submitted, the inventor having been able, "by the help of the knowledge gained from the first report, "to introduce some improvements. These two samples passed "successfully through all these tests, and were favourably "reported on."

The other explosives reported upon are not the subject of any very special comments, beyond perhaps a case where the inventor of an explosive absolutely refused to disclose the exact composition and manufacture of his powder, a decision which left the Home Office no alternative but to express their inability to place it upon the authorized list. Other comments upon certain new explosives show the obstinate persistence of those inventors who attempt time out of number to make use of chlorate of potassium as an oxygen-bearing constituent. Their efforts have not been successful up to the present, but there is reason to believe that the difficulty will soon be overcome.

GENERAL REMARKS.—In this report, as in the others issued in previous years, there are a number of points which can hardly be the subject of special notice in an article of this kind, although they largely concern the routine work of the Department; and it is upon close attention to these that the efficient administration of the Explosives Act depends. Records of visits to factories and stores, and attendances at inquests, do not make sensational reading in an official report; but there is every evidence that H.M. Inspectors of Explosives are carrying on this work with all the enthusiasm which was so strong a feature of the late Sir Vivian Majendie. With Colonel Ford as Chief Inspector, and Captain Thomson second in order of service, there is every guarantee of maintaining proper continuity of the work. Major Cooper-Key, whose first introduction to the explosives department was concerned with the Woolwich Testing Station, has now taken Captain Thomson's former position in the department as third Inspector, and Captain Lloyd has been appointed during the past year to take over the control, and to be responsible for, the management of the testing station. It will thus be seen, as is also explained in the body of the report, that the department is by no means over-provided with officers.

The loss of Sir Vivian Majendie, following so closely as it did upon the increase of the number of H.M. Inspectors to four, reduced the official staff once more to three, and for some time made it difficult to keep pace with the work, but the department is once more in full swing, and the records of inspectional visits shows that complete order has been re-established. The appearance of the report some two months earlier than last year provides further evidence that the work of the department is well in hand.

INCIDENTAL JOTTINGS.

CHANGES AT WOOLWICH. Major H. C. L. Holden, R.A., must indeed be a proud man if he can only hear the chorus of congratulations which have followed his appointment as Superintendent of the Royal Gun Factories, Woolwich. This officer has now been so long associated with the Inspection Department, that it seems almost as though it were impossible to replace him. His mechanical and electrical ability and scientific genius have contributed immensely to the success of that department, and all good wishes go with him in his new post, where there is a splendid field for a man with a real practical knowledge of ordnance. The Royal Carriage Department is also to be congratulated upon retaining its old and esteemed chief, Col. Sir George Clarke, R.A., for a further period. The Royal Laboratory is equally fortunate in its new superintendent; Major Douglas, having assisted Col. Bainbridge for many years, now succeeds him in the duties with which he is already familiar. We believe him to be a strong man, and with Col. Bainbridge as chief superintendent, Woolwich Arsenal should be safe from the marauding of the Works Department, and from being victimized by so-called "centralization."

GREAT INVENTIONS. Truly the big gooseberry and the sea-serpent are forgotten in the daily papers this year for the plethora of inventions in war material. One daily paper writes (needless to say from New York) of a shell "of terrific explosive power resembling a "flash of lightning, to burst into fragments, and annihilate "the whole army," whilst from Madrid comes the news of a new 15 m.m. Q. F. gun, to pierce 16 metres of Harveyised steel at 2,000 metres, and then there is the Weymouth Electric Gun, for which a youth of nineteen has refused £75,000 from the Admiralty.

ADMIRALTY GENEROSITY. Here is a gun weighing 1 cwt., having an observed velocity of 14,320 f.s., and a power equal to that of a 100 ton gun, and the Admiralty only offer £75,000 for it! This is the first occasion since the time of Brennan that the Admiralty are reputed to have put their hands in their pockets to secure something valuable. Dive deeper, my Lords, or a syndicate may get it, and the British public will be ——. Well, we'll see!

MARK IV. BULLETS. From the East, West and North come adverse reports upon the behaviour of the Mark IV. bullets made in 1898 at range firing. Some report that the bullet leaves the nickel envelope in the rifle whilst the core is fired away, and others that the bullet "refused the rifling," which must have been rather severe on the bolt, and one feels no surprise when we are told the "action jammed." If we exonerate the makers of the ammunition we must implicate the rifle manufacturers. Perhaps they could explain it? Better still, the authorities responsible should gauge every barrel bore. "Pot hunting" rifles are full of surprises! Meanwhile the Bisley shooting men are to be furnished with Mark IV. bullets of recent R.L. manufacture, which have been thoroughly tested to the satisfaction of the officials.

THE STANDING POSITION. It is generally accepted in the newspaper reports that the reason why England won the "wooden spoon" at the International competition at the Hague is because our men were not used to "standing whilst firing." At lying (I mean the prone position) they beat several of the competitors, including the Dutch. Perhaps the N.R.A. will take note and give something to stand up to in competition. Seriously, it does seem a sorry fact that this important posture should be so neglected. In the "musketry regulations" it appears that the first lesson a recruit gets in shooting is to load and fire in standing position, and if our war correspondents are correct, from "photos taken on the spot," one rarely sees the prone position resorted to during an engagement. Not that I quote war correspondents as being strictly accurate in every detail. The picture of the British soldier "hurdle racing" over the wounded horses, or running at the "double" with rifle to his shoulder firing all the time, is the sort of artistic licence we allow, knowing that such a scene would put the artist on the high road to the Royal Academy.

THE SWISS ARMS. The fortunate winners of the International competition were the Swiss, who use a Martini action, and singularly the second and third places were also won with block actions, which is rather a blow to the advocates of the bolt. The Swiss employ a cotton powder, lead bullet, patched and covered with a hard steel envelope, with a solid point, and reduced in diameter at the base, the bore being 7·5 m.m. The cartridge case is brass, of the rimless type, with a very square shoulder. So far as the manufacture is concerned, no continental power can beat the Swiss for the uniform excellence of their cartridges.

NOBEL-DYNAMITE TRUST CO., LIMITED.

ANNUAL GENERAL MEETING.

THE thirteenth annual general meeting of the Nobel-Dynamite Trust Company, Limited, was held on the 2nd ult., at Winchester House, Mr. Thomas Reid presiding.

FINANCE.

The Secretary having read the notice convening the meeting, the Chairman said:—You will have been pleased, I feel sure, to find that your directors are able to recommend the payment of a 12 per cent. dividend on the increased capital of the company, although the subsidiary companies have only had the use of the money realised by the new issue during a few months of their financial year. The rate of dividend paid in latter years has therefore been maintained, and the average rate paid since the formation of the company, 13 years ago, is as near as possible 10 per cent. per annum. The continued prosperity of your undertaking must be ascribed to the fact—which I have already on several occasions brought to your notice—that we have kept pace with the times and continually added new sources of revenue to your business, which was at first exclusively confined to the manufacture and sale of blasting material. That particular original branch of your business has been assailed by keen competition in most markets, and this competition is making itself felt more and more. The mining enterprise of the world and the develop-

ment of public works has, of course, advantageously affected the business as regards turnover, but while the depression in prices, due to competition, at present exceeds any advantage to be derived from lessened cost of production, that condition will be greatly modified as the business continues to expand. We have constantly striven to find suitable branches of industry which can be linked with your undertaking, and have chiefly developed a large business in war material, both in the manufacture of smokeless powder and ammunition. In that line the past year has shown favourable results, due to the general activity in armaments manifested in almost every quarter.

FOREIGN EXTENSIONS.

You will remember that I mentioned to you last year that we had made an agreement under which we participate in the results obtained by some of the largest American manufacturers of explosives, and I am pleased to say that the arrangement with these companies has worked most satisfactorily, and has every appearance of turning out to mutual benefit. Some of the undertakings which we have acquired necessitate further development, and I feel sure that we shall very soon succeed in placing them in an equally flourishing condition with the rest of the companies in which you are interested. I am alluding more especially to the Australian Explosives and Chemical Company, Limited, which has laboured since we acquired it under very adverse circumstances, an exceptionally hot summer and an explosion of some importance which occurred in the past year having retarded considerably the improvements which we have sought to introduce. The fire which occurred at the chemical works at Billwärder, near Hamburg, which is linked with your largest German subsidiary company, has not caused any loss, being covered by insurance. The works are being rebuilt in the most approved manner, and new branches of chemical industry have been added to those in which these works were originally employed, and we are contemplating still further extension in that direction. Whilst thus seeking to render your undertaking more and more independent of momentary depression in one or other of the various branches of your industry, blasting explosives, of course, have our constant care, and nothing is left undone to ensure technical and scientific improvements and watchfulness with regard to new features, upon which the continued success of your business rests.

NEW DISCOVERIES.

I think I ought to add a word of warning against your giving credence to reports regarding new discoveries, which in the press frequently assume fanciful proportions. I need hardly point to the improbability of wireless telegraphy proving a danger to us by menacing, as recently reported, the safety of explosives stored in any part of the world; but I think I ought to mention that liquid air has not, as an explosive, reached a stage where it can be regarded as a dangerous competitor to the products of our manufacture. Liquid air itself is not an explosive; but explosives have been devised in which liquid air plays a part. No one can foretell the value of such new suggestions, and we therefore at once entered into an arrangement for carrying on experiments jointly with the inventor, securing an interest in, and the right of pre-emption of, the patents which we are advised control this new departure. It is, as I have previously remarked, exceedingly difficult, if not impossible, to make any forecast regarding the future results of your business; but I think that I am erring on the side of caution if I say that there is nothing apparent for the moment which would warrant anyone predicting a less favourable result in the future than we have attained in the past.

THE AUDITORS' FOOTNOTE.

With regard to the docquet which the auditors have adhibited to this year's accounts, I wish to explain that this was submitted to us too late to arrange to deal with the matter to-day; hence the notice in the report intimating the intention of the directors to call a meeting of shareholders at an early date to consider the question, and have any possible doubt on the subject removed. I, however, think that it is due to you, as well as to ourselves, that I should to-day give you clear information as to the position raised by the auditors' comment. Perhaps I ought at the outset to allude to the state of things which existed before the Trust Company was formed For some years prior to the formation of the Trust Company, a strong competition existed in the sale of explosives between the German companies and the Glasgow Company. This was seen to be so ruinous that after a time the directors of the German companies and those of the Glasgow company, through the intervention of the late Mr. Nobel, met on numerous occasions, both here and on the Continent, to discuss the position, and, if possible, to come to some agreement whereby this competition could be brought to an end. These meetings resulted in an amicable agreement, but after a time, perhaps about a couple of years or so, it became necessary, from certain causes which I need not mention in detail, that a still closer bond of union should be made between the companies if we were to get the best result from our arrangement. Hence the formation of the Trust Company, which I believe was made on lines which, although perfectly familiar now, were then of a novel character. Those of you who were shareholders of the subsidiary companies will recollect that, at the formation of the Trust Company, it was a fundamental part of the arrangement that each of the companies was to retain its autonomy, and the business carried on by it was in every respect to be just as if no Trust Company was in existence, thereby necessarily implying that the directors would be entitled to draw fees for management as they had been in the habit of doing before the amalgamation took place. I might, indeed, quote the very words which I addressed to the Glasgow company's shareholders at the time, which were as follow, viz.:—"It is intended that the board of the Trust Company will consist principally of directors elected from the boards of the companies proposed to be dealt with, and that the registered office should be in London. Of course, it will be understood that each of the companies whose shares are to be exchanged will retain its own separate title, existence, and autonomy, and will continue to be controlled by its own board of directors and managers as at present." Similar statements were made by the German directors to their respective shareholders.

We all know how successful the Trust Company has proved, and therefore I am confident that the directors who initiated the business, and who are still in its management, will receive every consideration at the hands of the shareholders. With regard to the Glasgow company, I wish to point out that prior to the formation of the Trust Company the directors were paid a fixed sum, which on the last year of its operations

amounted to £1,000 divided among the directors—the amount of profit for the year being about £38,000—whereas, the directors of the German companies were paid by results. After careful consideration, this scheme was thought preferable to the Glasgow method, and at the annual general meeting in 1888 of the Glasgow company a resolution was passed fixing the remuneration of the Glasgow directors on the same principle as that of the directors of the German companies. As to the amounts paid to the Glasgow directors for their services, I think, when I tell you that the average of the past 13 years is £6,057 a year divided among the directors, you will agree with me that the sum is not excessive when you consider that the profits have averaged £122,902 per annum, as against an average of £37,632 per annum made by the company over the previous period of 14 years. The fees which the directors of the four German subsidiary companies received are fixed in accordance with the articles of association of these companies as they existed at the formation of trust. The average profits of those four companies for the past 13 years have amounted to £108,000 per annum, and the fees paid to the four boards have altogether averaged £7,400 per annum. It will thus be seen that the total fees paid to the 21 gentlemen who constitute the boards of these five subsidiary companies, viz., the Glasgow Company and the other four German companies, have amounted on the average of the last 13 years, in round figures, to £13,400 per annum. If the extensive and complex nature of the business, and the number of factories situated in different countries are kept in mind, it is pretty clear that the directors must devote, as they do, a very large portion of their time in attending to your business. Please recollect, gentlemen, that however important the consultative and advisory value of the trust board may be, your dividends are not earned in Winchester House, but by the subsidiary companies, which can only be managed by local directors. These are, generally, the grounds upon which—as business men—we think the payment of the fees, to which the auditors have drawn attention, are justified—justified by actual work done, and by successful results. It may be that owing to recent judgments the auditors had come to consider that these fees should have been specifically disclosed to the shareholders of this company. It is evident, in any case, that the directors received these payments in good faith, based as they are on the arrangements made at the time of the formation of the company, and I have enough faith in the fairmindedness of our shareholders to believe that they will confirm such remuneration, to which the directors are at least equitably entitled.

CONCLUSION OF BUSINESS.

I beg to move:—"That the report of the directors and the accounts for the year ended April 30, 1899, be adopted, and that a dividend be now declared on the paid-up capital of the company at the rate of 12 per cent., free of income tax, to be paid on and after June 3, 1899, and that the sum of £5,523 3s. 2d. be carried forward to next account."

Various other formal resolutions were put to the meeting, and were carried in due course. In answer to Major Waller, who asked at what date the directors proposed to hold a meeting to which the chairman had referred in his speech, the latter replied that it would be held at the earliest possible time, but he did not suppose that it would be held within less than a month or six weeks.

NOTES.

HOTCHKISS ORDNANCE CO., LTD.—The annual report and balance sheet of this Company for the year 1898 shows that after meeting all working and establishment expenses the total profit amounts to £39,104. Under the scheme for the reduction of capital, the amounts brought forward from the previous balance sheets totalled £38,041, and have been applied to the reduction of capital. The available profit is applied in the first place to interest upon, and redemption of, debentures, these charges absorbing £15,000. The balance of £24,104 has been applied to the payment of five per cent. on the preference shares and two and a half per cent. on the ordinary shares, so absorbing £16,475, and leaving a balance of £7,629 to be carried forward. The Annual General Meeting of the Company, which was held at Winchester House on Wednesday, the 28th ult., was the scene of a sad occurrence. Admiral Sir Windham Hornby, K.C.B., occupied the chair, and transacted the business of the meeting. Towards the close of some remarks in reply to various criticisms of Colonel Hemans, the late managing director of the Company, the gallant Admiral was seized with illness, and expired within a few minutes. This brought the proceedings to a sudden close, and the meeting was adjourned for a fortnight. The following is an account of what transpired from the commencement of the meeting until the business was abruptly concluded by the death of the chairman:—In moving the adoption of the report Sir Windham Hornby said that in the ordinary course the shareholders would have been called together three months earlier. In the summer of last year it was agreed to reconstruct the company, but unexpected opposition arose, which resulted in delays of various kinds, and it was only at the end of February last that the resolutions for reconstruction were agreed to. The majority on the occasion was a very large one, the holders of seven-eighths of the entire capital supporting the resolutions. Steps were then taken to obtain the consent of the Court to the scheme, and it was not until quite lately that that consent was given. The present report was the most favourable one that had been submitted to the shareholders for a long time. It showed that the total profit, after meeting all working and establishment charges, amounted to £39,104. Various circumstances contributed to making the past year a good one for the company, but he must warn them against expecting a recurrence of equally favourably conditions, although they had so far done very well this year. Generally speaking, the improvement which had taken place in the business was maintained. Satisfactory orders were coming in, and their works were fully employed. He hoped that all would be satisfied to find that the company had resumed its place in the list of dividend-paying concerns. After alluding to the valuable services rendered by Mr. Slaughter, Mr. Balfour, and others in connection with the reduction of the capital, he paid a special tribute to Mr. Parsons, and said that he thought that the remuneration paid to that gentleman should be at least equal to the sum received by his predecessor in the post of managing director. Nothing had yet been decided with regard to the debentures, but the board had every hope of making an arrangement which would reduce the interest payable to some extent. The progress made by the company's automatic gun was satisfactory, but he thought it unwise to say much about it at a public meeting.

Mr. Parsons, in seconding the motion, thanked the chairman for his kind references to his work, and said that he should be quite willing, when he felt that he was entitled to additional remuneration, to leave the matter in the hands of the board. Colonel Hemans criticised the management expenses, which he considered were too high. Mr. Lee Smith thought that it was rather late for Colonel Hemans to complain of the expenses, as they were no more than when that gentleman was managing director. Mr. J. Balfour remarked that Col. Hemans had never before advocated economy in connexion with the company, and added that in view of his opposition to the reconstruction scheme no one could consider him as a friend of the company. Mr. G. A. Touch moved as an addition to the resolution that Mr. Parsons should receive a salary equal to that of his predecessor, or such other sum as the board might think fit. Mr. Woolfton seconded. The chairman, in reply, said that Colonel Hemans had told the truth, but not the whole truth. When that gentleman became managing director, ten years ago, he received £5,000 down, and a salary of £1,000 a year. As an agent, Colonel Hemans did very well, but, when the company ceased to get employment from the Government, he was put into a position for which his training and knowledge had not at all prepared him, and that was the cause—it was not his fault—of his melancholy failure as managing director. After some time the board secured the services of Mr. Parsons, and then they began to find out what a managing director was. The chairman then proceeded to explain the various items of expenditure which Colonel Hemans had criticised, and it was at the close of these remarks that he was seized with his fatal illness. The meeting was adjourned for a fortnight

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BISLEY RIFLE MEETING.—The programme for the Bisley meeting, which commences on the 11th inst., does not contain any very notable features. As in the previous year, the manufacturers of powders suitable for service rifles have not presented prizes for events confined to the use of particular explosives. With regard to the service ammunition to be supplied at the meeting, numerous enquiries have been addressed to the N.R.A. as to whether there is any likelihood that the new hollow-nosed bullet will prove erratic in flight, as it appears to have done in a recent shoot near Edinburgh. A reassuring letter has been sent out from the offices of the Association to the effect that the ammunition which will be issued has been exhaustively tested, and has given satisfactory results in no way suggesting any possibility that the experiences of the Scotch meeting will be repeated at Bisley.

THE TRANSVAAL DYNAMITE MONOPOLY.—The Parliamentary paper giving full details of the correspondence on the subject of the Dynamite Monopoly which has taken place between Mr. Chamberlain and the Transvaal Government, is practically identical—with, however, slight variations in the wording of the translation—to that published in our last issue, which was reproduced from the *Johannesburg Star*. The conclusion of the correspondence is contained in a letter from Mr. Joseph Chamberlain, in which the following paragraph occurs:—"I do not find that that reply in any way meets the arguments contained in my despatch, and I request that you will instruct the British Agent at Pretoria so to inform the Government of the Republic, and to intimate to them that her Majesty's Government adhere to their protest and reserve their rights in the matter." The reply to this last letter is to the effect that the South African Republic abide by the views expressed in their note of March 9, and especially by paragraph 10. It will be remembered that the paragraph referred to stated that in the opinion of the Transvaal Government her Britannic Majesty's Government are not entitled to a protest such as now formulated by it. The Parliamentary paper, which is obtainable at Messrs. Eyre & Spottiswoode's, price 2½d., contains a large amount of useful information connected with the Dynamite Monopoly, these including matters connected on the one hand with the attempts to secure the expropriation of the monopoly, and, on the other, the offers by the consessionaires put forward in exchange for a renewal of the concession. The paper also contains a reprint from the *Johannesburg Star* of November 5, 1897, containing the exact terms of the monopoly including the contract entered into between the concessionaires and the acting State Secretary of the South African Republic.

MESSRS. GREENWOOD AND BATLEY, LTD.—We have received a copy of the annual report and balance sheet of this company for the year ending March 31st, 1899. After providing for interest on debentures, for expenses of management, and writing off £5,896 for depreciation, and £2,750 for doubtful accounts and allowances, a net profit of £22,097 is arrived at. This, with the amount brought forward from the previous year, makes an available total of £25,136. Of this sum £10,000 has been placed to a reserve fund, and £12,180 has been absorbed by payments of 7 per cent. on £140,000 of preference shares, and 3 per cent. on £260,000 of ordinary shares. The balance, £2,955, has been carried forward. The balance sheet shows an item of £255,269 for capital expenditure, this amount resulting from additions during the year, and deductions for depreciation. The other assets are:—Cash, £400; Debts due to the Company, £77,440; Expenditure on Patents, etc., £3,445; Investments, £22,247; and Stocks of finished work and raw materials, £90,370.

E. C. POWDER CO., LTD.—The report and balance sheet of this Company for the year ending March 31st last was submitted at the sixteenth Ordinary General Meeting held on Wednesday, the 21st ult. The net profit for the year, after the deduction of office and other expenses, amounts to £3,821, which added to the balance brought forward from last year makes a total of £6,046. An interim dividend of two shillings per share was paid in January last, and a further dividend has been declared, making four shillings in all, this absorbing £3,300, and leaving a balance of £2,746 to be carried forward, subject to directors' fees. These proposals of the directors with regard to the dividend were approved at the Annual General Meeting. In the course of the proceedings thereat the Chairman remarked that the balance sheet was somewhat of a disappointment to the Board, because they mentioned last year that they hoped to have a better result to record. Unfortunately, it has been a bad game season, and, consequently, less sporting powder has been used. At the same time, they have every reason, looking to the disadvantageous circumstances against which they have had to contend, and also to the keen competition of other sporting powders that have been very freely pushed and advertised,

to be satisfied with the result. They feel perfectly certain that if it were not for the excellence of their powder they should not have been able to maintain their position in the way they have. In the opinion of the Chairman there never was a time at which the excellence of the E. C. powder was so universally recognised as it is at present. The reason why the company is not so prosperous as it used to be is that, owing to competition, the price of powder is materially reduced, and the old position the company occupied can only be regained by a material increase in the business done. Without venturing to be unduly sanguine, he expressed his confidence that during the current year the company would materially increase its output, and that as time goes on it will regain its former position on smaller profits on the price of powders, which will be compensated by the larger amount of business. The Chairman vouched for the absolute accuracy of the fact, that during the last year they have not had a single complaint with regard to the powder. On the other hand, they have had the most flattering recognitions of its excellence, and for this reason the board ought to recognise the ability and energy of the managing director, Mr. Borland, for the way in which he has perfected the powder, so that at the present time it is believed to be the very best powder in the market.

MR. CHARLES LANCASTER.—We have received an intimation from Mr. Charles Lancaster that he has received a certificate of registration of a trade mark, consisting of a design in which three mannikins, or pigmies, are combined with a sporting cartridge. The design which was forwarded did not reach us in time for reproduction, but it may be seen in this firm's advertisements of pygmy cartridges.

SPORTING BALLISTITE.—Our attention has been drawn to the numerous successes of this sporting powder in the competitions at the recent international pigeon shooting week at the Gun Club and Hurlingham. In thirteen of the advertised events, Ballistite was represented by wins or places in no less than twelve instances, winning altogether £1,362, out of a prize fund of upwards of £3,000. As is well known, this powder is found extremely efficient for long distances, where it preserves its velocity and clean-killing properties in spite of the severe handicap represented by the long distance from the traps at which the best shooters are required by the handicap rules to take their stand. The merits of the powder in this direction account for its growing popularity for game shooting, where it is a great advantage to know that a long shot is well within the powers of the gun provided that the bird is fairly hit.

VICTORIA SMALL ARMS CO.—Under the above title the factory of Messrs. Cogswell & Harrison, Ltd., is identified with the production of a thirteen guinea ejector gun, which may be purchased either for cash or by twelve monthly instalments of £1 5s. 6d., making £15 12s. when this form of credit is taken. Two other weapons, viz., a better finished gun at fifteen guineas, and a non-ejector at ten guineas, are supplied on the same system. In the design of this series of guns, special attention has been given to the production of a reliable arm of good balance and solid construction. The parts have been manufactured on the interchangeable system, and every gun is submitted to the "nitro proof" as well as to the ordinary compulsory proof. The Victoria Small-arms Co. are to be congratulated on their enterprise in entering the market with a gun which will compete with foreign-made productions in price, and which may still be expected to stand the hard wear which British-made weapons have always shown themselves able to withstand. The wholesale depôt for these guns is at 29a, Gillingham Street, S.W., while they are to be obtained retail at 226, Strand, W.C.

E. C. POWDER.—We have received copies of circulars issued by the E. C. Powder Co., Ltd., to the trade regarding its arrangements for the coming season. The circular opens with a reference to the undoubted favour with which E. C. No. 3 has been received by sportsmen throughout the country. The circular then calls attention to the fact that arrangements have been made for the supply of cartridges to the trade which are loaded by the Company. The Company appears to have taken the question of cartridge loading energetically in hand, with the result that it guarantees the production of a first-class article carefully tested to do full justice to the high merits of the Company's powder. The Company also offers to load customers' own named shells if they so desire, and this offer will be better understood if read side by side with the following paragraph, as the offer obviously refers to the loading of cases supplied by Messrs. Kynoch, Ltd.: "We regret "to say that we have found it impossible in the interests of "our Company to continue to supply our powder to Messrs. "Kynoch, Limited, as they, being manufacturers of a rival "powder, have not been able to see their way to give us an "assurance that they would not place our powder at a dis- "advantage compared with their own. We trust that you will "not be placed at any inconvenience by the above, but if this "should be the case, kindly communicate with us, and we will "advise." Notice is given of certain modifications in the price of E. C. powder, which we understand are designed to get over the complication of accounts due to the crediting of returned powder tins.

LOADING INSTRUCTIONS FOR THE 1899-1900 SEASON.—We have been favoured with a view of an advance proof of the coming season's edition of the loading instructions for sporting powders, similar in general character to the one we so favourably noticed last year. The information given in the table, which is issued by our contemporary, the *Sporting Goods Review*, at the price of sixpence post free, has been revised and brought up to date, and there is no doubt that the information it contains will be found as useful to loaders of cartridges as was generally admitted to be the case last year.

NEW DYNAMITE FACTORY IN CAPE COLONY.—We understand that active measures are proceeding for the erection of an explosives factory in Cape Colony under the auspices of the De Beers Mines, Ltd, and the Chartered Company. The object of the promoters is to instal a factory for the making of nitroglycerin explosives capable of supplying the local needs of the diamond fields, and further for providing a base for the supply of these high explosives in South Africa generally.

THE NORTHUMBERLAND GUNPOWDER FACTORY.—A lodge vote has been taken among the societies interested in the proposal to form a company for the co-operative manufacture of gunpowder in Northumberland, in order to resist the recent increase in prices of blasting-powder in the district. Out of a total vote of 351, there was a majority against of 157. This scheme has ceen dragging somewhat of late, and certain offers of capital were made on condition of berths with the new company. Perhaps it is as well that the scheme will be dropped without the process of enlightenment being carried on.

EXPLOSIVES DEVELOPMENTS IN THE LAST QUARTER CENTURY.

IN his report to H.M. Inspector of Explosives, Dr. Dupré, the chemical adviser of that department, refers to the fact that last July he completed 25 years of service in that position; and he takes the opportunity of reviewing the progress which has been made during a period which certainly covers the modern history of explosives. Nobody could have been better placed than himself for the observation of these changes, and we might be permitted to add, nobody could have done more than he himself has done in his official capacity to indicate the lines upon which explosives would have to be developed, in order to bring their forces under the requisite control in the interests of their safe manufacture and handling. Our object in reproducing Dr. Dupré's brief essay is that, by so doing, those interested in explosives, whom the annual report of H.M. Inspectors may not reach, will still have an opportunity of appreciating the developments of the industry so well, and so briefly, expressed in the following terms:—

"In 1873 the only explosives, other than gunpowder, licensed for manufacture and importation were dynamite and a few preparations of nitrocellulose. One chlorate mixture, Horsley's powder, had indeed been licensed, but fortunately it has never come into use. In 1898 not less than 81 explosives of Classes 1 to 4 were on the authorised list, while 19 others had passed all necessary tests and had become licensable, and 13 others had been in this list, but for which no licence is at present in force. But this total of 113 explosives, as compared with three or four in 1873, by no means exhausts the list of explosives submitted for licence to the Home Office, for a considerable number of such were, on examination, found to be unsuitable, for one reason or another, on account of the danger their transport, use, and storage might involve.

"In face of such activity of inventions one might at first sight suppose that a corresponding change in the number of the materials employed had taken place. This, however, is by no means the case. Nitroglycerine and nitrocellulose, the only explosives of the kind in use in 1873, are still the main ingredients of the bulk of our explosives in 1898. Thus, not less than 62 of the 81 explosives on our authorised list consist mainly of either nitroglycerine or nitrocellulose, or of a combination of the two. From this, however, it must not be concluded that little or no progress has been made during these 25 years, which would be a conclusion very wide of the truth. In the first place, our more strictly scientific knowledge regarding the character of explosives has greatly increased, and it is now generally possible to form a very fair estimate of the possible value of any explosive from its composition alone. Thermo-chemistry in particular has made great strides in the interval, and though we are not yet, and probably never shall be, in a position to rely on theory alone in the selection of our explosives for any particular use, it becomes, nevertheless, a more and more important factor in such selection. Our knowledge regarding the conditions to insure safety have also greatly advanced.

"Thanks to the genius of the late Alfred Nobel, nitroglycerine has been converted into a gelatinous solid free from the danger attached to the use of liquid nitroglycerine, and almost as powerful, which, moreover, readily lends itself to the production of explosives of very varying power and intensity of action. This invention, owing mainly to our insisting on the production of a blasting gelatine free from the dangers of liquefaction and exudation, has led to a great increase in our knowledge of the character of nitrocellulose.

"In 1873, nitrocellulose was divided practically into two kinds only, so-called insoluble nitrocellulose or guncotton and soluble nitrocellulose or collodion cotton, the solvent implied being a mixture of ether and alcohol. Now, we know that solubility in ether alcohol is not, as was supposed, a function of the degree of nitration, but solely one of method of manufacture. Nitrocellulose of very varying degrees of nitration, up to tri-nitrocellulose, can now be manufactured soluble in the above mixture. The most remarkable and far-reaching advance in the use of guncotton and nitroglycerine, an advance based, in a measure, on the above-mentioned discovery of blasting gelatine by Alfred Nobel, is the recognition of the fact that by converting these two materials into more or less hard homogeneous non-porous solids they almost completely lose their character of detonating agents, and may be used as most effective propellants. The rate of combustion of these gelatinized explosives is under very perfect control, inasmuch as they burn only on their surfaces, by varying the relation between weight of explosive and surface exposed. Almost all our smokeless powders, which have added so much to the power and utility of our guns, are based on this discovery.

"The next most important, or perhaps equally important, advance, which we owe mainly to Dr. Sprengel, is the substitution of ammonium nitrate for saltpetre in many explosives. The great value of this compound lies, partly in the fact that it leaves no solid residue on combustion, partly that it greatly reduces the temperature of explosion of all explosives in which it is employed. The latter fact, chiefly, renders it so valuable an ingredient in the so-called safety explosives. A great drawback to its use, however, is its property of rapidly absorbing moisture from ordinary atmospheric air, which renders a perfectly waterproof wrapper or case absolutely necessary.

"Concurrently with the introduction of ammonium nitrate came the use of various nitro derivatives of the so-called aromatic compounds, which, though usually not of a composition to serve as explosives by themselves, yield very powerful explosives in admixture with ammonium nitrate.

"The only compound of this class which is at present largely used as an explosive by itself is tri-nitrophenol or picric acid. Picric acid, now known as one of our most powerful detonating explosives, was manufactured for many years, and in considerable quantities, as a valuable yellow dye, without a suspicion of, and with utter disregard to, its

highly explosive character. It furnishes an extremely striking and valuable illustration of the danger involved in proclaiming an explosive to be perfectly safe on the strength of its having been manufactured and used for some years without accident.

"True nitro-compounds, like picric acid, nitro-napthalene, di-nitro-benzole, &c., &c., have the great advantage over compounds like nitro-glycerine and guncotton, which are really nitric ethers, that is, organic nitrates, in not being liable, like these, to spontaneous explosion when even slightly impure, and in remaining unaffected by the presence of even relatively large quantities of acid.

"Many attempts have been made in the course of the 25 years to make use of the powerfully oxidising character of chlorate of potassium in the production of an explosive, but so far without success. There is, however, some reason to hope that this difficulty will soon be overcome."

THE PERSIAN GULF FIREARMS SEIZURE IN COURT.

FRACIS TIMES & CO. *v.* CARR.

THIS action arose from the seizure of arms by H.M.S. *Lapwing* in the Persian Gulf. The plaintiffs were the consignors of ammunition which was seized by Commander Carr, of H.M.S. *Lapwing*, who was the party proceeded against for damages in the present action. Sir Robert Reid, Q.C., Mr. Joseph Walton, Q.C., and Mr. F. W. Hollams, appeared for the plaintiffs, and the Attorney-General, the Solicitor-General, and Mr. Acland, for the defendant. The hearing of the case occupied three days, and on the fourth day, the 8th ult., Mr. Justice Grantham summed up the case for the jury.

SUMMING UP.

His lordship said that he was sure that they would not begrudge the time they had spent in assisting to determine the very important question that had been raised—namely, whether the Government were justified in the action which they took in the circumstances mentioned, or whether, although the orders for the seizure of the goods were given by the Government, it was an illegal seizure, and compensation must be paid to the owners for an act which, if it had been done by any private person, would have been illegal. It was necessary that the Government should have the courage to act on its opinions, which sometimes had to be suddenly formed, and might involve that which was hard upon traders, but was for the general welfare of the nation. They must not be too inquisitive to find out the cause operating on their minds, because the complications of our Imperial interests were so vast that the Government was placed in almost incredible difficulty to know what to do. The merchants of this country were often dependent on their action, and on the other hand the safety of the Empire was often at stake. The case they had to determine was a difficult one, in view of the issue joined by the parties and of the way in which the case had been fought by the Government. His lordship could quite believe that they did not know the whole history of this case yet, but they had to decide according to the evidence, and therefore, if the verdict was not satisfactory, neither he nor the jury must be blamed, so long as it was given on the evidence. On the one side they were asked to show sympathy with British merchants, but on the other the Attorney-General had told them that this was a case of high policy and that they must be very careful before they found a verdict against the Government, and that practically the plaintiffs were nothing more than smugglers. But they must put aside these questions of sympathy and high policy, and try the case in the prosaic way in which English justice was generally administered. The Attorney-General had told them that this was an illegitimate trade, and his lordship was sorry to hear him say that, because if this was so, he had convicted the Government of being engaged in an illegitimate trade. His lordship thought that any trade which the Government assisted merchants to carry on was a legitimate trade. The position in which this case was left was most unsatisfactory. The Attorney-General would have them believe that the Government were acting on behalf of Persia. It was sad to hear that the Government were assisting the Shah to put down smuggling in Persia. Those who paid for our Army and Navy would hesitate to pay enormous sums for them if they thought that the money was going to be used for assist countries which were supposed to be doing more for others than for ourselves. That was the defence, that they were only helping poor Persia. His lordship could have understood it if the Attorney-General had said that what was done was in the interests of England, and that the Government thought the trade was injuring India and supplying the Afridis with arms. If the case had been fought on that ground it would have had the sympathy of every one. His lordship was surprised that the defence for this conduct was that the English traders knew this to be an illegitimate trade because a ship called the *Zulu* had been seized for carrying it on. The evidence in the *Zulu* case was the strongest argument in favour of the plaintiffs. In that case the Government had done what every one was proud of. Practically, the Consuls advised the English merchants to go on with this trade because otherwise it would go to foreigners. This was a trade that the Foreign Office had advisedly assisted, in the interests of England, by using their influence to prevent too heavy a tax. Why they changed their policy in a moment without the knowledge of the traders his lordship could not conceive. The defendant relied on the judgment given in Muscat as being a judgment *in rem*, but the jury must assume that it was not a judgment *in rem*, though on legal argument it might turn out to be so. Why the Government changed their policy they did not know. One could only suppose that they got bitten with the craze that the Afridis were getting arms and ammunition through Persia. If that was true they were justified in stopping the trade, even though they might have to pay damages afterwards. He would be surprised if the jury did not say that a merchant could change the destination of his goods if he found the port was closed. It was said that the plaintiffs were smugglers, but the whole thing was done as above board as possible.

FINDING OF THE JURY.

In reply to his lordship's questions the jury found that the goods were for Muscat only, and not for Persia or India, that a reasonable man would have believed them to be for Persian or Indian ports, that the plaintiffs shipped the goods *bona fide* and in the ordinary course of business, that the trade was carried on with the knowledge of her Majesty's Government, that the words "Muscat—optional" were added to the port marks before the ship left London, that they were added with the *bona fide* intention that the goods should be landed at Muscat if desirable, that the plaintiffs were bound by the act of the ship's agents in altering the marks at Port Said, and that there was no evidence that the plaintiffs were notified of the proceedings of the Sultan's Court at Muscat.

His lordship said that this was a verdict for the plaintiffs for the amount of the value of the goods, on the finding that that they were not intended for Persian ports.

JUDGMENT.

After the finding of the jury as above, his lordship reserved judgment pending the consideration of certain questions of law, which chiefly concerned the validity of the decree of the Sultan of Muscat, under what might be regarded as Muscat law. These points were argued at length on the 17th ult., and his lordship announced his intention of delivering judgment on the succeeding Monday, the 19th ult.

The following written judgment was accordingly read by Mr. Justice Grantham:—

This case was tried before me and a special jury to determine the facts in dispute, the question of law raised on the pleadings being expressly reserved for argument on a later day. At such trial the plaintiffs and the defendant were at

liberty to call any witnesses or give any evidence that they thought necessary, but each side (I presume advisedly) omitted to call witnesses that were within their power, and to give evidence that was open to them which might, and probably would, have decided some of the important points at issue, as to which we are still left in the dark. I allude especially, as far as the plaintiffs are concerned, to the want of evidence as to the action taken by them after the ammunition was seized, while on the part of the defendant it would have been much more satisfactory if we had known the circumstances which caused the Government suddenly to change the whole course of their conduct towards people dealing in arms with the Persians and the Sultan of Muscat, and still more suddenly to obtain the decree and afterwards the judgment or order of the so-called Court of the Sultan of Muscat, under which order the goods of the plaintiffs were seized and appropriated. If my judgment does not do justice to the real facts, the parties have only themselves, therefore, to blame. The findings of the jury were findings in effect for the plaintiffs on the ground that though the proclamation of the Sultan of Muscat may have been a lawful one, and one which authorised the defendant to seize certain goods, yet the defendant seized other goods not within the proclamation, and should not defend his conduct by relying on orders given him under that proclamation. Now, however, the case has been argued on the legal defence raised in the pleadings—viz., that, whatever the findings of the jury might be, the defendant was entitled to rely upon the proclamation and subsequent order or judgment of the Sultan of Muscat, which judgment, he alleges, amounts to what is called a judgment *in rem*, and determines against the world the *status* of the goods so seized by him. In my judgment this contention of the defendant is right, and my judgment must be for him. To arrive at a correct conclusion it is desirable to break up the question into five or six branches or heads, such as the following:—(1) Had the proclamation or order of the Sultan of Muscat the power and authority of a proclamation of a responsible legislature or of any equivalent sovereign power? (2) Even if the Sultan's proclamation had that authority, could the defendant rely upon it by way of defence if the seizure of the plaintiffs' goods was illegal by the law of this country? (3) Were the goods seized goods which were the subject of seizure under that proclamation? (4) Could such a Court as that of the Sultan of Muscat have jurisdiction to deliver a judgment which would have the force of a judgment *in rem*? (5) Had the judgment or decree subsequently pronounced by the so-called Court of the Sultan of Muscat the power of a judgment *in rem*? (6) Were the plaintiffs bound by that judgment without evidence that they were either parties to it or had an opportunity of being present on the trial which preceded the giving of the judgment? (1) Had this proclamation the authority of a fully-constituted sovereign power? Clearly to my mind, yes. The learned counsel for the plaintiffs during the trial criticised very much this suggestion, and endeavoured to discredit the position and authority of the Sultan; but, as scarcely any two states are governed in exactly the same way, it would be impossible to say that a proclamation must emanate from a particular body or authority constituted in any particular and constitutional way, and, as the Sultan occupies a very considerable stretch of country as an independent sovereign, and has been considered responsible and independent enough to justify us in entering into treaties with him for many years, so he must have authority to make and pass laws in accordance with his own views of what is necessary for the well-being of his state and people, and within his own territory those laws must be binding. Some doubt was thrown on his power over his territorial waters, but, notwithstanding what was said by the learned counsel as to the effect of the judgment in the Franconia case, I have no doubt that the three-mile limit applies to the waters of Muscat, and that within that limit those waters must be considered as under the territorial power and authority of the Sultan. (2) If the Sultan's proclamation had that authority, could the defendant rely upon it by way of defence if his seizure of the plaintiffs' goods was contrary to English law? In my judgment, yes. The plaintiffs' counsel here again criticised very strongly this proposition, and ridiculed the idea that the authority of the sovereign power where the act was committed could in our Courts justify an act that was contrary to our law, but the case of "Phillips *v.* Eyre" (L.R., 4 Q.B., 225, and 6 Q.B., 1) was too clear upon this subject to admit of any doubt upon the question. For in that case it was distinctly held by Chief Justice Cockburn, and subsequently by the unanimous judgment of the Court of Exchequer Chamber, delivered by the late Mr. Justice Willes, that an Act of Indemnity passed subsequently to the commission of the alleged wrong would exonerate the person committing it from liability for such wrong in this country, though this wrong was contrary to the laws of this country. In other words, to entitle the plaintiffs to succeed, they must show that the act complained of was unlawful, not only according to the law of England, but according to the law of the country where the act was committed. "Reg. *v.* Lesley" (29 *L.J.*, M.C., 97) is also a good authority for the above proposition. (3) Were the goods seized made liable to seizure under that proclamation? The jury have found that they were not, and I think rightly, on the ground that, at the time of seizure, the goods were intended for Muscat and not for any Persian port, but for the reason given below I am of opinion that that finding does not entitle the plaintiffs to judgment. (4) Could the Court of the Sultan of Muscat have jurisdiction entitling it to deliver a judgment *in rem*? I think it could. The answer to this question depends on the answer to the first question, for if we acknowledge that the Sultan is a sovereign power, we cannot deny him the right of holding a court and giving decisions on matters of state or of law, which would be binding on his own territory, and if the decision was as to the legality of the seizure of the goods according to his law, that decision would naturally be binding on the goods then under the control of his Court. (5) Had the judgment or decree of the Sultan's Court the force of a judgment *in rem* apart from its effect on the plaintiffs' position? and (6) If it had, were the plaintiffs bound by it, considering the want of evidence of notice to them of the holding of such Court? The real difficulty in the case arises under these last two branches, in consequence of the finding of the jury that these goods were not going to Persian ports, and it is desirable to read the pleas and the replication by the plaintiffs to see how they have created the difficulty. [His lordship here referred to the pleadings.] It was stoutly alleged by the plaintiffs that the Court held in the circumstances mentioned could have no jurisdiction to deliver a judgment *in rem*, and some laughter was occasioned by the statement that of the two so-called judges responsible for this judgment one was the Lord Salisbury of Muscat, and the other the Lord Wolseley of that state—in other words, the Prime Minister and the Commander-in-Chief. Now, as we have it on the authority of Lord Salisbury that English admirals are capable of holding and administering successfully any and every difficult position that they can be placed in, I think we should be quite content to let Capt. Carr, when he has obtained that high rank which we all hope to see him occupy, act as judge of a prize or any other Court in any of our dependencies, and if he had as his fellow judge our present Prime Minister, I think we should all of us trust them to pass judgment on such questions with the greatest confidence; and if we therefore ourselves form Courts so constituted, can we complain if in these independent states, where no trained lawyers are to be found, we find that they throw the responsibility of deciding such questions on the two most important and responsible ministers in their dominions? The judgment seems in proper form and is specially confirmed by the Sultan, and I hold, therefore, that the Court had jurisdiction to give a judgment *in rem*. Assuming that it had jurisdiction, however, it is said that its judgment ought not to be accepted because it is contrary, to natural justice that a judgment should be given and be binding when the person against whom or against whose goods it is given had no opportunity of being heard, and that the plaintiffs had, in fact, no opportunity of being heard against it. I agree that a foreign judgment may sometimes be invalid on account of the proceedings in which that judgment was obtained being contrary to what is called natural justice—*i.e.* owing to want of due notice

to the party affected by it—and the case of "Schibsby *v.* Westenholz" (L.R. 6, Q.B. 155) may be taken as an authority for this proposition. But the onus is thrown on the party objecting to the judgment to show that he received no notice of the proceedings, and that the proceedings were not in accordance with the constitution and requirements of the Court in question. Now the plaintiffs do not allege any informality in the proceedings or constitution of the Court, but they allege by their pleadings that they had no notice of the Court. In my opinion they have failed to prove that no notice was given to them, or that they had no opportunity of appearing before the Court, though they had every opportunity of giving such proof, and as the jury were unable to answer the question definitely, we must look to the admitted facts to see whether or not the plaintiffs have proved any presumption of want of notice or knowledge that the Court would sit or was sitting. There was a partner in Bushire who would hear at once of the seizure of the goods. They had a regular agent at Muscat, who by his letter of March 9 tells them that the English Government had been anxious to get this Court held, but that the Sultan objected, and that in consequence his allowance was stopped. Now this, whether true or not, shows that this agent was cognizant of all that was going on, and as he had received special orders from the plaintiffs to apply to the captain of the ship, Captain Paramor, for the delivery of the goods to him on the arrival of the ship at Muscat, and we find he did not apply to the captain of the ship or to Captain Carr, his not applying must have been for some good reason, and as neither the partner nor the agent applied for the release of the goods, it looks as if, notwithstanding the evidence before the jury, they were unable to give satisfactory explanations of the real destination of the goods. But besides these men, the ship's agents, who were not called by the plaintiffs, but whose evidence might easily have been taken, were stated by Capt. Carr to have been in constant communication with him, but they never asked for the release of the goods, though they evidently knew that some of the goods seized were afterwards given up to the claimants on proof being given that they were not liable to seizure, and as everyone in the place evidently knew what was going on, and as I am to draw inferences of fact in any questions of fact not found by the jury, so as to avoid a fresh inquiry, I must hold that the plaintiffs, even if they did not have direct notice, did get notice, and did have an opportunity of appearing before the Consul and before the Court, and, consequently, as the jury has found that any reasonable man would believe that the goods were going to Persian ports, I find that the plaintiffs wilfully and deliberately abstained from raising any objection to the seizure at Muscat, and cannot, therefore, now contend that the seizure was illegal or that the judgment was contrary to natural justice. If any authority were necessary, "Cornish *v.* Abington" (4 H. & N. 549) would be ample authority for my so finding. For these reasons my judgment must be for the defendant.

A stay of execution for ten days on the usual terms was granted with a view to an appeal.

THE WOOLWICH TESTING STATION.

OFFICIAL REPORT FOR 1898.

MAJOR COOPER-KEY, R.A., signs the report for the year 1898 on the working of the Explosive Testing Station at Woolwich. It is explained in the introduction to the report that since the year opened Capt. M. B. Lloyd, R.A,, who was appointed one of H.M. Inspectors of Explosives on June 1, 1898, has been associated with Major Cooper-Key in this work, and that towards the end of the year he has taken over entire control of the station. Reference is deservedly made to Capt. Lloyd's exceptional qualifications for work of this description. The report, as a whole, is of such interest that we herewith reproduce it practically in full, apart from our ordinary notice of the Annual Report of H.M. Inspectors of Explosives of which it forms a part,

THE APPARATUS.

The apparatus continues to work quite smoothly. Doubts were at one time entertained as to the capability of the gas engine to yield sufficient motive power to do the necessary work, but all difficulties have since been removed, and it is possible to fire between 30 and 40 shots in a day without any undue strain. There is a certain grim satisfaction in the fact that with the best will in the world, we have found it quite impracticable to utilize any suggestion in the nature of an improvement from outside sources, notwithstanding the number and experience of the experts, both British and foreign, who have honoured us with a visit. Captain Lloyd has made some slight alterations in the "drill," with a view (1) to ensure that the tube shall be thoroughly cleared of all residual gases after each shot, and (2) to empty the gas holder on the completion of the mixing by means of the fan, instead of by hand as heretofore. The removal of the concrete screen between the cannon and the observer is a decided improvement, inasmuch as the recoil and the appearances at that end of the tube when a shot is fired are, on occasions, exceedingly instructive.

THE CONDITIONS OF THE "TEST."

The necessity for altering the conditions of the test has not yet arisen, and does not seem likely to arise, at any rate, for some time. No complaints have reached my ears as to any want of uniformity. In all essential particulars the conditions are identical on every occasion. There are apparently only two channels by which errors may creep in notwithstanding all our efforts, viz.: (1) Atmospheric influences; (2) the fact that the stemming is done by hand. As regards (1), it would be almost, if not quite impossible, to experimentally determine the effect of the varying conditions of the atmosphere on the explosive properties of the gaseous mixture. These conditions may be divided into four classes, barometric, thermometric, anemometric, and hygrometric, and each of these may again be subdivided into "exceptionally high," "average," and "exceptionally low," and when it is considered that the experiments must necessarily be of a negative nature, and that, therefore, nothing under a very large number of shots would be of any value, and that the number of ways in which these conditions might be severally combined, amounts to no less than 81; and lastly, that every class of explosive would have to be separately tested, it follows that many thousand shots would have to be fired in order that a definite conclusion might be arrived at; and even if the requisite weather could be supplied to order, this would involve an amount of work which would scarcely be commensurate with the object to be attained; it being exceedingly doubtful if in the end we should find that atmospheric changes had any material effect on the results.

I have, however, a strong suspicion—although at present it is no more than a suspicion—that there is one somewhat rare meteorological condition which appreciably affects the explosiveness of the mixture—I refer to the case of a high barometer combined with a moist atmosphere, a combination which appears to render the mixture distinctly more explosive. Why this should be I am not in a position to state, but that it is so I have fair reason to believe, and since coming to this conclusion, I have received the independent testimony of a well-known mining engineer in corroboration of my view. As regards the other channel by which want of uniformity may be introduced, viz., stemming by hand, Captain Lloyd has suggested that this should be done by hydraulic means, in which case the personal error would be entirely eliminated, and the stemming might be applied both as to amount and consistency with mathematical precision.

THE QUESTION OF "UNIFORMITY."

I have dwelt somewhat on this question of uniformity, inasmuch as it is to my mind the hub round which all other considerations should revolve, and the importance of which is, I regret to say, not yet fully realised, even by experts. I have been frequently asked by men whose opinions carry the greatest weight in the mining world, why the conditions of the test are not more assimilated to those obtaining in a mine. To particularise, the addition of coal-dust to the explosive mixture has been continually urged as being a necessary adjunct if useful information is to be obtained, "Informa-

tion," in fact, is the rock on which they split. The "information" gained by previous experiments has, no doubt, culminated in the formation of a "Test," but once this "Test" is settled, surely everything should then give way to considerations of uniformity, *i.e.*, "fairness." It became apparent at a very early stage that no sort of uniformity could be obtained if such a variable influence as coal-dust were allowed a place. How much dust should be added? How should complete incorporation of this dust with the gaseous mixture be ensured? How should the apparatus be thoroughly cleaned after each shot? How, again, should an absolutely equal degree of sensitiveness to ignition be attained? These and other similar questions proved unanswerable. Take the first and simplest. How much dust should be added? If we have already the most sensitive possible mixture of combustible material and oxygen, why add more of the former? Dr. Haldane,* than whom a higher authority on these matters would be hard to find, states that more than ·1 per cent. by volume of coal-dust in suspension in pure air would probably render the mixture non-explosive—indeed, he goes so far as to say that it is a question whether watering and otherwise reducing the quantity of available dust in a mine is not rather favourable to the very result it is desired to avoid—the formation of an explosive atmosphere.

Moreover, although the theory that coal-dust without the addition of fire-damp cannot initiate an explosion was sore stricken at Camerton in 1893, and received its death-blow at Timsbury two years later, yet the fact that, as evidenced by the official reports on these catastrophes, the said theory died hard, seems to prove, if proof were required, that up to that time such well qualified judges as H.M. Inspectors of Mines were convinced that an explosive mixture in which the combustible material was added in the form of fire-damp was far more sensitive than when this material was added in the form of dust. Indeed, it would appear that in order to *originate*† an explosion the necessary conditions would involve an abnormally intimate mixture with the oxygen of the air of precisely the correct percentage of dust, combined with a source of heat of considerable volume as well as intensity, whereas a very varying proportion of fire-damp will form with air an inflammable mixture, and one liable to be ignited by a comparatively insignificant source of heat. If this can be said of methane, it is even more true of coal gas, not only on account of its lower temperature of ignition, but also from the wider percentage limits between which a mixture of the latter with air remains inflammable. If, then, we have the most sensitive mixture possible, which is at the same time in the most manageable form, why interfere with it in order to introduce a substance which, although doubtless always present in a coal mine, has in only a very few authenticated cases been the *originating* cause of a disaster?

It is scarcely conceivable that an explosive which can be fired with impunity through a mixture such as that in use at the Testing Station is less safe than one which under precisely similar conditions cannot be so fired. So long as the necessity is deemed to exist for the use of explosives in coal-getting, so long will accidents occur; holes will be bored through fissures containing gas; blowers of gas will be tapped in the course of boring—an inflammable atmosphere in either case being brought into actual contact with the explosive; the stemming may, in the case of a blown-out shot, impinge on a solid body and set up locally a dangerous temperature; and, lastly, a shot may be fired unstemmed, either by accident or design; but it is surely possible for us to assist, by means of such technical knowledge as we may possess and by frequent experiments, the ceaseless efforts of H.M. Inspectors of Mines towards reducing the number and minimizing the effects of these lamentable sources of disaster, without in any way interfering with the uniformity and fairness of the test.

* "Causes of Death in Colliery Explosions."

† The *propagation* of an explosion by means of dust is quite a different matter—indeed, in these days of careful inspection and efficient ventilation, it would appear doubtful whether it would be possible for such propagation to take place without dust; but from a "Testing Station" point of view this is a matter of no moment whatever. The originating cause is the one important consideration.

REMARKS ON THE NEW EXPLOSIVES ON THE PERMITTED LIST.

As foreshadowed in my last report, gunpowder of a high class, in combination with a chemical "cooler," has obtained a place on the Permitted List. Not only this, but specially manufactured gunpowders have at length been produced which are capable of passing the test even without the assistance of a cooler. These results, I would venture to suggest, may be regarded as directly due to the Explosives in Coal Mines Order. The necessity having arisen for such a gunpowder in consequence of this Order, manufacturers have found comparatively little difficulty in producing one satisfying the conditions imposed, whereas had no such necessity arisen they might well have been content with an explosive for which they had already an assured sale and have made no effort to improve thereon.

With regard to the other explosives on the list, there is little to remark. A reduction has been sanctioned in the fee to be paid in the case where an alteration in the packing or method of firing an explosive already on the list necessitates a re-test, or rather a *confirmatory* test under the slightly altered conditions.

Steps are being taken to provide each of H.M. Inspectors of Mines with a special metal case, as approved by the Railway Clearing House, for the conveyance as ordinary goods of samples of permitted explosives to the Testing Station, in order that an abbreviated test of, say, 10 shots may be carried out; and mine managers and others are encouraged to take advantage of this facility in all cases where they entertain the slightest suspicion as to the behaviour of any permitted explosive used by them.

DETERMINATION OF EQUIVALENT CHARGES.

The method of obtaining the equivalent charges of the various explosives by means of lead blocks remains unchanged. So far as regards high explosives the results are probably fairly accurate, although, no doubt, somewhat disadvantageous to those of them which have been purposely "tamed" for use in soft coal. No more practical method, however, has yet been produced, and it is moreover unreasonable to suppose that a quarter of an ounce or so in the weight of the charge can make any material difference in the result of the "Test."

With gunpowder it is a somewhat different matter. The "time" factor, ignored by the lead block, is now of more importance. A combination of the "mortar" and "expansion" tests, such as the propulsion of a ball from a lead block, might possibly meet the difficulty—although this is somewhat doubtful—but, in case an alteration in the conditions of the test should at any future time be deemed expedient, it would, I venture to think, be more satisfactory on the whole to use equal charges of all non-detonative or low explosives, and trust to the exigencies of trade for the elimination of such as would only pass the test by reason of their want of explosive power.*

The adoption of this principle would, however, still leave undecided the very important question of the comparative efficiency of high and low explosives, and I would suggest for your consideration that, in order to settle this vexed question once and for all, and set up a standard which could hereafter be regarded as official, it might be well to initiate a short series of experiments in a stone of medium hardness (or, if preferred, in a hard coal) to compare the effect of a good gunpowder with that of carbonite, or some other of the less violent high explosives. Although the solution of the problem should perhaps be a matter more for private enterprise than for Government interference, yet it is impossible to establish anything in the nature of a *standard* unless the results receive the hall-mark of official sanction.

During the past year, for instance, I have made many endeavours to obtain from unprejudiced experts a definite answer to this question, but without success. I have gathered,

* Practically this is what obtains at present—the equivalent charges varying between 5½ and 6½ ozs. with, however, the additional risk of assigning a prohibitive charge to a comparatively powerful and efficient explosive by reason of its slow action and consequent insignificant expansion of the lead block. The converse is so unlikely to occur as scarcely to be worth consideration.

however, that the semi-official standard established in Germany, and quoted by me in a footnote to my last year's report, disagrees very considerably with the results obtained in this country. Although the ratio of 3 to 1 adopted at the Testing Station (*vide* Report for 1897) is perhaps, having regard to the conflicting opinions on the subject, as fair a proportion as any other, yet it would appear somewhat unsatisfactory, where large and important interests are at stake, to decide the question by hearsay alone, when it can be by no means impossible, by actual experiment, to arrive at a reasonably accurate conclusion which may be quoted as a quasi-official standard of comparison.

INFLAMMABILITY OF ANTHRACITE DUST.

A deputation of the South Wales anthracite colliery owners having approached the Home Secretary, with a view to the relaxation of the Explosives in Coal Mines Order in favour of certain of their mines in which fire-damp in appreciable quantities was unknown, a series of experiments took place at the Home Office Testing Station at Woolwich, on the 29th July, to determine the inflammability or otherwise of various samples of anthracite dust—(1) in suspension in air alone, (2) in suspension in a mixture of air with a small percentage of coal-gas.

Representatives of the mine owners and miners were present, in addition to five of H.M. Inspectors of Mines and three of the officials in charge of the Testing Station, and the following programme, partly arranged beforehand and partly suggested on the spot, was carried out:—

(1.) Two ounces of a non-permitted explosive were fired in the open under a heap of quite uninflammable clay-dust. *

(2.) The same was repeated under a similar heap of steam coal-dust.

(3), (5), (6), (9.) The same repeated under similar heaps of anthracite coal-dust from various mines.

(7.) The same repeated under a heap of especially inflammable steam coal-dust.

(8.) A repetition of No. 1 experiment. *

(10.) A treble charge of a *permitted* explosive was fired under a much larger heap of steam coal-dust.

(11.) A 1-lb. charge of a non-permitted explosive was fired from the cannon in the vertical cylinder stemmed with clay only. *

(12.) A similar charge but stemmed up to the muzzle with anthracite dust was fired into a mixture of the same dust and air.

(13.) A more than equivalent charge of a *permitted* explosive was fired under exactly similar conditions.

(14.) A 1-lb. heap of the non-permitted explosive was placed on an iron plate in the vertical cylinder and covered with anthracite dust. Some of the same dust was then fanned into the cylinder and the heap of explosive fired.

The general result of these experiments was to prove to the satisfaction of all present that, although doubtless steam coal-dust was more inflammable than anthracite, yet the difference was purely one of degree, the latter dust, even when mixed with over 30% of foreign mineral matter from the main haulage roads, &c., giving a large volume of bright flame in every instance where a non-permitted explosive was used. Moreover, in experiments Nos. 10 and 13, in which a *permitted* explosive was used, there was absolutely no appearance of flame whatever, shewing very conclusively that any relaxation of the Order so as to sanction the use of non-permitted explosives in dry and dusty anthracite mines would be attended with grave risks.

A distinctive feature of these experiments, and one to which I would venture to draw your attention, is the fact that in no case did we obtain a true *explosion* of dust. A combustion which occupies an appreciable time can scarcely be dignified by the name of an explosion. The dust appeared to be ignited by the shot and to burn for such time as the particles were able to communicate sufficient heat from one to another. There was no instantaneous conversion of the solid into the gaseous form, and no noise beyond that due to the shot itself. Can it be that there are two distinct means by which a so-called explosion of coal-dust can occur, viz.:—(1) The comparatively gradual oxidation of the solid particles of dust with the evolution of light and heat, commonly called combustion, and (2) the destructive distillation of the coal-dust followed by instantaneous oxidation of the hydrogen and methane evolved. For the production of the former of these two phenomena the dust cannot well be too thickly distributed through the atmosphere, whereas for the latter, according to the above-quoted authority, any material increase beyond ·1% by volume renders the mixture innocuous, either by reason of the heat absorbed by the superfluous dust, or by the production of so much gas as to exceed the limit of inflammability. Of one thing, however, I think we may rest assured, viz., that either phenomenon is equally dangerous in a fiery or dusty coal pit.

But to return to the experiments. Although the main object of these was now fulfilled, it was thought advisable, in order to make the investigation more complete, to determine whether the addition of coal-dust or anthracite dust to a non-explosive mixture of coal gas and air would render this mixture explosive.

With this object in view the gas gallery was brought into requisition. A 4½% mixture of coal gas and air having been prepared, the cannon was loaded with a 2-oz. charge of a non-permitted explosive loosely tamped with 9 inches of dry clay. On firing there was no explosion in the gallery.

Several shots were now fired with anthracite and steam coal-dusts loaded in the cannon as stemming, in such a manner that the explosion of the charge projected the dust in a fine state of division into the otherwise non-explosive mixture of coal gas and air. In every case there was an explosion of the mixture with a considerable appearance of flame at the valves of the gallery.

This result was confirmatory so far as coal-dust was concerned, but it can scarcely be considered to conclusively prove that an inexplosive mixture of gas and air can be rendered explosive by the addition of coal-dust, inasmuch as the circumstances of the two experiments were by no means identical. In the former case, viz., the case in which no coal-dust was used, the shot was stemmed with clay (although the clay was very loosely inserted), whereas in the latter the shot was practically fired *unstemmed* into a mixture of coal-dust, gas and air. Nevertheless, the experiments on the whole were extremely instructive.

EXPERIMENTS WITH DETONATORS.

On the 29th November I was present when Captain Lloyd carried out some interesting experiments to test the distance at which one detonator will fire others. The detonators used were Nobel's, containing 80% fulminate and 20% chlorate of potash, and the *modus operandi* was as follows:—

A sufficient number of little pads of puddled clay having been manufactured, one, supporting the firing detonator, was placed in the centre of similar pads, each of which held in an upright position an ordinary non-electric detonator with its open end stuck into the clay. Thus the distances could be accurately measured, and the composition was not exposed to the direct action of the flash. The following programme was then carried out:—

I. (*a*) A No. 6 (1 gramme) was fired in the centre, with others arranged round it at 4, 6, 9, and 12 inches distance respectively. Result—None fired.
(*b*) Repeated, but with one at 1 inch, one at 2 inches, and two at 3 inches. Result—All fired.
(*c*) Repeated, but with four arranged round at a radial distance from the centre of 3 inches, the whole being confined by an up-ended barrel. Result—All fired.
(*d*) Repeated, but without the barrel. Result—3 fired.

II. Carried out similar experiments with a No. 7 (1½ gramme) in the centre. Result, at 6 inches radius—none fired. Result, at 4 inches radius—all fired. Result, at 5 inches radius—2 fired.

III. A similar experiment with a No. 8 (2 grammes) in the centre. Result, at 7 inches—1 fired.

* The object of this was to enable the amount of flash from the explosive itself to be noted.

IV. (*a*) A bundle of 5 No. 6 detonators were fired in the centre of a circle of 4 others at a radius of 12 inches. Result—1 fired.

(*b*) The number in the bundle was increased to 20 and the radius of the circle to 24 inches. Result—1 fired.

(*c*) Repetition of (*b*), except that the bundle was screened by means of stout cardboard and the radius reduced to 12 inches. Result—3 fired.

V. A 2-ounce cartridge of gelignite was detonated in the open in the centre of a circle of detonators at a radial distance of 24 inches. Result—None fired.

VI. A No. 6 detonator was fired half an inch away from a cartridge of gelignite from which the wrapper had been removed, with the result that the gelignite was not fired.

Experiments I., II., and III. seem to prove that a No. 6 will not fire others at 4 inches distance; No. 7 will not fire others at 6 inches distance; No. 8 will not fire others at 8 inches distance, or more simply a No. 6 is unlikely to communicate explosion to others at 6 inches; No. 7 is unlikely to communicate explosion to others at 7 inches; No. 8 is unlikely to communicate explosion to others at 8 inches.

Experiments IV., V., VI. present certain features of interest, more especially when considered in conjunction with the circumstances attending an accident which occurred in a lead mine in Derbyshire early in November last, by which a miner unfortunately lost his life. In this case the unhappy man was evidently leaning over a box about 18 inches long by 10 wide, containing about 90 No. 6 detonators at one end and about 3 lbs. of gelignite at the other. In his waistcoat pocket he was carrying a fully prepared charge of gelignite with a fuze and detonator attached. He was killed by the explosion of 90 detonators in the box, but neither the gelignite in the box nor the charge in his pocket was fired—a somewhat startling result, but in the light of the foregoing experiments not so very improbable. While on the subject of detonators, I am glad to be able to report that we have experienced no recurrence of the epidemic of miss-fires referred to in my last year's report. Moreover, from information supplied by Mr. Stokes, H.M. Inspector of Mines for the Midland District, I am now able to furnish a probable solution of the problem. Mr. Stokes has proved beyond question that missed shots are occasionally due to the priming composition being shaken away, not from the "bridge," but from the fulminate. This would quite account for the fact that, as reported by me last year, "the circuit tester in connection with the firing key invariably shewed a current *after* the operation of stemming was completed, although the only possible explanation of the miss-fire would appear to be the breaking of the 'bridge' *during* the operation."

THE GUNCOTTON YARN "TELL-TALE."

Further experience has shown that the guncotton yarn at the end of the tube is not so certain as could be wished in its action as a "tell-tale." At best it was never suggested that it should be regarded as infallible, but only as an assistant to the officer in charge. From its liability to be ignited by a blow from the stemming on the one hand, and not to be ignited by a very mild explosion on the other, it would certainly appear advisable to provide a more reliable "tell-tale," which could be absolutely depended on, not only to assist, but actually to guide the testing officer's opinion. The requisites of a good tell-tale are two, viz., (1) to be so far removed from the actual line of fire as to preclude all liability of being struck by the stemming or fired by the explosive itself, and (2) to be in such close proximity to the gas that the very slightest combustion of such gas will not fail to ignite it. Neither of these considerations are fulfilled by the present arrangement, but Captain Lloyd has suggested a means by which these two conditions may be ensured, *i.e.*, by means of an auxiliary tube placed parallel with the present gas gallery, and which will contain a similar mixture to that in the main gallery. The guncotton "tell-tale" might be placed actually inside this tube. Another and perhaps a simpler suggestion, due to Captain Thompson, is that a hole should be drilled in one of the leads from the gas holder to the gallery, and a plug, to the end of which a tuft of guncotton yarn might be attached, should be fitted to this hole. The only disadvantage of this plan would be that the guncotton yarn would not be visible to the observer, and on occasions a misunderstanding might possibly arise as to whether or not any yarn had been attached before firing the shot.

It is a matter for regret that no progress has been made with the investigation of the influence on the behaviour of an explosive of (*a*) the diameter of the bore-hole, and (*b*) the varying velocities of the evolved gases; but this omission must be put down to the changes in the Department rendered necessary by the sudden and lamentable death of Sir Vivian Majendie. I was at once called on to take my full share of inspectorial duties, which, added to the routine testing work, left me no opportunities of initiating a course of experiments of sufficient extent to be of any value. I am confident, however, that in handing them over as a legacy to my successor the ultimate result will more than justify the postponement.

This report, as mentioned at the commencement of this article, is signed by Major Cooper-Key, R.A.

CORRESPONDENCE.

THE MARK IV. BULLET.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—In your issue for June, under the head of "Incidental Jottings" I see it stated that: "The small-arm projectile now employed is a hollowed-nosed bullet, known as the Mark IV., which, we understand, owes its inception to the genius of Col. Bainbridge and the staff of the Royal Laboratory."

If this is not intended ironically, perhaps the best comment upon it will be a short *résumé* of what has taken place since the adoption of the small-bore rifle.

The first bullets for the ·303 rifle made by the Royal Laboratory, or on their specification, were issued to the troops, and, when fired at Bisley, found to be absolutely useless; they deformed or stripped in the barrel, &c., and, according to report, went all over the place, many being found only a few hundred yards in front of the firing point.

These bullets having been condemned, the Royal Laboratory tried their hand again, this time covering the leaden cone with a very strong case, which, of course, enabled the bullet to be fired, but at the sacrifice of efficiency, the small rigid bullet giving a clean penetration quite inadequate to stop cavalry, or even the rush of determined men.

For some eight years our troops were supplied with these bullets, although the danger arising from their use was constantly pointed out during that time; but at length their want of stopping power was practically demonstrated in the Chitral campaign by the enemy, who preferred being led against the British line regiments armed with the ·303 rifle to having to draw conclusions with the native regiments armed with the old larger bore rifles; the ·303 bullets, according to subsequent report, did not appear to have caused even temporary inconvenience to men pierced several times by them. The outcry was then so great that a bullet was constructed at the Government Small-Arms Factory at Dum Dum embodying the principle of expansion on impact, copied from sporting bullets that had been in use for years; and, following on that, the troops in Egypt made application to be allowed to weaken the nose of the bullet by filing, which application was sanctioned.

The Royal Laboratory then, after considerable experimenting, issued a specification and contract for bullets made with a hollow in the nose, but with the jacket of the normal thickness as before; these, naturally, would not expand on account of the strength of the case, notwithstanding the hollow in the nose, and were condemned, and a fresh specification (Mark IV.) issued, in which the case is thinned over the front part.

Heretofore bullets, having a hollow in the nose, have not been found to fire with accuracy at long range, though they have been sufficiently accurate at the 300 or 400 yards range required for sporting purposes. Possibly the genius of the Royal Laboratory may have overcome this little difficulty; but if Col. Bainbridge and the staff of the Royal Laboratory are responsible for the pattern and manufacture of the ·303 bullet since the introduction of the small-bore rifle, then any claim for genius in its inception is only calculated to court ridicule and hard knocks.

MICH. TWEEDIE, Major-General.

June 24, 1899.

THE LATE MR. J. ABRAHAM.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—In your May number you state that Mr. Abraham was the original founder of the Birmingham Small Arms and Metal Co. For the sake of accuracy, will you allow me to explain that the Birmingham Small Arms Company was founded in 1861. In 1873 the Company purchased from Mr. Abraham his Metal Works, and then altered the title to the Birmingham Small Arms and Metal Co. As part of the agreement, a seat on the Board was allotted to Mr. Abraham. In 1897 the Company sold the Adderley Park Works, and reverted to the original title of the Birmingham Small Arms Co., Ltd.

Yours faithfully,

HERBERT WALLIS, Managing Director.

May 16th, 1899.

THE EXPLOSIVE DYNAMMON.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—We observe a serious error in your notice *re* "The Explosive Kammerung" (No. 80, May 1, 1899, page 77), probably by the fault of the translator of Prof. Birk's article. The real name of the explosive is "Dynammon." Kammerung means chambering, as the chambering of the bore holes presents some advantages with all explosives of the safety class. Professor Birk is giving a description of some methods of chambering in his article in the German journal *Bautechniker*. Dynammon is a powerful explosive both for mining and military purposes, and adopted by the Austrian navy since 1890. The name Dynammon was given a year ago by the Austrian Government (the explosive trade is a monopoly in Austria). The former name was "Ammonium Safety Powder." The English patent, No. 25,568 (1898) of Count Geldern, referring to a mixture of naturally carbonised cellulose (such as peat, decayed leaves, etc.,) with nitrate of ammonia, is but a modification of the original Dynammon, which is not patented, containing charcoal of a peculiar class. Nobody, for instance, would claim a patent for a black powder containing peat or pit-coal instead of charcoal. If you want more accurate notice on Dynammon and its use, we are willing to give them as long as they do not concern special details, or secrets of manufacture.

We remain, Sir, yours truly,

MAYR & ROTH,

Felixdorf, May 12,1 899. Pulverfabrik zu Felixdorf.

[We thank our correspondents for their letter, and we should much appreciate further particulars of this explosive. —ED. *A. & E.*]

APPLICATIONS FOR PATENTS.

MAY 13th—JUNE 17th, 1899.

10,235 Breach Mechanism of Guns. Sir W. G. Armstrong, Whitworth & Co., Ltd. A. G. Hadrock, and S. M. Murray.
10,283 Quick Firing Guns. W. G. Potter.
10,350 Cartridge Packing Boxes. R. Fryer, and Kynoch, Ltd.
10,405 Ordnance and Projectiles. H. N. Simpson.
10,591 Pivot and Pivot Bearings for Gun Mountings. W. W. Bostwick.
10,601* Automatic Fire Arms. G. Roth and K. Krnka.
10,799 Break-down Gun Mechanism. G. D. Potter.
10,873 Safety Device for Small-arms. A. J. Boult. (*Agent for J. B. R. Aimé, France*).
10,928 Alarm and Signal Guns. F. Edwards.
10,997 Marking for Rifle Shooting. C. A. D. George.
11,014 The "Pinckney" Weapon for National Defence. P. Pinckney.
11,026 Breech Loading Ordnance. A. T. Dawson and G. T. Buckham.
11,051.* Safety Fuses or Detonators for Explosive Projectiles. H. P. Hurst.
11,075. A Hook Carrier for Guns and Rifles. L. H. Sibthorpe.
11,269. A Means of Cooling Gun Barrels. W. H. Fitzgerald.
11,271. Backsight for Rifles. W. P. Thompson.
11,294. Machine for Loading Cartridge-cases. J. P. de Braam.
11,319. An "Explosive Paste" for use as a Detonator. H. A. Anderson.
11,345 Cartridges fired by Electricity. W. Friese-Greene, and P. E. Knell.
11,364. Apparatus for Launching Torpedoes. H. L. J. C. Turc. (Date of Application in France, 5th November, 1898).
11,382. A Means of Preventing Explosions or Setting Fire to Inflammable Liquids. G. P. Epstein.
11,398. Triggers for Double Barrel Drop-down Small-arms, J. S. Heath.
11,526. Ordnance. A. T. Dawson and G. T. Buckham.
11,667 A Means of Discharging Projectiles. J. J. Fyfe and J. W. Fyfe.
11,759. Air Guns. W. P. Thompson.
11,770. Shooting Galleries. H. Künzel.
11,782. Machine Guns. J. Formby.
11,789.* Modified Form of Target. E. F. G. Pein.
11,929. Apparatus for Transporting Guncotton Freed from Surplus Acid in Nitrating or Acid-centrifugals. J. Selwig.
11,973. Light Gun Carriages. A. T. Dawson and G. T. Buckham.
12,093. Automatic Guns. The Hotchkiss Ordnance Company, Ltd. (*Agent for L. V. Benèt and A. Mercié, France*).
12,147. Fuse for Detonating the Explosive in Shells. H. P. Hurst.
12,153. Machine Guns and Small-arms. J. H. Barry and R. G. Pemberton.
12,190. Ordnance. M. A. Weir.
12,222.* Breech Mechanism for Machine Guns. J. W. Stockett. (Date of application in U.S.A , November 26, 1898).
12,316. Process for Producing Nitro-explosives. A. J. Boult. (*Agent for J. F. T. Sargent, U.S.A.*)
12,385. Projectiles. A. Barrallon.
12,392.* Manufacture of Explosives. F. J. W. Lindeman.
12,398. Manufacture of Shells for the Reception of Power for Ordnance. A. Barrallon.
12,404. Cartridges for Gun Charges. A. Barrallon.
12,412. Cartridges for Fire-arms. A. Barrallon.

12,428. Manufacture of Explosives. J. Y. Johnson. (*Agent for the Chemische Fabrik vormals Goldenberg Geromont & Co., Germany*).
12,464. Rifles. J. MacNaughton.
12,591. Manufacture of Explosives. C. H. Curtis and A. H. Durnford.
12,603.* Sights for Rifles. H. P. Holt.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MAY 27TH—JUNE 24TH, 1899.

13,147 (June 11, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., Sir A. Noble, and C. H. Murray, Newcastle-on-Tyne. A means of loading heavy guns at whatever angle of elevation or depression by mounting the whole of the ammunition hoisting mechanism on the gun slide. Accepted May 13th, 1899.

14,470 (June 13, 1898). G. F. Redfern. (*Agent for E. Ternstrom, and P. Nordenfeld, Paris*). A means of reducing the shock and strain upon a gun carriage, caused by the recoil by attaching brake shoes to the trail, the latter being itself mounted upon the axle of the carriage by means of spring plates. Accepted June 2nd, 1899.

14,659 (July 4, 1898). L. B. Taylor, Birmingham. A bullet, especially designed for automatic pistols, which consists of a metal jacket with a solid base, into which is inserted a core having a concave bottom. An air chamber is thus formed between the core and the jacket, which may be filled with a tube filled with fulminate. The jacket only partially covers the lead core at the nose, the exposed part of the latter being formed with a shoulder, which is claimed to assist the expansion. Accepted April 29th, 1899.

16,107 (July 23, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., D. S. Marjoribanks, and G. Stuart, Newcastle-on-Tyne. A means of preventing the metal cartridge case for quick-firing guns from bulging in the chamber by raising a band near the mouth of the case. This band acts as a gas check and prevents the gas from escaping into the space between the case and the chamber. Accepted May 27th, 1899.

16,402 (July 27, 1898). W. L. Wise (*Agent for the Maschinenfabrik Oerlikon, Switzerland*). A method of increasing the impulse of the chamber bursting charge on the mass of charge balls in a shrapnel shell, by inserting a closing pin in the charge hole of the driving plate, which is expanded to fit a recess made in the bursting tube and provided with a narrow bore. Accepted May 27th, 1899.

16,403 (July 27, 1898). W. L. Wise (*Agent for the Maschinenfabrik Oerlikon, Switzerland*). An arrangement for leading away the gases given off from the charge rings of time fuses, which consists of a cap or chimney having a guard over it. The rotation of the shell causes the air passing over the guard to exhaust the gases of combustion. Accepted June 2nd, 1899.

16,656 (July 30, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., and R. Matthews, Newcastle-on-Tyne. A method of loading heavy guns in any position by a hoist, in which one end of the rope or chain is attached to a lever fixed to the gun. The ammunition on being raised is therefore guided by the lever to the breech of the gun. Accepted June 2nd, 1899.

16,744 (August 2, 1898). O. Imray. (*Agent for A. T. Dawson, France*). A rammer for breech-loading guns, consisting of a number of telescopic tubes, the innermost one of which has a rammer head attached. This rammer occupies only a small space behind the gun when not in use, and for ramming it is rapidly elongated, forcing the charge into the gun. Accepted June 2nd, 1899.

17,481 (August 13, 1898). A. Riechwald (*Agent for Fried. Krupp, Germany*). A safety arrangement for time fuses, in which the unintentional revolving of the fuse-ring is prevented by a lever pivoted within the fuse body. One end of the lever is forced into a recess in the fuse ring by a spring, while the other arm prevents any movement on the part of the hammer carrying the priming pellet. Accepted May 20th, 1899.

21,739 (October 15, 1898). H. E. Newton (*Agent for the San Francisco Arms Company, U.S.A.*) This patent relates to a number of modified forms of supplying cartridges from magazines in automatic guns, the principle of which consists of a horizontal rotating cartridge holder, by which the cartridges are delivered downward, and are received one by one into the breech by side plates so arranged as to support them in a position ready to be advanced from the plates longitudinally into the barrel. Accepted May 6th, 1899.

22,333 (October 24, 1898). H. H. Lake (*Agent for A. M. Jenkins, U.S.A.*) A modified form of automatic target trap, from which the clay birds may be thrown at constantly varied angles by means of a device which keeps the swinging frame constantly oscillating. Also various other modifications. Accepted May 20th, 1899.

1,700 (January 24th, 1899). H. P. Hurst, U.S.A. A safety fuse which is made separately, and is attached to an explosive shell. The fuse is separated from the shell by a partition, which is removed by the centrifugal force developed by the revolution of the shell when fired, thus exposing the bursting charge to the fuse. The object of the partition is to prevent the shell being exploded in the event of the fuse exploding prematurely. Accepted May 27th, 1899.

2,149 (January 31, 1899). J. O'B. Gunn, U.S.A. A blasting compound consisting of 63 % nitrate of sodium, 22 % mineral coal (that is coal containing hydrocarbon gas), and 15 % of sulphur. The explosion is due to the expansion and liberation of the hydro-carbon gases contained in the coal. The ingredients are powdered finely and mixed. Accepted June 2nd, 1899.

3,123 (February 11, 1899). P. Pondorf, Germany. A device for controlling the direction or arrangement of projectile cases which are open or recessed at one end, consisting of a stud or stop which intercepts bodies travelling with their open end first, and acting as a pivot, turns them in the right direction. The cases travelling with their pointed ends first are not intercepted. Accepted May 27th, 1899.

3,952* (February 22, 1899). A. E. Lard, U.S.A. The Lard Single-trigger Mechanism.

6,215 (March 22, 1899). F. M. Garland, U.S.A. A machine gun which has two barrels loosely supported so that the recoil causes them to travel backwards against the action of springs The recoil of one barrel automatically loads the other. Accepted May 6th, 1899.

7,123 (April 4, 1899). F. W. H. Meessner, Germany. An arrangement, consisting of stuffed pads or cushions, for holding fire-arms on cycles. The pad has a support on one side for carrying the rifle, and may be cut to fit any part of the frame to which it is to be strapped. Accepted June 2nd, 1899.

7,249 (April 6, 1899). A. H. H. Mahn, Germany. A device for controlling the sights of small arms, consisting of a pendulum which is in an exact perpendicular with the sight when in its normal position. The slightest deviation of the sight from its proper position, therefore, is at once noticed. Accepted May 27th, 1899.

7,602 (April 11, 1899). M. C. Lisle and F. A. Simonds, U.S.A. A projectile for use with high explosives, the jacket of which consists of a cord tightly wound round the soft metal centre. It is claimed that the cord prevents the lateral distortion of the projectile on striking a hard object, thereby increasing its penetrative power. The cord also lubricates the bore of the gun and engages firmly with the lands. Accepted May 13th, 1899.

7,620 (April 11, 1899). F. K. Young, U.S.A. A cartridge for use with automatic fire-arms, which has, in the place of a cap, a piston which extends to the base of the bullet; on striking the piston, the cap, which is at the top of the piston, ignites the powder and tends to force the piston outwards against the face of the breech block. The breech block being movable, however, is forced back by the pressure of the cartridge piston. Accepted June 2nd, 1899.

* This Specification is more fully described under "Selected Patent."

SELECTED PATENT.

THE LARD SINGLE-TRIGGER GUN.

3,952 (Feb. 22, 1899). This single-trigger gun mechanism is of a special character, which appears to place it outside any of the recognised classifications to one or other of which the leading mechanism used in this country belong. The involuntary pull, due to the firing of the first barrel, is a necessary part of the series of

movements which bring the trigger into engagement with the second sear. In order to supplement a weak, or otherwise unsuitable, recoil, a special "helper" is provided.

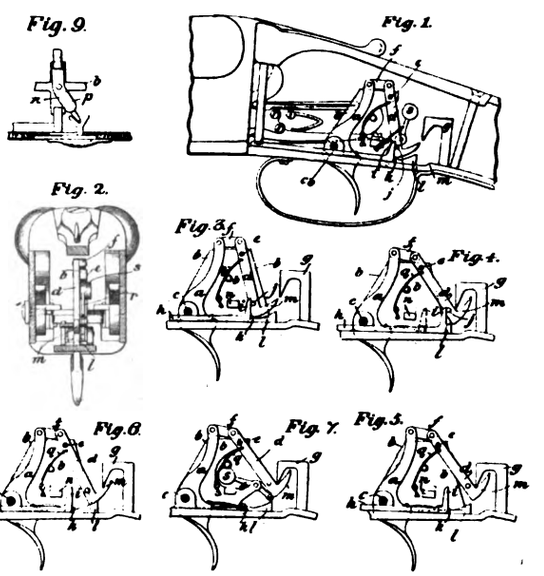
The series of movements involved in the working of the mechanism are somewhat difficult to grasp. The trigger is not provided with an ordinary trigger blade. It has, as shown in any of the illustrations, Figs. 3 to 7 inclusive, an upward extension *a*, which is rigidly fixed to the blade *b*, which is known as the firing blade, the latter taking the place of the ordinary trigger blade. The trigger, together with its attached plate, is pivoted on the pin *c*. Mounted on this firing plate *b* is the stop lever *d*, which is pivoted at *e*. The movement of this stop lever *d* is directed and controlled by the link *f*, the pivoting of which is clearly shown in the illustrations.

The working of the mechanism is dependent upon the relative movements of the firing plate *b*, the stop lever *d*, and finally the hook *g*. Fig. 3 shows these parts in their position after firing, and before the gun has been opened for recharging. In the act of opening the gun by means of the ordinary top lever, the rod *h* is driven backwards, and the upright extension *i* at its rear end engages with the pin *j* on the stop lever *d*. In this way the stop lever is driven backwards from the position shown in Fig. 3 to that of Fig. 4. When the gun is closed, and the top lever returns to its normal position, the rod *h* recedes to the position shown in dotted lines in Fig. 4. It will be necessary before going further to explain the movement of the stop lever from one position to the other. In Fig. 3 the lower end of the stop lever *d* will be seen to be resting on the lump *k*, which forms part of the piece *l*, which is solidly fixed on the trigger plate. The first movement of the rod *h* pushes the stop lever over and beyond the lump *k*, and the stop lever *d* together with the firing plate *b*, drops down under the impulse of the trigger spring. The end of the stop lever then lies in the recess just beyond the lump *k*. This descent of the stop lever causes its point *m* to assume such a position that it can pass beneath the point of the hook *g*, and in this way the continued movement of the rod *h*, carries the stop lever towards the position shown in Fig. 4. In moving along, the lower edge of the stop lever *d* bears upon, and slides over, the sloped surface of the piece *l*. When the lower edge of the stop lever has passed the piece *l*, the trigger spring is free to act, and the stop lever drops downwards, and is held in this position by its contact with the rear end of the piece *l*. Fig. 4 shows it thus retained independently of the rod *h*, which may then return to its normal position on the closing of the gun.

The parts are then ready for the firing of the first barrel. The mechanism provides for the firing of the two barrels in whatever order may be required. Fitted upon the firing blade *b* are extensions or "lugs" *n* (Fig. 2) on either side corresponding with the two sears. They are arranged so that the two sears would be released simultaneously by the pulling of the trigger but for the special mechanism comprised in this patent. The movement of the trigger for the firing of the first barrel is limited in extent, as shown in Fig. 5, by the distance shown in Fig. 4 between the stop lever *d* and the hook *g*. The distance which the stop lever and hook allow the trigger to be raised would not allow the firing blade lugs to reach high enough to discharge either of the two sears. It is here where the selective mechanism is applied. It consists of a two-armed lever *p* (Fig. 9), which is pivoted so that its two arms extend through either side of the firing blade *b*. These arms are set at an angle with one another, so that one or other of them acts as a connecting piece between one of the lugs and the corresponding sear. These arms are adjustable by means of a thumb piece on the outside of the gun under the control of the shooter. According to the position of the thumb piece one or other of the arms acts as a connecting piece between the lug and the sear on the side corresponding with the barrel to be fired first. This effectually bridges the space ordinarily existing between the lug and the sear, so that the limited movement of the firing blade is sufficient to release the sear on the side with which the arm *p*, shown in Fig. 2, is placed in engagement by the shooter.

The firing of the second barrel is effected by the disengagement of the stop lever *d* from the hook *g*, which allows such an extent of movement to the firing blade as will enable the lug to reach the second sear unassisted by the arm *p*, shown in Fig. 9. An unduly long draft of the trigger is avoided by preventing the full descent of the firing blade after firing the first barrel.

It is necessary, however, to explain before proceeding further how the parts arrange themselves for the firing of the second barrel. On pulling the trigger for the first barrel, the stop lever *d* is drawn into the position shown in Fig 5, and it is there held until the involuntary relaxation causes the release of the trigger. With sufficient time available, the spring *q* would pull the lever clear of the hook *g* into the position for firing the second barrel, as shown in Fig. 3. But the suddenness of the recoil throws the stop lever back into the position shown in Fig. 4, the spring *q* not having time to act. It is the recoil of the gun which throws the stop lever back into the hook. The involuntary pull, following upon the involuntary release lifts the stop lever *d* over the piece *l*, and there being no further recoil to interfere with the action of the spring *q*, the stop lever is



drawn to the position shown in Fig. 3, where the firing blade is retained higher than at the firing of the first barrel by the lump *k*. The parts are then in the required position for firing the second barrel. With regard to the involuntary pull, it is explained that even if the recoil did not throw the stop lever clear back to the position shown in Fig. 4, it would still be blocked, say, in the midway position shown in Fig. 6, where the full movement of the trigger would be prevented.

There is a peculiarity about this mechanism to which attention might be drawn. It is the recoil of the gun itself which blocks the parts so that the involuntary pull is necessary before the second barrel could be fired. With a dummy (or a miss-fire) cartridge in the first barrel, the gun would operate as a two-pull gun, whereas, with appreciable recoil in the firing of the first barrel, the action would be that of a "three-pull" mechanism.

Fig. 7 shows the helper *r*, into the details of which we will not enter, beyond indicating that the weight *s* at the end of the small lever is swung round by the recoil, so as to give a supplementary kick to the stop lever *d*, and so ensure the recoil blocking it from action during the involuntary pull. Accepted June 2, 1899.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The International Rifle Match.—We print in another portion of this issue the joint report of Capt. Fremantle and Mr. A. P. Humphrey regarding the International Rifle Match which recently took place at the Hague. Several things are made quite clear by this report. It is evident that no disgrace need be attached to the defeat of the English team, on account of the circumstances under which the match was contested. While the peculiar features of the shooting were applied to all the competitors alike, some of the conditions were actually a hindrance to those unprovided with special weapons or appliances. Allowing, however, for all this, it is perfectly clear that shooting from the standing position is not cultivated in this country to the extent it might be; but this introduces a very difficult question indeed. Standing shooting is most unpopular among English marksmen, and many of them go so far as to say that practice in this direction spoils them for what they regard as ordinary shooting, viz., shooting in the prone position. If standing and kneeling shooting is to be encouraged in this country, it should not be done under conditions which will lead to the cultivation of a band of specialists in the work, so forming a class as much apart from the ordinary military rifle shot as revolver shots are separate from the ordinary volunteer marksmen. There is plenty of evidence that volunteers as a class would strongly oppose the introduction of compulsory standing competitions as part of their ordinary work. The particular qualities which are cultivated in those competitions where judgment of wind and slow pull-off are the main essentials to good shooting, would be largely deteriorated by snap-shooting at targets dancing about on the foresight. Standing competitions are ordinarily conducted at distances where wind judgment is not of very great importance. The military rifle, to fire off-hand, is too heavy to be held in the firing position long enough for a really steady aim and slow pull-off. It is more a question of raising the rifle and firing instantly the sights seem to be in alignment with the desired part of the target. Errors are difficult to correct, because there is no certainty in determining the cause of failure. All this tends to discourage the ordinary marksman from interesting himself in this form of shooting; and perhaps the wish is father to the thought when he commences to argue that rifle shooting in the standing position is not a military necessity. If the National Rifle Association decides that it is, then it will have to face a large amount of opposition, say, for instance, when it decided to make standing shooting a prominent section in the first stage in the Queen's Prize. The Volunteer competitors as a class would then be forced to pay much greater attention to the matter than at present. As the conditions for the "Queen's" now stand, out of a total of 76 shots, seven are fired at 200 yards in the standing or kneeling position, according to the option of the shooter. In any case these seven shots do not form a very material portion of the competition; and as practically all the volunteers elect to shoot in the kneeling position, it may be taken that standing shooting does not form a part of the Queen's Prize competition. Were the Council to make it obligatory to fire, say, 20 shots at 200 yards, half in the standing and half in the kneeling position, and possibly a further series at 300 yards, this would be a very effective means of creating greater efficiency in standing shooting

One needs to put forward the proposal in some such form as this in order to make it quite clear what is meant when one talks about the greater encouragement of standing shooting among military marksmen. Should the Council merely give facilities for special events to be shot in the standing position, their action will have little more than academic interest, in fact no more interest than if Captain Fremantle were to train a team of shooters for the special purpose of representing their country in the various continental matches under specialized conditions which are organized from time to time. The Hague rifle match has no interest whatever if its tendency will merely be to induce a few private gentlemen to practice a specialized form of rifle shooting. Its only interest lies in the publicity it has given to the fact that in Great Britain very little attention is paid to shooting in the standing position carried out under military, or any other, conditions.

The Bisley Rifle Meeting.—The N. R. A. annual rifle meeting at Bisley has been duly carried through, and generally there is every reason for congratulating the Council of the Association upon the success of their efforts. We refer in another part of this issue to the difficulty with the Mark IV. ammunition which faced them at the commencement of the meeting. The difficulty having arisen, the Council, with praiseworthy promptitude, dealt with it on lines which are highly to be commended; but still one cannot lose sight of the fact that this is the second time in the last three meetings that the entire success of the gathering has been placed in jeopardy by the vagaries of the War Office. This cannot but suggest that the Council would do well in the future to insist upon some arrangement whereby they would be enabled to test well in advance a suitable proportion of the actual cartridges delivered by the War Office for use in the competitions. The Government claim to have made such trials, and the N. R. A. endorsed them to the extent of issuing a declaration that the cartridges to be supplied were of good quality. Their information was admittedly second-hand, and as events have subsequently turned out, it is clear that this is not sufficient. The Association, having twice been deceived by the War Office, has itself, to some extent, lost the confidence of the shooters, while untold harm has been done at a very critical time by the universal condemnation of our service ammunition, and this without any really satisfactory proof that the faulty ammunition at Bisley and Edinburgh was anything more than a chance bad batch. There are plenty of persons connected with the N. R. A. who would be perfectly competent to make such tests of a certain proportion of the ammunition supplied for the meeting as would enable a very fair idea to be obtained as to how it would behave in the hands of the ordinary competitor. Scientific testing of velocity and pressure might well be ignored in such trials, as it would be quite sufficient to determine that the bullets leave the rifle in a satisfactory manner, so far as this can be judged from ordinary firing. Rough tests such as these would go far to prevent a repetition of the fiascos of the past. They would not need to be exhaustive nor ultra-scientific, but merely a supplement to the routine tests of the manufacturer—in fact, an advance test of the practical trial which the Bisley meeting itself affords. The weather throughout the meeting has been about the best on record, although the extreme heat rendered the conditions more pleasant for spectators than competitors. The shooting during the meeting generally was of a very high character, though the uncertain quality of the wind, and the difficulties of mirage due to the intense heat, were sufficient to prevent an inconvenient amount of high scoring. The catering, as in the previous year, was of a much improved character as compared with earlier years. Rumour has it that the present contractors do not feel inclined to renew their contract on its expiration; but it is to be hoped that between now and then the Association itself will see its way to undertake the work and carry it out under the supervision of a competent officer. The railway arrangements have, as usual, been the subject of much hostile comment; but one must in time get used to this defect, as the railway company seem indisposed to remedy even the elementary troubles which a station railway porter could deal with. A big additional traffic for a very short period is not the kind of thing a railway company will go far out of its way to cater for; but some of the difficulties seem to have arisen from the undue delay which has from time to time occurred in the running of the tramway between Brookwood and the camp, though, speaking for ourselves, we were lucky enough not to have had experience of this trouble. Life in the camp is always of the pleasantest character, and this year seems to have been no exception to the general rule. The evening entertainments afforded great enjoyment as in the past. The relations of the competitors with the Council are once more of a most cordial character; and this has been brought about by the enlightened manner in which the complaints of two years ago have been met, and by the spirit of friendly co-operation which has thereby been established between the rank and file of the Association and its governing body.

THE MARK IV. BULLET.

The British public have been absorbing information during the past few weeks from a number of different directions regarding the Mark IV. bullets. Special correspondents at Bisley have found it a suitable topic upon which to exercise their pens when desirous of writing something scientific about rifle-shooting. Questions in the House have led to the circulation of departmental opinions on the same subject. War Office orders have again supplied us with information; and finally the records of the Peace Conference have not been without references to this burning question.

Whether or not the bullet is a humane one, so far as the object struck is concerned, does not for the moment interest us so much as the more important question as to whether it is humane to the shooter. Doubts were cast upon this last point at the Bisley meeting by a cartridge carrying a Mark IV. bullet blowing the bolt backwards out of a Lee-Enfield rifle, and just missing the head of the shooter. Other cases of misbehaviour on the part of this bullet were evident at the commencement at the Bisley rifle meeting, and as they were of a similar nature to the accidents which occurred at the Edinburgh rifle meeting, it became clear that the exhaustive Woolwich tests, referred to in our last issue, did not in reality prove the satisfactory character of the bullet, and that in consequence the reassuring circular issued to prospective Bisley competitors, which also was referred to in our last issue, was misleading.

The N.R.A. Council were placed in a serious dilemma when their meeting threatened to come to a disastrous close on account of the bad ammunition supplied by the War Office. They, however, acted with great promptitude, and secured a proper supply of Mark II. ammunition, which sufficed for the requirements of the meeting. The War Office were, of course, placed in an unenviable position, but they rose to the occasion in a manner which has raised a smile among those having a correct knowledge of the facts of the case. It was explained with great plausibility that the pressure of the gases caused the lead inside the jacket of the bullet to flow somewhat, with the result that it emerged from the jacket at the nose, the lead passing out of the barrel, and the jacket remaining inside. Further experiments led to the designing of a Mark V. bullet, which is to be made with an alloy of lead and antimony, so as to provide greater hardness of the core, and so prevent the tendency of the lead to squirt out from the jacket.

It will be seen that this explanation entirely ignores all consideration of the jacket itself. We, however, took the trouble to make exhaustive inquiries at the Bisley Camp and elsewhere, with a view to satisfying ourselves on this point; and our inquiries have led us to conclusions diametrically opposite to those which have been circulated from head-quarters. The failure of the bullets of the Mark IV. type (and it should be remembered of Royal Laboratory make) appears in every case to have originated with the jackets. We interviewed competitors at the Edinburgh meeting who had actually had experience of these difficulties, and in every case it appeared that the forward portion of the jacket had been split open longitudinally. This points to a weakness of the jacket, and not of the lead core, though, of course, with the jacket split open at the nose any lead or lead alloy would be certain to blow through. It is well-known that the pressure of the powder gases on the base of the bullet is transmitted throughout the lead, and is resisted by the jacket. If the jacket fails to resist the pressure of the lead from within, it begins to split, and the resulting flow of the lead in due course enlarges the exit. The opening at the nose of the Mark IV. bullet is far smaller than in the case of the Dum Dum and of a number of other soft-nosed bullets; and yet the difficulty of the splitting of the jacket at the nose has not been experienced with these other types of projectiles where there is a much larger unprotected area at the nose than in the Mark IV.

Further, it should be clearly understood that millions of rounds of Mark IV. ammunition have been used since its introduction early in 1898. Ammunition of this type was used at the battle of Omdurman. Yet we find that a fault which appears to have arisen in one particular R. L. batch is explained by the sudden discovery that the bullet is radically bad as regards the composition of the metal composing the core. If the past use of pure lead were the correct explanation of the difficulties which have lately arisen, it is rather curious that they have not been heard of before.

The proper manufacture of the nickel jackets for small-bore bullets is not an easy task, and metal which satisfies the requisite chemical test may be radically bad in its physical properties. The metal may be hard and brittle at the same time that its composition may be true to the chemical specification. The official explanation of the faults in the Bisley ammunition absolutely ignore the question of the jackets. What we must regard as a nominal alteration in the composition of the metal forming the core will not stand in the way of a more exact manufacture in the future of the nickel jackets. While we must regard the alteration in the metal of the core as a sop for the British public, we are convinced that improvements in the nickel jacket will mark the real distinction between Mark IV. ammunition of recent R.L. manufacture, and the Mark V ammunition of the future.

To summarise our arguments, we have excellent reasons for believing that the Mark IV. ammunition of R. L. manufacture, which went wrong at the recent Bisley and Edinburgh meetings, contained bullets having rotten nickel for the jackets. Certain elementary tests serve to show that nickel can be made for bullet jackets which will not split as that of the R. L. type has done. The nickel jacket of a bullet can, when empty, be blown out cold by hydraulic pressure somewhat like a piece of red-hot glass tube, and it may be crushed or twisted without any flaws developing. The nickel of the Mark IV. R. L. bullets would hardly pass through these tests, otherwise the jackets would not have been split in the manner which has marked the numerous cases which we have investigated both at first hand and second hand.

STORES FOR EXPLOSIVES.

THE NEED FOR GREATER LATITUDE.

Few tasks are so difficult, and at times impossible, as finding a suitable site for a store for explosives, and consumers and merchants who could purchase explosives in large quantities have often to submit to the expensive annoyance which small and frequent deliveries entail, because the impossibility of obtaining a convenient site prevents the erection of a store.

A multiplication of registered premises is the result, and undoubtedly there is no lawful mode of keeping explosives which is so dangerous, especially when for explosives of the type which necessitates the keeping of detonators also. There is also increased danger and encouragement to commit illegalities in the conveyance of small quantities, apart altogether from the temptation to keep more than is permitted.

In mining districts, where the demand for explosives is one which should be most easily satisfied, because there is a large and regular consumption, the difficulty of obtaining a site is generally greater than in other localities. This is caused principally by the many lines of railway which so intersect the country as to make a perfect network of iron roads.

Groups of miners' cottages, schools, shops, and churches fill up the interstices, and, seek as one may, there is nearly always some "protected work" within 100 yards. Considering the many accidents which occur in registered premises, and the practical freedom from accidents in stores, it is thought by many that, to encourage the safer mode of keeping explosives, the distances which stores must be from some "protected works" might be modified, or that screening, as in the case of magazines, might be taken into account.

The reasons for including in "protected works" dwelling-houses, hospitals, schools, shops, churches, reservoirs, navigable water, piers, workshops, factories, public halls, or places where the public are wont to assemble, are obvious. But highways, public footpaths, brick kilns, or lime kilns, tramways (which local inspectors nearly always insist on classing as railways) and railways can hardly be considered as equally

dangerous to, or liable to danger from, an explosive store. It may be necessary to protect railway stations or shunting yards, but these have nearly always a dwelling-house attached to them, or would be included among places where the public is wont to assemble, whereas "protected works," classes 1 and 2, include railways which pass through lonely country districts, and the traffic on which is confined to a few trains daily.

Where "railway" (whether worked by steam or otherwise) withdrawn from "protected works," class 2, and mineral or private railway (whether worked by steam or otherwise) withdrawn from the "protected works," class 1, which must be occupied by the licensee or the occupier of which gives his consent in writing, to the same being considered as included in class 1, and were both included in "protected works," class 1, which are free from such restrictions, it would be much easier to find sites for stores in many districts.

A distance of 100 yards from any furnace, kiln, or fire, for the use of any boiler, engine or machine, or for any manufacturing purpose, is even perhaps ample in the case of a D. store, and proportionately less for smaller stores; if such furnace, kiln or fire is part of a workshop or factory, it is, in that case, protected otherwise.

It might also be permissible to reduce the distances for a building completely screened by the natural features of the ground from any "protected works" (within certain limits), as it is frequently a justifiable subject of adverse comment by local authorities and their inspectors, that a magazine to contain 18,000 lbs. of dynamite may, in such a case, be placed within 200 yards of a dwelling-house without consent of the occupier, whereas a store to contain 2,000 lbs. must be not less than 200 yards distant. The anomaly is greater when the occupier of a dwelling-house gives his consent in writing, as a magazine to contain 40,000 lbs. of dynamite need not be at a greater distance than a store to contain 2,000 lbs.

Magazines, being subject to visits from H.M. Inspectors of Explosives, and very strongly constructed, the outer doors being covered with sheet iron, are certainly kept cleaner, and are more secure than stores which are under the control of local inspectors, but the different degree of safety so secured in the former class of buildings is not commensurate with the extreme difference in quantities which may be kept in magazines and stores at similar distances from "protected works."

The words "highway" and "public footpath" included in "protected works" class 1, have in many cases interfered with the erection of stores. Rights-of-way and bye-paths, or mere tracks through fields, taken as short cuts by miners, are held by some local inspectors and local authorities to be public footpaths, but a clearer definition, such as "roads maintained or controlled by the road trustees or local authorities," would remove any doubts. Increased facilities for obtaining sites for stores cannot fail to lead to an increase in the number of such buildings, and a much more than a corresponding decrease in the number of "registered premises."

Whatever may be the average condition of stores as regards cleanliness and security, there is no doubt but that they are much superior to "registered premises" in freedom from accidents. Thanks to the substantial packages, an inner and outer in the case of blasting powder, and sometimes as many as five distinct coverings in high explosives, the risk of an accident through spilling an explosive on the floor or shelves of a store is very remote, whereas the risks in "registered premises," where inflammable oils and matches are often lying about, is great indeed, and the wonder is that so few accidents occur.

The largely increased use of explosives which involve keeping a supply of detonators, has also raised a difficulty, possibly not foreseen when the Explosives Act, 1875, was drawn up. Probably, no one conversant with high explosives would suggest the extension of facilities for keeping them on "registered premises," but would rather see the trade confined to those who own or rent magazines or stores.

The owner of a magazine must be a large consumer or dealer, and it will only cost, say, £10 additional to erect an annexe in which he may keep 100 lbs. weight of explosives contained in detonators or electric detonator fuses. But the owner of a store possibly cannot well afford the additional expense, involving, as it does, the erection of a fence for the protection of the small annexe. It is generally understood that there must be three feet of space, and three feet of stone, concrete, or hard burned brick between the nearest points in the interior of the magazine or store and annexe, and these conditions might perhaps be modified. Were it legal to attach the annexe to the store with, say, 18 in. of stone, concrete, or hard burned brick between the nearest points in the interior of either building, it is probable that many would erect annexes, and so reduce the dangers and illegalities which now prevail in the keeping of detonators and electric detonator fuses.

The weight of explosive to be kept in such annexes might be limited to, say, three, six, ten, and fifteen pounds respectively, in connection with A. B. C. and D. stores, and this would meet the wants of owners of stores who now register some out-building or an office for keeping these highly dangerous articles, places which are often most unsafe and direct sources of danger, or keep them anywhere and anyhow.

Every extension of legal facilities which is unaccompanied by increased danger tends to safety, and the alterations suggested are such as have seemed reasonable to many who have had large and varied experience in the erection of stores, and who have had to abandon the intention of erecting others simply because sites could not be found. They are put forward in the confident belief that they would lessen danger to the public, and be of advantage to all concerned.

Regarding the transport of explosives, it is well-known that large quantities are conveyed by passengers in public vehicles as personal luggage, a practice which is most reprehensible. This is seldom done in the case of gunpowder or other explosives which may be freely sent by rail in metal cylinders, but it is often done in the case of gelignite and kindred nitro-glycerine explosives, because of the excessive cost of sending them by rail, a cost which is practically prohibitive when small quantities are wanted. The rules for packing explosives of the first division of the third (nitro-compound) class provide that the inner or outer package shall not be of metal. It is therefore illegal to pack such explosives as dynamite, gelignite, gelatine-dynamite or blasting gelatine in metal cylinders for conveyance by rail or steamer.

The order of the Secretary of State containing this rule was made on 27th November, 1875, before the three last mentioned explosives were invented, and it is considered a hardship that they are, notwithstanding, excluded from conveyance by rail in metal cylinders.

There is certainly no high explosive which is so much in demand as gelignite, and yet a package, no matter how trifling the weight may be, cannot be sent by rail except in a gunpowder van at a mnimum cost of 10s. for carriage, or at a minimum charge for one-half ton, if over the lines of two railway companies. There may be some special reason for this rule, prohibiting the use of metal cylinders, which is not known even to those who are thoroughly conversant with all modern explosives; but were gelignite, gelatine-dynamite, and blasting gelatine permitted to be sent in them on the same terms as other high explosives, it would be an immense advantage to consumers in many parts of the kingdom, and prevent illegal carriage by passengers in public vehicles.

The late extension of facilities for keeping on "registered premises" gunpowder and small-arm nitro-compound, and the permission granted to send both classes of explosives in one cylinder, show that H.M. Inspectors of Explosives are ready to meet the wishes of those affected by the Explosives Act, 1875, when such wishes are collectively expressed, and can be granted without danger. The firms who make and purchase such sporting explosives are, so far, united and have such organisations that they readily combined to ask for these facilities. Unfortunately, however, the owners of stores, and more especially those who would own stores, were sites more easily obtained, are too much scattered and isolated to combine for the purpose of laying their wishes before H.M. Inspectors of Explosives.

It may, however, be hoped that some considerations will be given to the views and wishes expressed by the writer of this article and good result therefrom.

FUMELESSITE, LIMITED.

MINING REPORTS AND PRESS NOTICES.

WE have received a copy of a pamphlet bearing the above title. It is apparently issued in the interests of the explosive Fumelessite, and the address of the Syndicate is given as Bush Lane House, Cannon Street, E.C.

The pamphlet opens with various claims in favour of Fumelessite, which are apparently based upon reports and newspaper notices which appear in the body of the pamphlet. Among the claims to excellence one naturally would expect fumelessness, which duly appears. It is explained that "this to the miner is one of its (Fumelessite's) most valuable properties, and in tunnel work, shaft sinking, head driving, when expedition is an important consideration, will be duly appreciated." In our opinion the text is a little vague, for no explanation is given as to what becomes of the fumes that would naturally follow from the combustion or explosion of the materials forming this explosive. Matter is indestructible, and the products of combustion or explosion come under the heading of matter, and presumably gaseous products of combustion come within the category of fumes.

The first letter regarding Fumelessite is signed by "J. H. Gribble, Manager, Royal Gunpowder Mills, Ballincollig," and bears date Feb. 12, 1898. A second letter, signed by the same gentleman, follows, and is dated March 2, 1898. Both letters are eminently favourable to the explosive, and it appears that for quarry and coal-mining work, where it is necessary to recover the material in large pieces, the explosive is much superior to dynamite. Of course, speaking for ourselves, we should have liked to know more about the explosive as compared with ordinary gunpowder, though the only comparison in this particular is contained in a remark that the cost of manufacturing Fumelessite would not be much greater than of high-class blasting powder. One of the letters refers to the making of a sample lot of this explosive, 40 lbs. in weight, the previous samples having apparently been of laboratory production. Mr. Gribble's letter concludes with the following remark:—"I am therefore convinced that Fumelessite will be largely used and esteemed by most of those requiring a useful and economical explosive."

Further practical trials of Fumelessite are reported by a Mr. D. T. Laing to a Mr. J. Myers, of Birmingham, in a letter dated Dec. 7, 1897. After expressing various favourable opinions, based on the results of these trials, Mr. Laing states that if the cost of producing this explosive is no greater than that of dynamite—"I am convinced that Fumelessite will be esteemed and used by most of those requiring a useful and economic explosive." He also states that "its safety and strength combine to make it a most desirable agent in warfare." Of course, there are various uses for explosives in warfare, but Mr. Laing gives us no precise details of the uses to which this explosive would be put in military or naval operations.

Other letters of a similar character to the last follow, and in several cases the name of Mr. Harold Boyd is mentioned as the inventor of Fumelessite. In every case the explosive seems to have distinguished itself for use in quarries, being generally considered superior to dynamite.

So far it will have been noticed that Fumelessite has chiefly been tried for quarry work, where the important characteristic of fumelessness would hardly be appreciated at its full value as compared with the enclosed area of a coal mine for instance. Fumelessite does not appear in the list of explosives permitted under the Coal Mines Act for use in dangerous mines. In the ordinary way we should have expected that the explosive would have been submitted to the important qualifying test imposed by the Home Office for this purpose. But the present pamphlet contains no indication that steps have been, or are being, taken to present the explosive for this trial. The pamphlet, however, favours us with the opinions of Mr. Frank J. Agabeg, M.S.E., M.N.E.I.M.N.E., General Manager of Messrs. Apcar & Co.'s collieries, which are apparently in India. He explains that he saw Fumelessite tried at the Sinbpore Colliery experiments, and was then struck with it, we trust not seriously. The explosive seems to have given equally as satisfactory results in coal as it had previously done in granite quarries.

A curious pondering seized us as we read Mr. Agabeg's letter. It seemed to be an old friend, and yet how could it be familiar when dealing with an explosive which has only just made its appearance on the list of explosives authorised for use and manufacture in this country. Unfortunately, in the printing of the pamphlet, the date appears to have been omitted from Mr. Agabeg's letter, so that we could obtain no guidance in that direction. After a little research we came across a little pamphlet entitled "Ripp-lene." This is another explosive invented by Mr. Harold Boyd. We soon found a letter in identical terms to the one above noted in reference to Ripp-lene. In fact, the only difference that we can find

between the version of Mr. Agabeg's opinions in the five-year old pamphlet and in the one which forms the subject of this notice is that wherever the name Ripp-lene occurs in the one Fumelessite appears in the other. The date of the letter by Mr. Agabeg, which appears in the old pamphlet, is Jan. 31, 1894. As before stated, the corresponding letter in the new pamphlet is not dated.

We might weary our readers by going into this matter at too great a length, so we merely content ourselves by reproducing a list of reports and press notices which, with the one exception noted above, are identical in the two pamphlets. In other words the following set of opinions in regard to Ripp-lene, which were published about five years ago, are now reproduced as having been written about Fumelessite :—

W. Atkinson, Adelaide, October 28, 1892.
D. J. Crouch, M.E., January 16, 1893.
John H. Garden, January 14, 1893.
Pictorial Australian, October, 1892.
Leon Perret, Adelaide, December 17, 1892.
G. D. Seaton, Calcutta, April 25, — (probably 1893).
Indian Planters' Gazette, May 6, 1893.
Indian Daily News, December 27, 1893.
Indian Empire (no date given, probably in 1893).
Englishman, Calcutta, Monday 15th (probably May, 1893).
Indian Journal of Pharmacy, June, 1894.
Madras Mail (probably in 1893 or 1894).

Now a word as to these press notices and reports. We may, of course, dismiss as improbable that both sets of reports and notices have a separate origin. Such a coincidence would be too extraordinary. Obviously the original letters and press notices of Ripp-lene have been edited to serve their purpose over again for Fumelessite. Of course we must assume that Ripp-lene and Fumelessite are absolutely the same thing, but even on this assumption we think that those interested in Fumelessite would have done better to have explained that the Fumelessite of to-day is the Ripp-lene of five years ago. Then they could have reproduced the real verbatim reports of from five to seven years ago, showing that Fumelessite, under the name of Ripp-lene, had long ago become popular among mine managers and journalists.

As things stand at present, it is probably open to Mr. Agabeg to deny absolutely that he ever wrote favourably of Fumelessite, or in fact ever heard the name. In the same way the newspapers who have championed Ripp-lene would be perfectly entitled to repudiate their alleged reports on Fumelessite.

In the latest Home Office list of "licensable" explosives in the nitrate mixture class, we find Fumelessite and Ripp-lene specified as separate explosives. The new custom of not giving the compositions of explosives leaves us in the dark as to the distinction, if any, between the two; but in the 1897 report Ripp-lene is defined as consisting of a mechanical mixture of nitrate of potassium, nitrate of barium, sulphur, oxide of iron, sawdust, and bituminous shale, provided that such shale shall be free from pyrites.

We do not propose to discuss this explosive from the basis of its chemical composition, nor its fumeless decomposition. We think that we have done sufficient in the direction of clearing away any smoke that may have hung around some of the undated reports and press notices which have heralded its second birth.

INCIDENTAL JOTTINGS.

THE SHOOTING MAN. Whatever severe critics or sarcastic caricaturists may say, I maintain that the Bisley pot-hunter is a jolly good fellow. He knows all the good points of his rifle and cartridges; if he doesn't know the bad points, his inventive genius, together with the advice of those wiseacres who hang round the camp to tell him what a martyr he is to circumstances, will soon discover some. But when the day is over, and the warriors succumb to the seductive weed and glass of toddy, they smilingly recount, in spite of their adversity, the story of their prowess. He is a modest winner and a graceful loser. Here's to the shooting man.

THE EXPERT. This is the genius who makes a bad listener; he knows all about shooting, and you "have to get up early in the morning" to tell him anything fresh. Lee-Metford rifle—heavens, man! didn't I bring this before the War Office? Yes, but I never got the credit or a farthing for satisfaction. Don't talk about Cordite, the idea occurred to me 30 years ago, but I didn't think so much of it at the time, etc. Presently, however, he settles down to some good information. All experts have a special groove, and when they drop into it they are interesting till they commence to repeat themselves.

THE CRANK. Woe betide you if you get button-holed by the crank. Unlike the expert, he will listen for ever, so long as the information is pessimistic; but at the end of the day, when he is at his best, he summarises his waits, and is unconsciously humorous. "I was told by an American (who, you know, are far ahead of us, etc.,) that no man can ever expect to shoot with a cartridge with a beastly square shoulder, and so-and-so says the caps are entirely wrong in principle, because to cover the fulminate with varnish is courting failure. Varnish soon wears off, and, in many cases, long before loading, the fulminate is ready to pulverize at the slightest inducement." Yes, he has tried every powder, but there is only only one in the world, and that is guncotton, pure and simple; he lives for the day when its use will be practicable. It is the dream of his life, but till then every detail of gun or ammunition is a ghastly failure. And then that Mark IV. bullet—Here we beat a precipitate retreat; the subject is getting commonplace.

WIRELESS EXPLOSIONS. A wag once advertised directions for using insect powder—"Catch the insect and put the powder in its mouth." This seems very much on a par with the report of experiments in electric wireless explosions to be conducted with any radius within ten miles. So if you want to blow up your enemy's magazine first put on your bullet-proof cuirass and steal to the magazine in the dead of night and fit up your receiver and detonator. Don't forget to cut the lightning conductor, which is generally to be found at such places, or it may divide honours with the receiver or even be utilised. Having done all this, and the sentry not having detained you, the magazine may be blown up next day, or at any time you wish, provided the enemy doesn't interfere with your arrangements Awfully simple, isn't it? Quite beats putting a Lyddite shell into the place, and blowing it up without preliminaries.

Cyclops.

A NEW METHOD OF MOULDING AND PRESSING GUNCOTTON.

A NEW method of forming and compressing Guncotton has just been perfected at the Stowmarket factory of the New Explosives Co., Ltd., and it is now possible to produce charges of compressed Guncotton mechanically true, and of a size and weight hitherto unapproached. At the same time, the new process ensures a perfectly uniform density throughout the block, and permits any required density from 1.4 downwards being attained.

By the new process it is also possible to regulate with exactitude the percentage of moisture, and to ensure its uniform distribution. The maximum percentage of moisture depends, of course, upon the density. By the new process any required percentage from this maximum downwards can be exactly obtained.

By the methods hitherto employed of compressing Guncotton, blocks of a greater thickness than 2 in., or of a greater weight than about 8 to 9 lbs., cannot be made, but with the new process blocks of any shape, size, thickness, and weight that are likely to be required, can be made readily and safely.

With the old method of work certain practical difficulties have prevented the direct formation of "shaped" blocks such as are required to form the bursting charges for shell and for torpedoes, and it has hitherto been the practice to build up such a charge from a number of discs and to reduce them to the required shape and size in a lathe. By the new process such charges can be formed in a single block without any subsequent turning or other shaping being necessary.

Some of the chief advantages of the new process are:—

1. There is no space wasted, as is the case with built-up charges, through slightly imperfect contact between the individual blocks, and thus, either a heavier charge (about 15 per cent. more Guncotton) can be got into the same space, or less space will be occupied by a charge of given weight.

2. The metallic cases for solid charges may be much lighter than for built-up ones, since with the former their function is merely to prevent the loss of moisture from wet Guncotton, or to prevent the absorption of moisture by dry Guncotton. They can thus be made as light as possible, as the solid charge inside will prevent deformation during transport. With built-up charges the case must be strong enough to prevent damage either to itself or to the charge it contains. For many uses a metal case, however light, may be discarded, and one of a thin waterproof material substituted.

This saving of weight will be of high importance under many circumstances.

3. The uniform density of charges made by this new process is very favourable to the complete and effective detonation of the entire mass, and to the presence of a uniform amount of moisture in every part of the charge.

4. Any required density from 1.4 downwards may be obtained with exactitude and ease. Also, any required amount of moisture can be left in the charge, from the theoretical maximum corresponding to the density, which moisture is uniformly distributed through the charge.

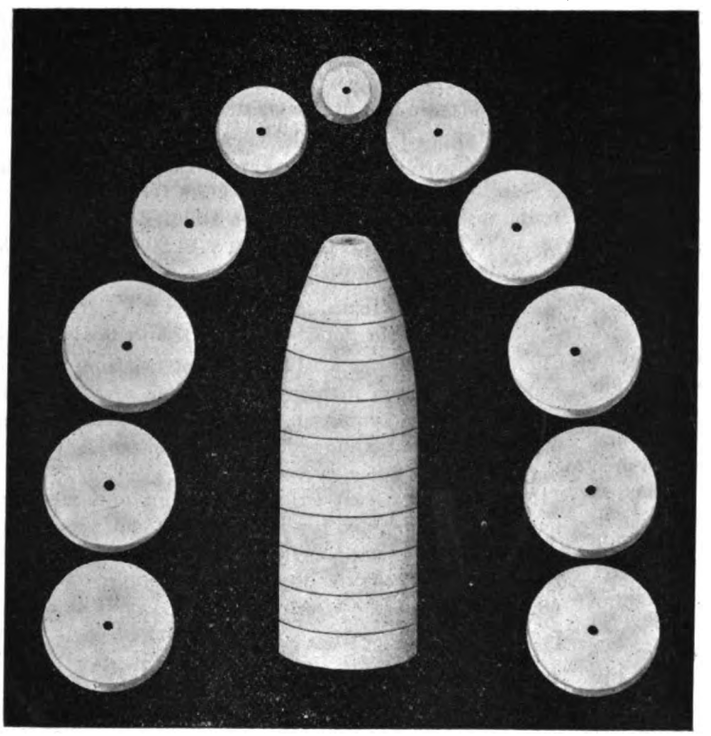


FIG. 1.—Illustration of a Guncotton Bursting Charge for an 8-inch Deck-piercing Shell, built up in separate discs and turned in lathe to shape—the component discs being shown around an assembled charge.

FIG. 2.—Illustration of a Guncotton Bursting Charge for an 8-inch Deck-piercing Shell as it is shaped, moulded and pressed in one solid block by the new process.

These points are of the highest importance in cases where, like torpedo charges, it is essential to have the centre of gravity of the charge in a pre-determined position both vertically and longitudinally, and the charge so fixed in its containing case that the centre of gravity cannot shift. The difficulty of ensuring this with a large torpedo charge built up from a great number of discs and segments is well known.

5. Where a number of similar charges with conoidal or other shaped ends have to be made, such as bursting charges for shell, they can, by this new process, be produced exactly to size without any turning, &c., being necessary, and reworking the "turnings" is also avoided.

Fig. 1. shows a shell charge for an 8-in. deck-piercing shell made by the old process, containing 25 lbs. of wet Guncotton; and Fig. 2, a charge occupying the same space for the same shell, weighing 28¾ lbs., made in one solid block by the new method, this illustrating the great saving of space by the new process.

The Government of the United States of America have adopted Guncotton as the bursting charge for shell, after lengthy and exhaustive experiments with other well-known explosives.

The following are some extracts on the subject from the "Report of the Chief of Ordnance, 1898":—

"THE BOARD ON POWDERS AND HIGH EXPLOSIVES,
NEW YORK ARSENAL, 1ST OCTOBER, 1899.

. . . . . "As regards the bursting charges for shell, that for cast-iron shell, which is a black, fine grain powder, was readily provided, and the ordinary base percussion fuse for exploding it. In the case of the steel shell the case was otherwise. It had been found that black powder exploded in the steel A.P. and D.P. shell, which have very strong walls, did not prove sufficient to break up the shell sufficiently, and in some cases blew out the base plug, leaving the shell uninjured. A more powerful explosive, therefore, seemed to be a necessity for these steel shell, and for some time experiments had been in progress for the determination of a suitable high explosive for this purpose. Tests were made with wet Guncotton, emmensite, and later with joveite, etc., but these last two have not resulted in such satisfactory results as to lead to their adoption.

"At the outbreak of the war the wet Guncotton seemed to give the most satisfactory and reliable results, all things considered, and an order was placed with the New Explosives Company, of Stowmarket, England, for about 82 tons of wet Guncotton, to be furnished in zinc cases that would fit the cavity of the projectiles for which they were intended . . .

"*Recommendation.*—The Board recommends that wet compressed Guncotton be adopted for high explosive shell charges for all projectiles of and above siege calibre."

The report bears the signatures of FRANK H. PHIPPS, Leiutenant Colonel, Ordnance Dept., U.S.A., *President*; SIDNEY E. STUART, Captain, Ordnance Dept., U.S.A.; and GEORGE MONTGOMERY, Lieutenant, Ordnance Dept., U.S.A. It is addressed to the Chief of Ordnance, U.S. Army, Washington.

We understand that the New Explosives Company, Limited, will contract for the supply of compressed Guncotton made by this new process, or will sell the invention outright to any Government or Guncotton manufacturer, undertaking at the same time the erection of the necessary moulding and pressing machinery.

INTERNATIONAL RIFLE MATCH.

REPORT TO THE N.R.A.

The following report to the Council of the N.R.A., regarding the recent rifle competition at the Hague, bears the signature of Capt. the Hon. T. F. Fremantle, Captain of the English team, and also of Mr. A. P. Humphrey, both members of the Council of the N.R.A.:—

1.—Your two delegates, accompanied by Colonel Crosse and most of those who were to shoot at the Dutch Rifle Meeting, crossed *viâ* Hook of Holland, on the evening of Saturday, June 17th, and arrived at the Hague early on the following morning. It was thought a day's rest, followed by practice on the Monday and Tuesday, would suffice to get the shooters into form for the match on the Wednesday, but, in fact, this amount of practice was found insufficient, the conditions of shooting being so different from those to which our men are accustomed.

2.—The team that fired consisted of—

Major J. H. Cowan, Royal Engineers.
Quarter-Master-Sergeant I. Davidson, Hythe Staff.
Sergt.-Instructor Wallingford, Hythe Staff.
Staff-Sergt. Rothon, 12th Middlesex R.V.
Colour-Sergt. Davies, 1st V.B. Welsh Regiment.

Reserve:

Captain Heath, 18th Middlesex R.V.
Lieutenant Paterson, 1st V.B. A. & S. Highlanders.

3.—The match was fired by teams of five from the several Nationalities, each man firing 120 shots at 300 metres (328 yards), viz., 40 standing, 40 kneeling, and 40 prone, 30 sighting shots being also allowed. The official scores have not up to the present time been received.

In the result Great Britain was third in prone shooting, fourth in kneeling, and last in standing; and seventh of the eight competing nations in the aggregate total. Sergt.-Instructor Wallingford, of the Hythe Staff, won the Gold Medal for the highest individual score made in the prone position.

4.—The fact last mentioned shows that neither the rifle (the ·303 Service Rifle) nor the ammunition (R.L. Cordite of 1897) was in fault. Nor can it be admitted that the British team was inferior in skill to those of the other nations. But it was undoubtedly handicapped in many respects.

(*a*) Some opportunity had been given to the team to fire at home at a bullseye of the same kind as that used in the match—24 in. at 328 yards—the equivalent of a 36 in. bullseye at 500 yards. This naturally requires a rather different method of aiming from that suited to Bisley targets. But the additional difficulty of shooting from under a low roof in a stall partioned on both sides is considerable. The use of the "bar" sight is almost precluded, as no light falls on the sights from above or behind, and they have to be defined against the glare of a patch of sky seen over the targets. This made to our men a much greater difficulty than had been anticipated.

(*b*) Many of the other teams used for the standing position at least—most of them for all positions—fancy rifles of great weight, with "set" or "hair"

triggers, which give, as compared with a heavier pull-off, a great advantage in standing and some in kneeling. These rifles were in many cases fitted with elaborate unpractical devices to assist the grasp of the rifle. When military rifles were used, the pull-off had been specially arranged so as to require a pressure of 2 lbs. or less; the pull-off of the Lee-Metford, though reduction was effected so far as possible by extemporised means, could not be brought below 4 lbs.

(*c*) The great number of shots fired in the match, 30 sighters and 120 shots in competition per man, proved unexpectedly fatiguing, and much increased the disadvantages due to heavy pull of trigger, &c. Few of our men can give the requisite time or obtain sufficient accommodation on their ranges to accustom themselves to fire so many shots in the day with due care and deliberation.

(*d*) The only distance fired at in all the Rifle Competitions of the Dutch Meeting was 300 mètres (about 328 yards), and it appeared that one at least of the teams had not had occasion to fire all the season except at the particular distance and target used in the match.

(*e*) It must, however, be admitted, after making all these allowances, that the standing shooting of our team was not up to the foreign standard. Far more attention is given to the cultivation of the standing position abroad, while our system of shooting imposes upon no one the strain of firing a long series of shots standing in any important competition.

5.—The International Match, as at present arranged, must be considered unsatisfactory as not conforming to practical or military requirements. Thus, the innermost circle of the bullseye (four inches in diameter) and the width of the two-inch rings into which it and the rest of the target are divided, are so minute as to be beyond the accuracy of the rifle at 300 mètres. In the kneeling position, cushions and supports for leg and foot are allowed, and your delegates were only able to get the position so far restricted as that both knee and foot should touch the ground. The couches provided for lying down were narrow and placed at a steep slope to suit the crooked stocks generally used, and special permission had to be asked for the British team to shoot off the bare ground. While aperture sights were forbidden, open sights of all patterns, often with very delicate screws for adjustment, were used. The custom of shooting from under cover, and at one distance only, is such as would never be adopted in this country. To sum up, Rifle Competitions seem to be looked upon, except by Great Britain, Norway, and Denmark, as a fancy sport, which is not meant to bear any particular relation to military or useful conditions.

6.—Under these circumstances, it will demand the Council's careful consideration whether a British team should take part in next year's match in Paris. If so, it should go through a course of special preparation with rifles to some extent modified from our military pattern. And it is almost imperative that individuals should be relieved of the expense both of their journey and sojourn abroad, as well as of the ammunition used in practice.

7.—A Committee has been formed, consisting of two representatives from each country, to decide on the detail of the conditions for next year's match. But in all essentials it will be similar to this year's. We endeavoured at the meeting of the delegates in Holland to obtain more military conditions, but our propositions, though they were fairly discussed and met with some support, did not secure a majority.

8.—The systems of squadding and register keeping, as well as of general organisation, employed at the Loosduinen Rifle Meetings, appear suited only to competitions at a single distance and to a Rifle Meeting on a small scale. We have no new suggestion in these matters to offer to the National Rifle Association as a result of our visit.

9.—We desire to express our thanks to Colonel Crosse, whose services were of the greatest value, and also to the riflemen who so freely and loyally placed their skill at the disposal of the captain of the team.

10.—We cannot conclude without an expression of gratitude to the executive of the National League of Dutch Riflemen, and in particular to Major-General J. H. Laman Trip (Hon. Chairman of Committee), Mr. S. J. Van den Bergh, Mr. H. Sillem, and Mr. Remi de Block (Secretary), for their great hospitality and kindness, as well as for the impartial manner in which they provided for every detail connected with the match.

THE COLT AUTOMATIC GUN.

DEMONSTRATION AT RUNNYMEDE.

We have many reasons for knowing that the Colt Automatic Gun is a practical weapon which has passed beyond the experimental stage, and which is likely to make headway on account of its relative cheapness compared with the Maxim Gun. The demonstration which took place at the Runnymede Rifle Ranges, near Staines, on the 20th ult., could have no material effect upon our convictions one way or the other. The Duke of Cambridge, and the few hundred more or less distinguished guests who were also present at the demonstration, were gloriously entertained at luncheon. Of course, the object of such a function is to advertise the gun, presumably in the interests of company formation, of which we shall, no doubt, hear more in the early future.

The very nature of such demonstrations precludes the holding of any exact trials having scientific interest; or at any rate they are not such as to enable an impartial observer to form any really definite conclusions. Certainly, a programme of tests might be arranged by an impartial jury which would go far, if perfectly satisfactory in their carrying out, to determine the value of an automatic gun; but when trials are obviously arranged to show off the good points of a weapon, without seriously testing its capabilities in other directions, then of course such trials are purely negative in their teachings.

When one has read official reports of expert trials with machine guns, one sees that absolute perfection is rarely attainable, and the relative value of one gun compared with another is based upon expert examination of any faults which may have occurred.

We consider these preliminary remarks on the general question of automatic gun demonstrations and testing as a necessary introduction to our report of the proceedings on the 20th ult. We can only speak of what we saw, and without more detailed particulars, we do not see that our observations are conclusive in either direction.

The firing was divided between three guns placed in line The guns were fired from various ranges at a series of targets, and in due course the spectators were allowed to walk up to

the targets and examine the bullet holes. We did not keep a record of the number of shots fired in all, nor of the number of hits counted on the targets after the experiments. Of course the time available for the trials was too short to allow of anything in the way of obtaining exhaustive records at each distance, and partial records are not of very great importance.

The chief interest in the trials lay in observing the firing of the guns; but the system of dividing the firing over three guns made it very difficult to get an exact idea of what was going on. The three guns, mounted on tripods, would be placed in line, and would be adjusted upon the target. The vertical alignment would be fixed by a set screw on the tripod, and the gun would be swung during the firing in a horizontal plane so as to sweep the target. After what seemed to us about like fifty shots, the operator would cease firing; and while the other guns were at work, he would re-adjust the vertical elevation of the gun so as to correct the errors of alignment which developed during the previous firing. In due course a further series of shots would be fired, and then the guns would be moved forward to the next range.

Had there been no single case of jamming during the afternoon, well and good; but there were such defects. We saw some. Others watching other guns saw others. We saw a certain amount of fumbling with the cartridge bands, which would mean delay in action. We frequently saw the gas hammer assisted by hand in its action, and in one case we observed that it became necessary, after a certain amount of fumbling, to push the empty cartridge out of the gun by means of a cleaning rod introduced from the muzzle. On the cartridge being removed, the operator held it for a moment, pronounced it a bad cartridge, and put it into his pocket. Of course, we know no more than what we saw; certainly the cartridge was good enough to discharge the bullet, and whatever defects it may have possessed were not explained to us.

This is about all we know regarding the demonstration of the Colt Automatic Gun at the Runnymede Rifle Range. We saw no tests as to the number of shots which could be fired without a break. We saw no tests to demonstrate the number of shots that could be fired without incapacitating the gun by undue heating. Hence we can say nothing of these points. We believe the gun to be a good one, and one which will recommend itself on the score of cheapness. We cannot say that it is as good or better than the Maxim, because we have not seen the two tried side by side. We are, however, quite clear that the makers of the gun have overcome most of the difficulties which face the inventor of automatic guns. Chairmen's speeches at Annual General Meetings sometimes announce the arrival of an automatic gun better than the best. The Colt Gun has advanced much further than this. It has been used in warfare, and it has not discredited itself at a public trial, as a gun we well remember once did. But last month's trials were not without blemish, and, as we have already stated, we have not the information to deal expertly with such blemishes as showed themselves during the trials.

SCHULTZE GUNPOWDER.—The Schultze Gunpowder Company have again taken their old offices at 32, Gresham Street. This time they have been converted into a department for loading cases with Schultze Powder. Mr. C. Goldring, late of Messrs. Kynoch, Limited, is acting as superintendent and manager of this part of the business.

NOTES.

THE HOTCHKISS ORDNANCE CO., LTD.—The 13th ordinary general meeting of this company was held on the 12th ult. The managing director, Mr. C. F. Parsons, occupied the chair, and at the opening of the meeting referred to the sudden death of Admiral Sir W. Hornby, while presiding at the meeting on the 28th June. A resolution was passed placing on record the shareholders' high appreciation of the services rendered to the company by Sir W. Hornby, and tendering their deep and sincere sympathy to Lady Hornby. The Chairman then moved the adoption of the report, the details of the past year's working having been gone into by the late chairman at the last meeting. Colonel Hemans said that all the heart had been taken out of his opposition after the tragic event which occurred at the last meeting. He said, however, that statements had been made which touched his honour, and to these statements he was forced to reply. A charge had been made that he had opposed his fellow shareholders in the Courts in the capacity of debenture holder, and that he had been an enemy to the Company. He said this was not true, the fact of the matter being that, as a preference shareholder, he was advised that he had a legal claim against the company for £510, this amount being the arrears of dividend on his preference shares. It was in support of this claim that he took the steps complained of. With regard to the allegation that he was a failure as a managing director, he pointed out that he did not join the company until a year and nine months after its formation, and the shareholders' committee reported last year that the seeds of failure were incorporated in the company from the beginning, these being over-capitalization and the non-establishment of a factory for the manufacture of the Hotchkiss materials in England. Speaking of his personal efforts, he remarked that during the ten years that he was managing director, he put on the books orders to the amount of £700,000, on which there was a net profit of £114,000, and he thought that was not a bad record. Mr. Touch said, that although a good deal might be said on Colonel Heman's statements, he did not intend to reply to them. The report was thereupon seconded and adopted, together with a resolution endorsing the recommendation of the late chairman, that Mr. Parsons be placed on the same basis, in regard to remuneration as managing director, as his predecessor, and approving his appointment as chairman of the company. The proposed dividends of 5 per cent. on the preference, and 2½ per cent. on the ordinary shares, were then agreed to. An extraordinary general meeting was afterwards held, at which resolutions were passed—first, that the 45,000 ordinary shares of 4s. each, forming part of the reduced capital be consolidated into shares of £1 each; secondly, that the expenses which had been incurred by the shareholders' committee in the matter of the rearrangement of the share capital scheme be refunded by the company; and, thirdly, that the share capital be increased to £500,000 by the creation of 40,000 preference shares of £1 each and 11,000 ordinary shares of £1 each.

EXPANDING BULLETS.—Messrs. Westley Richards have recently issued a new bullet for the Mauser self-loading pistols and carbines, which has been constructed to expand when passing through animal tissues. It is claimed for the bullet that it fires satisfactorily from the automatic pistol,

and that it shoots accurately from 10 to 200 yards. We stated in our March issue that anything Mr. Taylor, now the managing director of Messrs. Westley Richards, might have to tell us on the subject of an efficient expanding bullet for automatic pistols would rouse our deepest interest. His company appear to have conducted public trials with this bullet on the 8th ult., but as we received no invitation to be present we cannot of course speak of the bullet from actual experience. The opinions of the *Daily Mail* and other general newspapers on the subject, who appear to have been represented on the occasion, seem to be highly favourable, and consequently we must assume the bullet to be a complete success. The smashing power of a bullet weighing eighty grains, even with a velocity of 1,409 feet per second, is not likely to equal that of the Webley service man-stopper, but if Mr. Taylor has succeeded in imparting even a moderate degree of stopping power to an automatic pistol bullet, unaccompanied by disadvantages in other directions, he is to be congratulated upon the outcome of his experiments.

KING'S NORTON METAL CO., LTD.—This Company recently applied for an extension of their licence in respect of their factory at Lifford, near Birmingham. In the past the Company have been obliged to make use of their Greenwich factory for the fitting of primers for the shells made by them, and they now seek to be allowed to carry out this operation at the Lifford works. The application was strongly opposed by residents in the locality, largely as it subsequently appeared, because it was thought that an explosives factory would be started under the authority of the extended licence, but the process for which sanction was sought under the licence was only manufacture in a technical sense, and the local authority sanctioned the granting of the licence on an undertaking being given as to the maximum of explosive to be allowed on the factory at one time.

SMOKELESS POWDER CALENDAR.—We have received from the Smokeless Powder and Ammunition Co., Ltd., of 28, Gresham Street, an advance copy of a calendar which they will shortly be issuing for free distribution. The calendar is a fine piece of lithographic work, and it represents a blue-eyed child of tender years, evidently on a shooting expedition, his weapon being one of those rolled tin-barrel guns with a real hammer and nipple, apparently capable of exploding a percussion cap. His retriever is a snub-nosed terrier pup, which will no doubt be quite capable of bringing to bag the whole of the game shot by his master.

EXPLOSIVES REPORT FOR WESTERN AUSTRALIA, 1898.

We have received a copy of the Western Australian Explosives Report for the year 1898, by Mr. E. A. Mann, the Chief Inspector of Explosives for the Colony.

The report opens with a statement that it has not been found necessary to make any alterations in the administration of the present Act, the satisfactory manner in which it meets the requirements of the Colony having again been apparent during the past year. The result is that the explosives trade has been carried on with freedom and safety.

Importation.

With regard to the importation of explosives, it is stated that the regulations governing this branch of the industry have been duly observed, while the general arrangements in connection with the landing of dangerous goods at Freemantle have been placed on a greatly improved basis. Only one breach of these landing regulations has occurred during the past year. The chief officer of a German cargo boat proceeded, upon arrival at Freemantle, to unload the explosives portion of his cargo by means of slings. This method of unloading explosives is illegal in Western Australia, but it appears that explosives may be discharged in this manner at South African ports, and the captain of the boat was unaware of this difference. Referring to the stowage of explosives on ocean-going vessels, the Inspector of Explosives reports a serious matter which occurred during the past year. The s.s. *Andania* from London arrived at Freemantle in September last with 1,220 cases of explosives on board. Upon her hatches being opened it was found that the cargo was in an extremely disordered and dangerous condition. The vessel had met with rough weather on the voyage, and had rolled heavily, the result being that the temporary bulkheads forming the magazine proved insufficiently strong to retain the cases in position. Various circumstances combine to prove that the explosives had been moving freely in the hold. Several of the cases had broken open, and 23 were more or less damaged. Their contents had become scattered, and some cartridges were collected which had been crushed into corners and flattened by the pressure of cases upon them. In one or two cases the lids were nearly ground through by friction. It is stated, however, that the explosives were in good condition, and showed no signs of exudation. This matter was thought too important to be allowed to pass unnoticed, and was immediately brought under the notice of the local agents, who communicated with the loading brokers in London. The latter instituted inquiries as to what authority was responsible for the supervision of the construction of such magazines before vessels left England, and it appears that no special official is responsible. Mr. Mann expresses the opinion that better precautions should be taken to ensure the safe loading of dangerous goods on vessels setting out on long voyages. There has been more than one instance in which vessels carrying explosives to Australia have been lost, and no subsequent tidings received of their fate. It is impossible to say, but it is a likely field for conjecture, as to whether this may not have been due to similar trouble arising with the cargo, but with a less satisfactory termination.

With regard to the loading of explosives, and their handling at Freemantle, the whole system has, since the 1897 report appeared, been greatly improved, chiefly owing to the establishment of railway communication between a jetty called Owen's Anchorage, at which all explosives are discharged, and Freemantle. This has enabled the entire explosives traffic, which was previously in proximity to the town, to be diverted so that it is now centered at the Explosives Reserve at a place called Robb's Jetty. As soon as a vessel arrives in port and has discharged her explosives into licensed lighters, the latter immediately proceed to Owen's Anchorage until the necessary permission has been given to land. The cargo is then tested and permits are issued. The explosives may then be moved directly from the lighters either into the magazines, or into railway vans, the explosives trains being then made up for various parts of the Colony. In this way

no loading of explosives is now carried on in the vicinity of the town, except in small quantities, not exceeding five cases (250 lbs), which are allowed to be loaded into portable magazines in the railway yard. This method of unloading and discharging explosives marks a great step in advance, though it is even now stated that several further improvements are desirable in the mode of handling explosives in railway vans. In July last attention was drawn to the fact that lighters having about 100 tons of explosives on board were lying off Freemantle. It is reported that, although necessary at the time, this has been completely obviated, and lighters do not now anchor within less than about three miles of the centre of the town.

The importations of explosives into Western Australia show a decrease in value as compared with those of 1897, the total value in 1897 being £92,199, and in 1898, £85,452.

The following digest shows the importations of various explosives during the past three years, and it will be seen where the fluctuations occur. We reproduced in our September issue of last year the complete records back to the year 1892, and there is no object in repeating the figures. It will be observed that the total values in the table below differ, as regards the year 1898, from the figure quoted above. In some cases the figures given in a table of the report showing the gross value of importations agree with the totals of the classified lists; in others they do not, but the difference, although slight, is not explained.

	1896.	1897.	1898.
	£	£	£
Nitroglycerin Compounds ...	45,299	65,930	66,829
Blasting Powder	5,417	11,096	3,736
Sporting Powder	786	333	118
Fuse	9,768	6,174	6,992
Rackarock	125	434	2,282
Fireworks	164	386	213
Cartridges	2,069	2,505	2,382
Detonators	3,986	3,675	2,803
N.O.E.	18,823	1,666	2
Total ...	86,437	92,199	85,357

It is explained in the report that there is no doubt the falling off in the quantity of explosives imported during 1898 is due largely to the big importation in 1897, and that there were consequently large stocks at the beginning of 1898. It is also suggested that the general depression of trade in 1898 had affected the explosive industry correspondingly with other sections of commerce.

The ascendency acquired by high explosives is again the subject of remark. The quantity of dynamite No. 1 now imported occupies only a secondary position to the amount of other nitroglycerin explosives, consequent on the increased demand for gelatine compounds. The quantity of dynamite imported in 1898 shows a decrease of 86·97 per cent., as compared with the amount imported in 1897, and the value of the same has decreased 85·95 per cent. The quantity of nitroglycerin compound imported has decreased only 1·21 per cent., while the value of this importation has increased 1·36 per cent. in value. On the total importations of explosives a decrease of 7·31 per cent. is shown.

Testing.

It is stated that, although the importations have decreased, the number of chemical investigations has been much greater during 1898 because the stocks held in various magazines have, on account of their increase in age, required more constant and careful testing. In 1897 the total number of samples tested was 339. During 1898, 467 samples were tested, an increase of 37·7 per cent. Of the 467 samples which were tested last year, 43 failed either to comply with the heat test, or to reach the standard of purity required, and were consequently rejected, this being 9.79 per cent. of the total number tested, as against 25·66 per cent. in 1897. The results of the chemical examinations have, therefore, been very satisfactory, and they show that the general quality of the explosives imported has been better than in any previous year. The rejection of these samples has led to the destruction of a large quantity of explosives, the principal cause being on account of the exudation of nitroglycerin. Altogether there have been destroyed 234 cases of nitroglycerin compounds containing 11,700 lbs. of explosives, representing 1 per cent. of the total importation of nitroglycerin compounds, as against 3 per cent. for 1897.

With reference to the application of the heat test to explosives, attention is called in the report to one matter of importance which occurred during the past year. The explosives imported by a large trader for some time showed remarkably high heat tests, higher than was to have been expected, and above the average obtained from other brands. The circumstances which accompanied these high tests aroused suspicion that the true heat test had been masked, by adding some material to the explosive which retarded the reaction upon the test paper. This would be a breach of the regulations dealing with authorised explosives. The importers were communicated with, and these suspicions were disclosed to them with a notification that, should any further shipment give the same indications, it would not be allowed to pass into consumption. The result has been a marked difference in the duration of the heat test, this result confirming the conclusion which had been arrived at.

Carriage.

In this colony the Government railways are practically the only carriers of explosives, and their operations cover a large area of that portion of the colony where the chief consumption takes place. The railway department has, during the past year, issued regulations dealing with the carrying of explosives on Government lines, and it is thought that they will bring about a much more perfect system of control than has hitherto existed.

Manufacture.

The continued absence of explosives factories in Western Australia is referred to in the report. It is suggested that the difficulties of the climate largely account for the continued importation of the necessary supplies, though, on the other hand, there is no local supply of raw materials such as would allow for the economical manufacture of explosives in competition with imported goods. The possibility, however, that the increase of local industries will in time make it possible to manufacture explosives in the colony is put forward.

Inspection.

Mr. Mann speaks well of the sub-inspector's work during the past year, but explains the great difficulty of carrying out a thorough inspection, the centres of settlement being so widely separated. He says that the sub-inspectors' work has met the requirements of the mining districts to a very large extent, but the necessity for an inspection by himself has been

shown during the year by the discovery of a large stock of dangerous dynamite at Kalgoorlie. The Freemantle reserves have been frequently inspected, and it is reported that, on the whole, they have been conducted most satisfactorily, although trespass on the reserve has been far more frequent than is desirable. This fault may only be overcome by the provision of a secure enclosure.

New Explosives.

Only one new explosive was examined last year and placed on the authorized list. This explosive is named Rendite, and is of Australian manufacture. It consists of potassium nitrate, sulphur, picric acid, and wood meal, with or without the addition of graphite, which must be free from grit. All the ingredients of this explosive must be thoroughly purified, and in the completed explosive the amount of graphite and picric acid must not in either exceed 2 per cent. Preliminary negotiations were also entered into with regard to placing westfalite on the list, but the application was not proceeded with.

RIFLED NAVAL ARTILLERY:

ITS RISE AND PROGRESS.

On the 18th ult. Sir Andrew Noble, K.C.B., read a paper dealing with the rise and progress of rifled naval artillery, and the following abstract gives most of the interesting passages of this important review of the branch of science with which the author's name has been prominently connected throughout a busy lifetime:—

It is both interesting and instructive to compare the guns, which in 1850 formed the principal armament of the most powerful frigates or line-of-battle ships, with the guns which now form the principal secondary armament of first-class cruisers and battle ships. In the year I have mentioned, and it will be remembered that within a short period the long peace which succeeded the Napoleonic wars was broken, the principal guns with which our ships were armed were 32-pounders. They were of very rude construction, mere blocks of cast iron, the sole machining spent upon them being the formation of the bore and the drilling of the vent. The velocity of the shot was about 1,600 ft. per second, and the energy developed in it by the charge was about 570 foot tons. The carriage upon which this rude gun was mounted was even more rude. It was made entirely of wood; generally, in later years, of teak or mahogany. It was carried on wooden trucks, or sometimes the rear trucks were replaced by a chock. To work with any degree of smartness such rude weapons a very strong gun's crew was necessary, and, indeed, the gun and its carriage were absolutely surrounded by its crew.

In the year 1858 the first great step in artillery progress was made. In that year the Committee on Rifled Cannon recommended the introduction of the rifled Armstrong guns into the Service, and the experiments which were made with these and other rifled guns opened the eyes of all who gave attention to the subject to the great advantages possessed by the new artillery. With regard to range, accuracy, and penetrative power, the superiority of rifled guns was so conspicuous that nearly all artillerists were at once convinced that the days of smooth-bored guns were numbered. The advantage in range at high angles of elevation at first excited some surprise, as the velocity of the projectile was, from causes to which I shall later advert, very much lower than in the case of the smooth-bored guns. Comparing, for example, the velocities and energies of the 32-pounder smooth bores, to which I have adverted, and the 40-pounder R.B.L. guns, which, on the introduction of rifled guns replaced them, the comparative muzzle velocities were respectively 1,600 and 1,200 f.s., and the comparative muzzle energies respectively 570 and 400 foot tons. It is hardly necessary to point out that at comparatively short distances the superiority of the rifled gun, both in regard to range and penetration, manifested itself. But in these early days of rifled artillery the point which attracted most attention was the great increase of accuracy. The writer, in using the method of least squares to determine the relative accuracy of rifled and smooth-bored guns of approximately the same weight, showed that at a range of 1,000 yards half the shot fired from a rifled gun fell in a rectangle of about 23 yards long by 1 yard wide, while in the case of the smooth bore the similar rectangle was about 145 yards long by 10 yards broad. The objection to the use of iron and steel as a material for carriages was shown by careful experiment to be founded on prejudice.

But the battle between guns and armour rendered it a matter of first-rate importance to increase the potential energy of our rifled guns, and the first steps in this direction were made by the Explosives Committee, who, by their experiments showed that, with improved forms of powder, the velocities, which had generally run between 1,200 ft. and 1,300 ft. per second, could, in the same guns, be raised to 1,600 ft., the increase in velocity being at the same time accompanied by a very considerable reduction of maximum pressure. But perhaps the most important step was made by my firm, who, acting upon certain experiments carried out at Elswick, and which formed the subject of memoirs by myself and Sir F. Abel, made in 1877 6 in. and 8 in. guns with which, while the maximum pressures remained the same, the velocities of the rifled projectiles were at a single bound raised from 1,600ft. to 2,100ft. per second, thereby increasing the energies by nearly 75 per cent., and immediately another reconstruction of guns and their mountings became a necessity. At the same time, from the increase in the length of guns, which the slow-burning powders and high energies then introduced demanded, a return to breech-loading from the somewhat retrograde change to muzzle-loading which had some years before been adopted, was also necessitated. Nearly all these new breech-loading guns were arranged for velocities somewhere about 2,000 ft.; the mountings were also greatly improved.

At about the date of the last visit of the Institute to Newcastle experiments were being made in three directions, the whole of which experiments were destined to have a most important bearing on the progress of naval artillery. The first of these had reference to the question as to whether gunpowder, which had since the days of Roger Bacon—that is, for nearly seven centuries—no serious competitor as a propelling agent for artillery purposes, was to retain its pre-eminence. The second was due to my own initiative. Seeing the great advantages that had attended the introduction of the small rifled guns designed by Hotchkiss and Nordenfeldt, my firm had constructed 4·7 inch and 6-inch quick-firing guns, and submitted them to the Admiralty. The success of these guns, both in our own and in foreign navies, was rapid and

complete; and it is not too much to say that for cruisers and the secondary armaments of battleships their adoption amounted to another reconstruction of artillery. The third series of experiments were on the question of the introduction of high explosives as bursting charges for shell, a question of great importance, both in an artillery point of view and as affecting naval construction.

With reference to the first of these questions, it is unnecessary to tell you that the long pre-eminence of gunpowder has come to an end. In this country for artillery purposes it has been replaced by the cordite of Sir F. Abel and Professor Dewar, and this explosive has also been used extensively abroad. Many other nations employ ballistite or kindred explosives, giving results generally similar, but having a somewhat less potential energy. Having spent many years in experimenting on gunpowder, I cannot quit that interesting subject without regret; but as I have also experimented largely with cordite and other kindred agents, I am obliged to confess that the new explosives have many and great advantages. The absence of smoke and an increase of energy, with the same maximum chamber pressure, of about 50 per cent., are advantages much too great to be overlooked. There is one point, however, to which I ought to allude, and which is, I believe, at present exercising the minds of the authorities to a considerable extent. I mean the rapid destruction of the bores due to the erosion by cordite. It must be borne in mind, however, that if taken in relation to the energy developed the erosion of cordite differs but little from that of brown prismatic powder, which is also very erosive, and gives rise to erosion of a much more objectionable character. Erosion is, in my opinion, caused by three factors—the heat of combustion, the pressure, and the motion of the products of combusion—not to any chemical action. This view is borne out, not only by my numerous experiments on erosion, but by the state of the surface of close vessels in which large charges have been fired, and by the examination of the chambers of guns from which a large number of charges have been fired. The object at which we have to aim is to diminish the temperature of explosion, and I am not without hopes that this greatly to be desired end may before long be achieved. The velocities obtainable with cordite are very high. There would be no difficulty, should it be desired, in approximating with ordinary projectiles to 3,000 ft. per second; but for many reasons I consider very high velocities objectionable, and, if a given energy be required, would prefer to see it represented by a lower velocity. I may here mention that with a 100 calibre 6-in. gun, and with a projectile of the dimensions of the ordinary 6-in. projectile, but of aluminium, I have obtained a muzzle velocity of close upon 5,000 ft.

Turning now to the quick-firing guns, I think it will be most convenient to consider the guns themselves in connection with their mountings; because these last, when rapidity of fire is in question, are quite as important as the arrangement of the guns themselves. Early in 1887, a gun and mounting were submitted for trial on board H.M.S. "Handy." The gun was the first mounted on the Elswick cradle, having the recoil press and spring box beneath the cradle, the piston rods and the attachments for compressing the springs during recoil being fixed to a horn on the gun. The weight of the gun and mounting was taken on balls under the pivot and the mounting and shield were carefully balanced. The whole weight of the gun and mounting was about 4 tons 12 cwts., and it could be trained quite easily by the shoulder, no gear being used. The sights were placed on the cradle, and did not recoil with the gun. No. 1 could with ease train with the shoulder piece, work the elevating gear, lay, and fire by means of an electric pistol. During the operation he was quite clear of the breech, and could keep the gun pointed continuously on the object. With this gun and mounting a very great advance in rapidity of fire was obtained. The breech mechanism was of the three motion type and was very quick and handy, but the great speed was obtained by the careful design of both gun and mounting, in such a manner that the movements of one did not interfere with those of the other. At the trial above mentioned ten rounds were fired in 47½ seconds, and later as many as fifteen rounds per minute were obtained. An interesting incident connected with this gun and mounting may be mentioned. The gunboat "Mastiff" was ordered to fire ten rounds as rapidly as possible from her service 5-in. B.L. gun. The time taken for the ten rounds was 6 min. 16 sec., so that the quick-firing gun fired its ten rounds before the then service gun fired its second shot.

I am now in a condition to make the comparison referred to in the opening sentence of this paper. I have placed side by side comparison of the 6·3-in. 32-pounder of 1850 and of the 6-in. 100-pounder of the present day. The velocity and energy given by the 32-pounder are respectively about 1,600 ft. per second and 570 foot-tons. The corresponding figures for the 6 in. quick firer are 2,570 ft. per second and 4,580 foot-tons. But the rapidity of fire and accuracy of the modern gun is even more remarkable. Most of you are doubtless aware of the conditions under which target practice is carried on in the Navy. Each gun's crew has three minutes to fire as many rounds as they can with accuracy, the variable ranges commencing at about 2,200 yards, diminishing to about 1,600 yards, and again increasing to 2,200 yards. In H.M.S. "Blake" the best gun's crew fired 18 rounds, hitting the target 15 times, while the total number of rounds fired by her ten guns was 148, the target being hit 110 times. H.M.S. "Royal Arthur" did nearly as well, the best gun having fired 18 rounds, striking the target 14 times.

The number of explosives which have been used or proposed as bursting charges for shell is very large, but in this short sketch I shall confine my attention to three—gunpowder, guncotton, and Melinite, including under this latter head the form known to our service as Lyddite.

From the numerous experiments we have made, either ourselves in this country or elsewhere, I draw the following conclusions:—

1. To attack unarmoured structures, I have no doubt that shell charged with high explosives are a most formidable weapon. The large quantity of explosives that can be carried and the power of immediately detonating the shell, permit the vessel to be attacked either by making large holes at or near the water line, or if the shell should burst on board the effect of the explosion and the destruction to everything in the wake of the shell would be very serious.

2. But with high explosives the shells are reduced to very small fragments, and even very thin steel plates resist penetration. Hence the importance of traverses, and supposing a first-class cruiser to engage two smaller cruisers, firing high explosives one on each broadside, a longitudinal traverse of very moderate thickness would be a protection, the importance of which could hardly be overrated.

3. Having regard to the size of the holes made by high explosives in unarmoured structures, I regard it of great importance that, wherever possible, the water-line should be protected from stem to stern with such armour as can be conveniently carried, and that the same protection should be afforded where the guns are carried on the main deck. On the upper deck effective shields, and as thick as can be conveniently carried, should be attached to the mountings.

4. Where an attack is made against thin armour, shell charged with gunpowder are more effective than high explosive shell, as, dependent upon circumstances, the former can be got to pass through thin armour and burst inside. I doubt if shell charged with any explosive can be got to pass through thick armour without bursting.

5. There is one serious objection to certain high explosives as bursting charges which is not shared by wet guncotton, and that is the liability to detonate if struck by another projectile, or even by a large fragment. Wet guncotton is quite safe in this respect, and yet, if fired, for example, by a fulminate, it detonates even more rapidly than in the dry state. This property has led certain Governments to adopt it as the high explosive for use on board ship.

In concluding this paper I desire to defend our Elswick practice, which I have sometimes heard attacked, of mounting as many guns on the broadside as can be conveniently carried. Personally, I share strongly the opinion which a distinguished admiral once made to me. That, supposing a fight between two cruisers, equally ably commanded, the victory would remain with the ship that got in first her second broadside, and the victory would be more assured if the broadside were the more powerful. It must also be remembered that with our modern weapons allowance must be made for a gun or two being disabled without altogether crippling the broadside. For these reasons I prefer to carry as many guns as possible, even if the number of rounds carried per gun were reduced.

REVIEWS.

The Life Work of Alfred Nobel. A Paper read before the Society of Chemical Industry, by Henry de Mosenthal. Published by Eyre & Spottiswoode, London.

We have received a reprint of a lecture bearing the above title which was delivered by Mr. Henry de Mosenthal before the Society of Chemical Industry on May 1st of this year. As we have already mentioned in these columns, Mr. Mosenthal has had special facilities for observing the career of the late Mr. Alfred Nobel, and to this he adds a natural aptitude for work of a literary character, both of which combine to forward the success of the present composition. The reprint is accompanied by a very finely executed engraving of the late Mr. Alfred Nobel, which appears to represent him much later on in life than the previous photographs with which we were familiar.

In compiling a record of this kind it is extremely difficult to explain the various stages of a man's inventions without becoming discursive, while, on the other hand, the interest is lost if the account is no more than a list of patents and a record of performances. The author has, in our opinion, made up his paper of the right combinations of fact and explanation, though we must regret that, for the present at any rate, he has not been able to go into his subject with greater detail than is possible within the limitations of a chemical society paper.

It is impossible in any such notice as this to attempt to follow in summary a paper which in itself condenses the work of a life-time into a few pages. The battling against difficulties of no ordinary kind, the maintenance of scientific research side by side with strenuous business exertions, and finally the uninterrupted researches in which Mr. Nobel was enabled to indulge when the work of his earlier years had borne fruit—all come out in this record of his life work. Even when his fortune was made, and his scientific researches had been recognised the world over, he was not allowed to continue his researches in peace. The campaign against him which led to his withdrawal from Paris had no better foundation than that the whole world had benefited from his researches in military explosives. The loss of the Cordite case in England was another blow to him; for whatever may have been the legal points involved he had every justification for believing that the results of his work had been adopted while he himself was excluded from the credit of the performance. Whatever monetary questions were involved in the case there is little doubt that the bitterest disappointment to Nobel himself lay in the fact that he had been deprived of the credit for a piece of scientific research which he had worked out himself, and had ample reasons for supposing that others had copied. These matters are not touched upon in the present biography except in the lightest manner; but the life work of Nobel is still eloquent upon the point, for there is evidence that he drops his work in connection with military explosives to take up other branches, such as rubber substitutes and artificial silks where he would not be involved with military copyists.

The paper concludes with a list of British patents by Alfred Nobel. A large proportion of these received provisional protection only; and it is clear that many of them indicate lines of research which were not carried out to maturity of success. This tends to give support to the characteristic motto of Nobel in earlier life, which is referred to by the author, viz.: his belief that the time of accidental discoveries is past, and that original work in the future must be based upon a careful course of trial and investigation. These provisional patents tend to show that one of the most successful inventors of the century tried many things before arriving at the one which promised commercial success.

Shot-firing by Electricity, with special reference to Quarry Blasting. By Robert Hunter. Issued by Hunter and Warren, Glasgow. Price 6d.

We have much pleasure in calling attention to the above pamphlet, which is a reprint from an article by Mr. Robert Hunter, of Messrs. Hunter & Warren, of Glasgow, which appeared in a recent issue of our contemporary, *The Quarry*. We understand that any supplier of blasting accessories consumes reams of paper in explaining by correspondence various little points on electric blasting which purchasers of apparatus require to have made clear to them.

In this pamphlet, as in the original article, the leading principles of electric shot-firing are explained in a manner which can be readily understood by the non-electrician. The pamplet is well illustrated by means of original photographs

of the leading types of exploders, indicators, and other apparatus in use; and generally the pamphlet will serve as an easy guide to electric blasting, such as will be found of great use to quarryowners and operatives.

CORRESPONDENCE.

MARK IV. BULLET.

To the Editor of *Arms and Explosives*.

Sir,—General Tweedie's letter in last month's issue came at a most opportune time, as Bisley has given us an illustration of what I was about to write—that the design and manufacture of a bullet are two very different stories. It is well known that the ·303 bullet was a Swiss invention, which was acquired and brought to the notice of the Government by Messrs. Greenwood & Batley. I have seen some of the original Swiss bullets, and they are quite capable of being fired "without split or fracture." I do not refer to the copper-covered, but those with cupro-nickel envelopes. The first Bisley experience was identical with the last; the design was not to blame, it was the idiosyncrasies of the cupro-nickel. Then, as now, some of the contractors supplying ammunition were able to work to Government designs without any casualties. Then, as now, the non-technical press plays the big drum, and every shooting man, expert and crank, blows his own trumpet, each in his own key, till the authorities give $\frac{1}{1000}$ in. alteration here or there, alter the mark, and harmony reigns again. At the first Bisley, the cupro-nickel, unable to stand, stripped at its weakest part, but having a solid nose, carried a cap of metal on the runaway core; in the last a similar thing happens, but the hole in the nose offering so much less resistance, the envelope opens out and declines a fragmentary elopement with the core.

I meant that the design of the Mark IV. bullet was due to the Royal Laboratory, and I still maintain that it is, as a man stopper, or penetrative projectile, head and shoulders above any other. The solid base bullet is inadmissible; it does not gas check and wears the rifle. The bullets with soft noses do not make good shooting at long ranges, and in warfare you have to hit a man in a fleshy part, such as the buttock, or you get no set-up; a soft-nosed bullet will go between a man's ribs, so long as it does not touch bone, and out the other side like a Mark II. The Dum-dum is a perfect bullet of this class, and, unlike any sporting bullet, has an open base, but even that was proved to be of little effect in the last frontier war in India, unless it landed on bone or thick flesh, and the native Indians do not cultivate the latter to any extent. The Mark V., which is the same design as Mark IV., will prove its value in the opinion of

Yours truly,

Cyclops.

APPLICATIONS FOR PATENTS.

JUNE 19th—JULY 15th, 1899.

12,824* Pneumatic Guns. W. R. Benjamin.
12,840 Weapons. A. Simms.
12,852 Adaptation of Breech-loading Guns for practice with miniature ammunition. The Morris Tube Ammunition and Safety Range Co., Ltd., and A. J. H. Wyatt.
12,943 Gun Carriages. C. A. McEvoy.
13,014 Pouches for Cartridges. A. P. J. P. Jacobs.
13,021* Cartridge Loading Machines. H. H. Lake (*Agent for R. T. Coleman, U.S.A.*)
13,027* Breech-loading Ordnance. P. M. Justice (*Agent for the Driggs-Seabury Gun and Ammunition Co., U.S.A.*)
13,171 Smokeless Powder Manufacture. E. H. Durnford and G. H. Wadsworth.
13,191 Machinery for Manufacturing Tubes. B. F. MacTear.
13,214* Range Finders. G. Langer.
13,215 Depression Range Finders. R. Brotherhood.
13,232* High Explosive Projectiles and Detonators. F. P. Hurst.
13,247* Mining Cartridges. W. E. Miller. (Date of Application in U.S.A., 8th December, 1898.)
13,255 Naval Range Finder. A. W. Abbott.
13,267 Guns and Rifles. J. W. Smallman.
13,278 Manufacture of Guncotton. A. Hollings.
13,314 Electrical Shot-firer for Submarine Mines. E. Edwards (*Agent for F. Maylander, Germany.*)
13,460 Compound Bullets. L. B. Taylor.
13,505* Ordnance Mountings. H. H. Lake (*Agent for C. Bonagente, Italy*).
13,549. Electrical Shot Firer. N. Schmidt.
13,591 Method of increasing Velocity in Big Guns. W. S. Simpson.
13,636* Cartridges. H. Hammond, E. Hammond, and F. Hammond.
12,670 Steel Castings for Projectiles. R. A. Hudfield.
13,750 Automatic Discharge of Guns. L. B. Mitchell (*Agent for A. H. Edwards, New South Wales*).
13,754 Covers for Rifles. J. W. Ottley.
13,769 Explosive Shells. J. W. Reno.
13,770 Shield for Artillery. C. H. Frybarger.
13,784* Fuses for Projectiles. H. P. Merrian.
13,785* Fuses for Projectiles. H. P. Merrian.
13,798 Gun-carriages. A. Riechwald (*Agent for Fried. Krupp, Germany*).
13,799 Recoil Brakes for Ordnance. A. Reichwald (*Agent for Fried. Krupp, Germany*).
13,887 Rifle Sights. J. Formby.
13,890* Gun Sights. W. H. Chambers.
13,965 Trunnion Bearings for Ordnance. A. Riechwald (*Agent for Fried. Krupp, Germany*).
13,969 Fuses for Blasting. B. T. Moore and H. G. Ticehurst.
14,122 Lock Mechanism of Fire-arms. N. Pieper.
14,219* Shot-proof Armour. H. Theis.
14,237 Cap for Projectiles. J. Imray (*Agent for E. Palliser, France*).
14,384* Prevention of Explosions Device. F. Henze.
14,468 Cartridge Machines. A. N. Whitney.
14,584 Machinery for Targets. A. Winser.
14,608 Bullets. G. Hookham.
14,648 Explosives Manufacture. E. H. Durnford and G. H. Wadsworth.

* These applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

JULY 1st—JULY 22nd, 1899.

9,066* (April 19, 1898). H. W. Gabbett-Fairfax, Leamington. Ejecting Mechanism for Small-arms.

9,067 (April 19, 1898). H. W. Gabbett-Fairfax, Leamington. A cartridge carrier and elevator combined, with a slide for transferring the cartridges successfully from the magazine into the barrel of recoil-operated small-arms. The carrier and pusher are themselves actuated by the sliding barrel. Accepted June 19, 1899.

11,342* (May 18, 1898). J. W. Smallman, Nuneaton. The Smallman Trigger Mechanism.

12,462 (June 3, 1898). C. Salmon and J. Ramsey, Erith. A machine for resizing ordnance cartridge cases. The cartridge case is forced through a die, which may be adjusted to the various positions required during the working of the machine, by hydraulic power. Accepted June 2, 1899.

13,334A (June 15, 1898). C. Möller, Norway. A torpedo constructed so that when discharged it shall rise automatically through the water and adhere to the structure to be destroyed by means of suction. The suction is caused by the displacement of a ball valve, which puts a vacuum chamber into communication with the mouth of the torpedo, and causes it to adhere to the bottom of the vessel. Accepted June 10, 1899.

16,655 (July 30, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., and J. Honner, Newcastle-on-Tyne. A method of lifting shells from the shell bays by means of a sling, one end of which is free to pass round the shell, and can be fastened to the other end by means of a detachable eye. Accepted June 10, 1899.

16,901 (August 4, 1898). R. A. Hadfield, Sheffield. A projectile which is cast with a blunt nose. A shallow disc-like cap is attached to the nose, the object of which is to make the projectile suitable for use in attacking hardened steel armour-plates. Accepted June 10, 1899.

17,151 (August 9, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., E. W. Lloyd, and L. Newitt, Newcastle-on-Tyne. This patent relates to torpedo launching apparatus, in which a stop is employed to retain the torpedo in the position ready for discharge. Various methods have been adopted for automatically removing this stop to allow the torpedo to have a free passage out of the apparatus; but this patent deals with a method in which the stop is automatically withdrawn by means of a concentrated form of the pressure which is used for ejecting the torpedo. Accepted July 1, 1899.

17,777 (August 18, 1898). F. C. Grimley, Colchester. This patent relates to moving targets. A tramway is constructed, which is balanced on a central fulcrum, and has a see-saw motion. The carriage containing the target is made to run backwards and forwards along the tramway by the force of gravity, the tramway being raised and lowered alternately. Accepted June 17, 1899.

17,878 (August 19, 1898). C. W. Curtis, London, and A. H. Durnford, Hounslow. An explosive, in which sulphur is entirely dispensed with, the ingredients being saltpetre and charcoal. These are compounded in the proportion of, preferably, 80 parts of saltpetre and 20 parts of a charcoal containing about 60 per cent of carbon. The ingredients are ground finely and mixed, and are then incorporated and granulated in the same manner as ordinary gunpowder. Accepted July 1, 1899.

18,068 (August 22, 1898). W. E. Heys *(Agent for Schaffer and Budenberg, Saxony)*. A method of making joints in pressure gauges, which consists in compressing the end of the Bourdon tube against the wall of the hole in which it is inserted by means of a coned piece. Accepted June 19, 1899.

18,233 (August 24, 1898). A. Luck, Dartford and C. F. Cross, London. A method for hardening grains, consisting of nitrocellulose alone, or compounded with restraining or other substances, by subjecting the soft grains to the action of a diluted solvent, after which they are washed and dried. Accepted July 1, 1899.

18,659 (August 31, 1898). A. Reichwald *(Agent for Fried. Krupp, Germany)*. A safety locking device for use in the type of guns where the horizontal wedge breech-closing mechanism is used. The safety mechanism is arranged in a recess in the breech wedge block, and an arm, which is controlled by the safety handle, may be placed so that it locks the trigger and prevents the breech from being opened. Accepted June 17, 1899.

18,868 (Sept. 3, 1898). A. Luck, Dartford, and C. F. Cross, London. A method of increasing the stability of nitrocellulose by freeing it from the nitrating acid and treating it with a salt of a heavy metal, such as lead acetate or zinc chloride. It is claimed that this process enables nitrocellulose to stand the "heat test" for a longer period than ordinarily. Accepted July 1, 1899.

19,773 (Sept. 17, 1898). A. Reichwald *(Agent for Fried. Krupp, Germany)*. This patent relates to a modified form of trigger-mechanism for big guns, which was the subject of a former patent. It consists of a device for doing away with a superfluous movement in returning the firing pin from the firing position to the rest position. Accepted July 1, 1899.

20,520 (Sept. 28, 1898). Kynoch, Ltd., and J. J. Iniss, Witton. A means of decreasing the pressure which is materially increased by the momentary resistance of the wad in ·303 cartridges by substituting for the ordinary wad a self-combustible wad preferably made of cordite It is claimed that the velocity is maintained, although there is a decrease in the pressure. Accepted July 1, 1899.

22,455 (Oct. 25, 1898). S. Pitt *(Agent for Colt's Patent Fire-arms Manufacturing Company, U.S.A.)*. A magazine pistol, in which the reloading and recocking operations are performed by the recoil. In this pistol, a case is placed along the barrel, which contains a spring for the recovering of the parts, and also contains the breech-bolt. The case together with the breech-bolt recoil after discharge and are retained in a backward position until the trigger is pulled. Accepted July 1st, 1899.

22,714 (Oct. 28, 1898). H. Korrodi, Switzerland. A modified tangent sight with a spirit level index for cannon, by means of which an exact reading may be taken to point of an angle of earth on a single graduated arc, the diameter of which is perceptibly equal to that of the graduated arc giving the sight. Accepted July 1, 1899.

22,948 (November 1, 1898). M. C. Lisle and F. A. Simonds, U.S.A. A machine, which is operated automatically, for winding the jackets on to projectiles. The jackets are made of twine, which is wound spirally on to the lead core of the bullet. Accepted June 10, 1899.

479 (January 9, 1899). C. F. Jeansén, U.S.A. A method of always retaining the sight support parallel with the axis of a disappearing gun, by means of apparatus which causes the sight support to move in the arc of a circle in unison with, and proportional to, the arc described by the gun in aiming it. Accepted June 10, 1899.

6,656 (March 28, 1899). P. M. Justice *(Agent for the Marsden Company, U.S.A.)*. A modified method of treating pith, making it specially applicable for use as an absorbent for nitroglycerine in dynamite. Accepted July 1, 1899.

7,352 (April 7, 1899). W. Roos, Germany. An explosive consisting of nitrate of soda or potash, either alone or with the addition of other oxidising agents, with di- or tri-nitro-substitution products of benzol, toluol and naphthaline. It is claimed that this explosive is effective in action, safe to handle, and cheaply produced. Accepted June 10, 1899.

9,847 (May 10, 1899). H. Henneberg, Germany. A cartridge in which the powder may be compressed, and is ignited in front by means of a striker, which extends right through the powder, and strikes a cap attached to a perforated disc placed over the powder charge. Accepted June 10, 1899.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

THE SMALLMAN TRIGGER MECHANISM.

11,342 (May 18, 1898). J. W. Smallman, Nuneaton.—This patent relates to a modified form of the ordinary double-trigger gun, whereby it is sought to obtain the advantages of a single-trigger mechanism. The special advantage of single trigger guns, which is secured in the present mechanism, is that the two triggers may be released without shifting the grip of the hand on the stock or at least of ensuring that the two triggers, when in the act of being pulled, are in the same position relatively with the stock. This is effected by placing the two triggers very close together, that of the right-hand barrel being in advance of the other by about the distance of its draft when pulled to release the sear. When the trigger is released after pulling, it flies forward sufficiently to leave a clear space for the shooter to place his finger on the second trigger, which latter may then be pulled in the ordinary manner. Should the shooter desire to reverse the usual order of firing his barrels, it is necessary to push the right-hand trigger to the forward position, so as to get his finger into contact with the trigger of the left-hand barrel. On withdrawing his finger after firing, the triggers rearrange themselves in their natural positions, so that the right-hand trigger is then in a position for firing.

In the appended illustrations Fig. 1 shows a side elevation of the mechanism, and Fig. 2 a plan of the same. Figs. 3 and 4 illustrate the parts in different positions, and Fig. 5 shows the position of the sear when uncocked and cocked.

The principal part of this mechanism is the lever *a*, which is pivoted on the trigger plate at the point *b*. At the extreme end of the lever *a* a spur is attached laterally, and enters the hole in the right-hand trigger blade. In Fig. 1 the triggers are shown in their normal positions, with the tumblers *d* cocked. In this position the sear tail *e* is shown resting lightly on the top surface of the lever *a*. Upon the first trigger being pulled, the sear nose

is drawn out of bent, and the sear, under the pressure of its spring *f*, tends to assume the position shown in full lines in Fig. 5, but is detained in its original position by the pressure of the finger upon the trigger. Immediately upon the relaxation of that pressure the sear is revolved on its pivot by the spring *f*, which presses against the sear tail, forcing it downwards. The sear-tail is pressing against the lever *a*, so that in being forced downwards it also presses the lever in a downward direction. The lever, by means of its lateral spur, working in the hole in the trigger blade, causes the trigger to move into the forward position. The trigger has then assumed the position shown in Fig. 4, thus creating a space between the two triggers into which the finger may be inserted for the purpose of pulling the second trigger. It should be explained that the front trigger cannot be pulled back far enough to discharge the second barrel, this being prevented by the shoulder *g*, which catches against the underside of the trigger plate, and prevents any further backward movement.

Fig. 1.

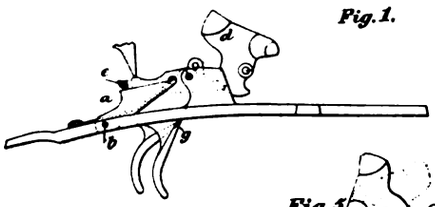


Fig. 5.

Fig. 2.

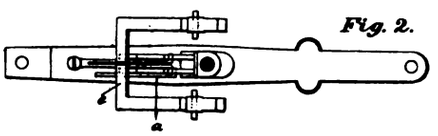


Fig. 3.

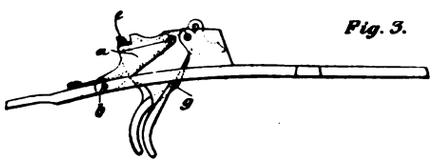
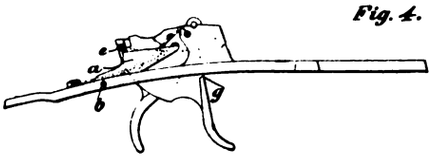


Fig. 4.



Various other methods for advancing the front trigger are illustrated and explained in this patent. In one of these the lever *a*, instead of merely working in a hole in the trigger, is fixed at this point, and the other end slides along the trigger plate, instead of being pivoted. The sear tail, in another case, presses against a special trigger spring, which serves to advance the trigger. These methods are merely illustrated in order to show the intended scope of this invention. Accepted June 17, 1899.

EJECTING MECHANISM FOR AUTOMATIC PISTOLS.

9966 (April 19, 1898). H. W. Gabbett-Fairfax, Leamington. This patent relates to some further modifications in the ejecting mechanism of the Gabbett-Fairfax automatic pistol. This mechanism is of the type which is operated by a rod which transmits the movement of the barrel, due to the recoil of discharge.

In the appended illustrations, Fig. 1 shows a section of part of an automatic pistol, with the ejecting mechanism attached. Similar mechanisms, in modified forms, are illustrated in Figs. 2 and 3.

The principal part of the ejector is the "finger" *a*, Fig. 1, which slides longtitudinally in a slot beneath the breech bolt *b*. This finger is situated diametrically opposite to the extractor *c*, the latter serving to draw the empty cartridge cases from the barrel preparatory to its ejection from the breech. The ejector finger *a* is provided with the shoulder *d*, which is in such a position as to be always bearing against the rim of the cartridge, as shown in Fig. 1. After a discharge the barrel is thrown back by the recoil, and by means of the projection *e*, the rod *f* is also carried backwards. Attached to the rod are two projections *g* and *h*, which engage with the projection *i* on the finger *a*. In travelling backwards the projection *h* on the rod *f* comes into engagement with the projection *i*, and carries the ejector finger backwards with it. After having travelled a certain

Fig. 1.

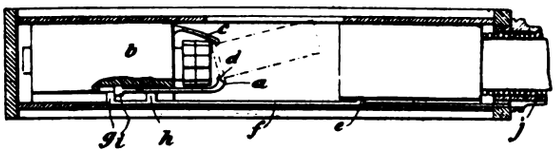


Fig. 2.

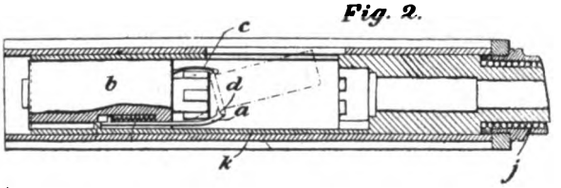
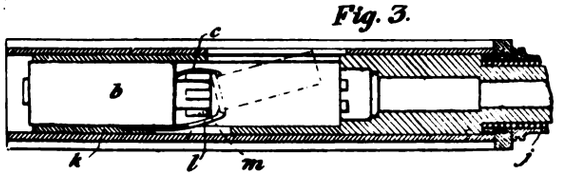


Fig. 3.



distance the breech bolt is unlocked from the barrel, and under the influence of the spring *j*, the barrel flies forward into the firing position, again carrying the rod *f* with it. As shown in Fig. 1, the projection *g* is brought into engagement with the projection *i* on the finger. The sudden dragging forward of the rod *f* jerks the finger forward, and by means of the shoulder *d* this jerk is communicated to the empty cartridge case, which is thrown forwards and upwards, and thus out of the breech.

Fig. 2 shows a modified form of this same mechanism, in which the rod *f* is done away with, and the rigid sleeve *k*, which is attached to the barrel, acts in its stead. In this case, however, instead of the sleeve pushing the ejector finger backwards, a spring is provided, which performs the operation.

In Fig. 3, the sliding ejector finger is dispensed with, and the resilient finger *l* acts in its place. When the breech bolt is released in order to close the breech ready for firing, the finger, by means of its resiliency, is forced into a cavity *m*, between the locking head and the barrel. Upon the barrel sliding foward after a discharge, the finger acts as a spring, and flips the cartridge out of the breech Accepted June 19, 1899.

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CONTENTS.

CURRENT TOPICS.

The Dynamite Question in the Transvaal—The debate on Dynamite in the South African Republic has resulted in the adoption by the Raad of the majority report of the Commission. The two alternatives upon which the members were mainly divided was the cancellation of the concession on the one hand, and on the other the upholding of the concession, accompanied by certain modifications of the existing arrangements. The latter conditions were finally approved after a long debate. The arrangements now set on foot involve a reduction in the price of Dynamite to 45s. per case, and Gelatine to 87s. 6d. per case. The Government reserve a royalty of 7s. 6d. per case, in place of the 20 per cent. on the profits which has hitherto been taken. The settlement of the questions on these lines is only final so far as the present status of the South African Republic itself is final. It will be remembered that the Colonial Secretary reserved his right of protest on behalf of the British Government in respect of the Dynamite monopoly, which he had argued in official despatches to be contrary to the provisions of the convention, and to this extent subversive of the rights of the Uitlander population. These rights are at the present moment the subject of the grave differences which now exist between the two countries, and the line of British protests goes in the direction of showing that the *status quo* must be altered, either by mutual agreement or under the compulsion of war. The future position of the monopoly depends upon the turn which affairs will take. If the more gradual processes of reform are adopted, the monopoly may continue in its present, or in a slightly modified, form for some time. If, on the other hand, war breaks out, the inevitable result of such a war will naturally be that a clean sweep will be made of the present unpopular institutions in the Transvaal, and it is hardly likely that the Dynamite monopoly will be left upstanding.

Shortcomings at Shoeburyness.—At the concluding proceedings of the Shoeburyness artillery meeting a prominent officer referred with gratification to the small dimensions of the camp this year, since it gave opportunities of paying greater individual attention to the competing teams. The speaker was either possessed of a brilliant grain of sarcasm, or else entirely lost sight of the real function of the meeting. The reports in the daily and other papers seemed to ignore the very peculiar conditions of this year's meeting. In reality, the National Artillery Association is in a very parlous state, and the smallness of this year's meeting results entirely from the disgust of many of the units in our volunteer artillery corps. The absence of many well-known teams, who competed in past years, is nothing more or less than a protest against their treatment by the Government and by the Association. Artillery affairs are in a very critical state. We may still observe energetic teams practising with guns of such an obsolete character that they would have been too antiquated for use in the wars of the early decades of the century. Such teams are invited to come and compete at Shoeburyness with modern weapons, about which they have practically no knowledge, and which they are not even allowed to inspect prior to the competition. It must be remembered that this competition may be fired in the course of half-an-hour, and it

represents the absolute crisis of the entire year's activity. The Government appears to do practically nothing to place volunteer artillery in a state of efficiency corresponding with that of the local rifle corps. The vitality and long-suffering characteristics of the volunteers are proverbial, but we have doubts whether their patience is not being tried too far. The whole question resolves itself under two headings—first, the provision of decent facilities for practice at the local head-quarters, and secondly, the reorganization of the annual meeting at Shoeburyness on practical lines. There are two parties in the Shoeburyness dispute—the one aims at development of the meeting as a pot-hunting assembly, and the other, recognizing the inequalities of opportunity existing between the two different corps, desires that the meeting should be more in the nature of what manœuvres are to the ordinary volunteer, that is, practical instruction in his work. The two issues are in reality joined into one when the true object of our volunteer artillery is considered. The efficiency of this arm of our volunteer service depends upon the granting of facilities for routine training at the local head-quarters, and upon expert supervision under the direction of competent officers at the annual meeting. The issue would be simple enough if some of our service agitators would take the matter in hand. In the meantime, the whole volunteer artillery organization is suffering from the neglect of those who have not yet been stimulated into activity by a proper realization of their duties.

A Lost Art in the States.—A false rumour has recently gained currency regarding the likelihood of an American team competing against one representing England at the next meeting of the N.R.A. This rumour, first put forward in the New York press, originated from a friendly conversation which took place between some of our shooters, who represented England against America in former contests, and a member of an American team. This conversation, which merely indicated the desire of the N.R.A. to promote such friendly contests, was translated by the energetic American pressmen into an official challenge. The spread of the rumour throughout America revealed various facts, which show that the would-be organizers of an international contest would be faced by practically insuperable difficulties, the chief reason, according to *Shooting and Fishing*, of New York, being that in America long range shooting is a lost art, and is now very rarely practised. The United States has no national organization for the encouragement of rifle shooting, the new Jersey State having a minor association, which is the only body interesting itself in such work. The result of this neglect of rifle shooting, from the point of view of practical military marksmanship, is that only those forms of rifle shooting have survived which appeal to the private sportsman. Curiously enough, the tendency of the ordinary American "shootist" is to put on marvellous targets. Very considerable latitude exists as to the use of various artificial aids to shooting, and in order to get the best results out of such appliances as are in use, the shooting is conducted at very short ranges. In this way a sort of gallery shooting has become very popular in the States, and many years of arduous practice seem to be amply rewarded by the reproduction in the columns of one of our American contemporaries of some marvellous record in the way of consecutive bull's eyes. One does not need to inquire as to how these sensational records are obtained. It is quite obvious that they are due to a specialized development of skill working in a sort of partnership with such appliances as were used in the recent international match at the Hague, appliances which our own men in several cases found more of a hindrance than a help. Rifle shooting in this country, at any rate, among civilians, is practically an adjunct of the volunteer movement; and if the United States are really serious in their intentions of increasing their available forces without the existence of a large standing army, then we may anticipate that means will be taken to recover the "lost art" of military regulation rifle shooting; and possibly when all these things have happened, the rumour of an international match between picked teams will not be the ridiculous figment of a heated imagination, which our contemporary assures us the thing is at present.

Official Rules of Warfare.—The ordinary member of society is subject to the polite compulsion of the policeman, but among nations there is no superior power to enforce the laws passed by the votes of the majority. Consequently the Hague Conference was only amiable chatter so far as those resolutions were concerned which were not unanimously approved. It is curious that the only real modifications in the list of excluded methods of war should have been directed against this country. The practical character of the English service bullet, and the efficiency of our balloon corps, provided material for interesting debates and resolutions at the Conference. Equally curious it may be that the supposed development of submarine vessels in another country were ignored. Great Britain will, of course, ignore the so-called prohibition of expanding bullets, and now we hear that it has been officially declared in Washington that the United States Government will not be bound by the decision of the Peace Conference on the same subject. It is, perhaps, curious that the two countries which have had the most recent practical experience in the use of war materials, decided to ignore the views of those not in possession of such knowledge. In this way the bad policy of forcing to a final issue a resolution upon which the powers were not unanimous is made quite clear, for it needs no argument to show that the Peace Conference at the Hague does not possess the power among nations that the Amateur Athletic Association exercises over sportsmen.

The New Explosive "Journalistite."—The daily press has a happy knack of discovering new explosives which possess marvellous properties, far exceeding the best that any existing firm dare claim for its products in advertisements and circulars. Certain classes of patent medicines, perhaps, rival the new explosives described in the daily press in the variety of their applications and attainments. It is the lot of the unhappy editor of any paper which appears to deal seriously with scientific matters, to answer enquiries from unknown correspondents who desire to get into communication with the makers of the marvellous new explosive for the time being. Possibly they desire to secure the exclusive agency for such a valuable commodity; perhaps even they may hold shares in the Nobel Trust, and are desirous of confirming the reports in the press, so as to clear out before that big organization crumbles to dust under the competition of the new mysterious compound. Sometimes the inventor is a German chemist, suggestive of the deep researches for which that

country is noted; at others he is a colonial expert who has discovered that juice extracted from the bark of a tree can, at nominal cost, be converted into an explosive stronger than dynamite, safer than saw dust, and which will only explode on receiving the word of command. A subscriber to one of the press-cutting agencies gets a liberal assortment of newspaper notices about such new explosives. Sometimes these notices bear the heavy imprint of the author's own inspiration, and we are then favoured with interviews with the inventor, in which the stock phrase always occurs, that, although dealing in such deadly materials, affecting almost the very existence of nations, the inventor is a mild-mannered and quite unassuming young gentleman. Sometimes, of course, his eye glistens when he speaks of the marvellous potentialities of his invention; but even so it is with the chastened air of restraint, due to the innate conviction of his power over the deadly and mysterious forces under his control. Readers of the "Wandering Jew" will remember how the plague followed upon the footsteps of this outcast, and in the same way the local press of different places tells us of the march of the inventor. At one place he creates a sensation by eating his dinner off the top of a cask containing the explosive, at another he quenches the glowing end of his cigar stump in the actual mixture, later on fracturing a heavy iron rail with its unconfined explosion. Finally we hear that he is in our very midst. The really successful explosive paragraph is, however, the one that multiplies itself on a system of propagation. The paragraph is written in a picturesque form, which appeals to all editors who have a column catering for those of their readers who appreciate science when dished up on the tit-bits system. Then the paragraph is multiplied to some purpose, and the gratified inventor will be encouraged by the rapid filling of his newspaper-cutting book. By the time things have got this far the most serious of the technical press feel bound to take the matter up, and in a gravely worded note they repeat in a modified form what the wandering paragraphs have circulated with such persistence. The editorial dignity requires some saving clause such as the usual "it is reported," but to all intents the paragraph is the same. There is a family likeness about all new explosives of the class "Journalistite." They are as efficient in a toy pistol for shooting darts at a target hung behind the door, as they are for expelling shells from the biggest guns; and of course they are suitable for the bursting charge of such shells, and are capable of sinking the biggest ship, even when exploded within a fifty-yard radius. All the governments of the world are experimenting with them, and are tumbling over one another to buy the secret for a fabulous sum. They are invariably made from some simple ingredients which may be had for the asking from any dust contractor, and the operations of manufacture are so simple that they may be carried out in the presence of visitors with a sausage machine and a pestle and mortar.

Rifles in India.—The Government of India have issued the following notice from Bombay Castle, which was dated July 15th:—"It is notified under orders of the Government of "India that on and after August 1st, 1899, licences for impor- "tation (1) of Arms taking Government Rifle or Carbine "Ammunition, whether of ·303, ·450, or ·577 calibre, (2) of "ammunition which can be fired from service rifles or cart "ridges of these calibres, will not be granted." This order appears to be a very serious matter for the gun trade, as India provides one of the best markets for the sale of English fire-arms. It is true that the order affects only those cases where licences for importation are required, for a number of exempted persons, including officers of the British army, do not require licences. Here, again, the exemption is only partial, as it only allows exempted persons to import reasonable quantities for their own use, and we believe that this clause will be interpreted to mean one rifle, which, of course, is ridiculously inadequate for a sportsman of any standing. The terms of the order appear to be somewhat vague in so far that the prohibition refers to arms taking ·303, ·450, and ·577 calibre ammunition, and ammunition which can be fired from service rifles or carbines of these calibres. It is quite clear that all service and other rifles taking the standard ·303 ammunition are disqualified, but it is not made clear whether the prohibition applies to arms of analagous calibre. The principle of the enactment is, of course, to prevent arms or ammunition from reaching native hands, in which case they might be used for purposes hostile to the British rule in India. There is plenty of evidence that this order has been framed in haste, and will have to be seriously reconsidered before long, unless, of course, the Indian Government wishes to pose as the friend of the foreigner, and in furtherance of such a policy brings forward regulations for the exclusion of British manufactures, accompanied by the exemption of foreign arms. It certainly seems curious tha the door should be thrown right open for the importation of arms and ammunition of foreign service patterns, which do not fall within the narrow compass of the order quoted above. Like the extraordinary incidents connected with the Persian Gulf seizure action, it seems to have been taken without any regard to its ultimate consequences. The provisions of the order might easily be extended to every form of rifle, but this is not what is required, since the whole principle of the order constitutes an undue interference with legitimate trade. The Government of India seems incapable of taking proper care of the arms placed in the hands of its soldiers, with the consequence that the rifle thieves reap a valuable harvest every year. It seems a pity that, instead of taking adequate measures for the protection of its property, it should place restrictions on a legitimate trade, which cannot be responsible for the evils which it is sought to remedy. The whole matter is one which requires systematic investigation at the hands of the trades affected, with a view to show the Indian Government the desirability of imparting a modicum of fairness to its efforts for preventing the improper leakage of fire-arms and ammunition among hostile tribes. India is essentially one of the finest countries for big game shooting in the world. A large number of wealthy Englishmen reside in the country, and in many cases one of their chief amusements is the hunting of wild animals. The ·303 rifle is a weapon which is largely used for this work, and the Indian Government desires to abolish its use by stopping the supplies of ammunition. The curtailment of arms which may be imported by an exempted person to a single rifle is absolutely ridiculous in the face of the armoury which is actually required for practical game shooting. It will no doubt be a pretty sight if the solicitude of the Indian Government ends by limiting the sports of Englishmen in that country to exciting games, such as hunt the slipper, and yet it looks uncommonly as though some such policy were afoot.

MESSRS. F. JOYCE & CO., LTD.

THE eleventh annual report of this Company, for the year ending March 31st last, was submitted to the shareholders at the Annual General Meeting, but they refused to pass the accounts, pending an examination by a committee of shareholders to ascertain the reasons for the considerable falling off in profits shown in the accounts. The net profit for the year in question was £19, as compared with upwards of £2,000 in the previous year. A general meeting of the shareholders took place on the 26th ult., for the purpose of receiving this report, and completing the business adjourned from the Annual General Meeting.

Considering that the investigations of the Committee have occupied some four months, it is somewhat unfortunate that this special general meeting, for which there could not be any particular urgency, should be held at such an inconvenient time as a Saturday morning in the height of the holiday season, and at a time of great stress in the gun trade. We refer especially to the busy period which gunmakers are having at this time of the year, because the Company appears from recent returns to have a very large number of its shares held among different gunmakers, while if we include ironmongers and other retailers who may also be presumed to be customers of the Company, their combined holdings account for about one-fifth of the total share capital of the Company. We must, therefore, express regret that the meeting was held at a time which rendered it almost impossible for the only class of shareholders who really understand the nature of the Company's business to be present; and for this reason we do not think that the best interests of the Company were served by holding the meeting at such a period.

The report which was submitted to the shareholders present at the meeting (say thirty out of a total of about 350) explained the diminution of the profits on the grounds that there had been heavy additional expenses, as compared with other years, in several directions. These included £400 due to a general increase in the price of raw materials, and £600 which had been written off the valuation of stock in the Company's balance-sheet. It appears that the surplus manufactures during past years of the Company's existence have been charged with a proportion of the establishment expenses. The resulting over-valuation of stock was passed year by year by the old auditors; but the new auditors insisted, in the interests of sound finance, on the writing off of the amounts so charged to stock; and in this way the £600 is accounted for. An increase of £200 in the expenses was accounted for by several items which it is expected will not recur; and £250 further is accounted for by unexpected repairs to the manager's house. This about concludes the list of items, together comprising a loss of profit of about £2,000, comparing one year with another. The shareholders present accepted this explanation of their loss of profits, and they accordingly passed the balance-sheet and report as submitted at the original meeting.

Personally, we were somewhat surprised that no mention was made of any enquiry as to whether the Company was maintaining its proper position in the market, and whether the loss of profit might not have arisen through inability to satisfy the requirements of customers, either from the point of view of punctuality of delivery, or from that of suitability to the requirements of the market of the materials supplied. Indications have not been wanting of late years that this Company has lost ground under the stress of increased competition, and there are many cases, particularly evident to those who have knowlege of the Company's customers, where orders, which might go to them, go elsewhere. The causes for this leakage of trade are not in our opinion beyond the capacity of a board of directors to deal with, backed up, as we believe they would be, by the general body of the shareholders.

To one used to the finance of public companies, the series of explanations of a reduced profit seem in several cases somewhat inadequate. Surely a company owning buildings and so forth to the value of little short of £20,000, should be in a position to spend £250 in repairs without the shareholders having to sacrifice a corresponding amount of dividend. The item of £600 for accumulated establishment charges, which ought to have been written off as they were incurred, is in itself a sign that the Company's finance has been too finely cut for some time past. In fact, all the explanations as to the suddenly evident loss of profit point in the same direction. £800 in the bank is, for instance, another sign that the Company's finances are none too flourishing. There may be precedents for such finance, but when we remember that this Company had £5,000 in the bank some six years ago, it looks as though one of the chief troubles of the present time is that fresh capital is required to economise the processes of manufacture, and so balance cheaper prices with cheaper, and at the same time, more perfect production. With an adequate debenture issue, the business of the Company could be strengthened all round, whereas by continuing to finance it on lines which render a £250 repair job a sad misfortune, the interests of the shareholders will suffer in the long run.

We have spoken perhaps somewhat explicitly in the course of this article; but in so doing we merely echo the generally expressed opinions of the trade, possibly, however, in our case with more consideration for the feelings of the Company than is ordinarily observed. What we do say is put forward in the hope that this plain statement of opinion will indicate the remedy for a trouble which goes deeper than mere unexpected bills for repairs.

One of the shareholders at the meeting asked what prospects there were for a dividend in the coming year, and the Chairman assured him that he and his co-directors looked forward to making a profit, particularly as several of the exceptional items in last year's accounts would not be likely to be repeated. Further, he laid great stress upon the agreement as to higher prices which had been made in conjunction with their rivals in business. He explained, however, that this arrangement would only be of benefit to the Company to the extent of about three quarters of the current year. This, of course, is quite true, but it is equally true that the full benefits of the raised prices will not be felt for at least another year; for not only were large stocks of unsold goods held by retailers at the commencement of the present season, but further, many orders for a part or the whole of the current season's requirements were given and accepted at the old prices.

It will be remembered that Sir John Maxwell and Colonel Ricardo retired from the board of the Company at the annual meeting. This left Mr. Stacey and Mr. Parnell as the sole surviving members of the board. Their numbers have now

been brought up to the minimum of three required by the Articles of Association by the appointment of Major Tufnell, Mr. Stacey having become chairman.

One of the shareholders present suggested that copies of the report submitted to the meeting should be circulated among the shareholders; for, as he pointed out, it was impossible to obtain a proper grasp of the matters dealt with from hearing it read through once at the meeting, supplemented though it might have been by a short explanatory statement by the chairman. This suggestion was applauded by several of those present, but apparently it was not put forward as a formal amendment to the main resolution; in consequence, the opinion of the meeting was not obtained thereon. In reply to this suggestion, the chairman explained that it was not intended to circulate the report among the shareholders in general, as the intention had been merely to read it for the information of those present at the meeting.

INCIDENTAL JOTTINGS.

GUNNERY PRACTICE.

COMPARISONS are constantly being made between English naval gunnery and that of the United States as regards the efficiency in shooting, and certainly we, most of us, in spite of our resolution to accept war news from America during the Spanish War with all reserve, were considerably astonished, if not perturbed, to read how "not one single shot was wasted." The rhapsodic vauntings of the American press and the eulogium of the English newspapers in chorus, inspired all our naval critics, whose writings in turn actually moved our venerated old sleepy Admiralty to action, and it really looked at one time as though efficiency in gunnery would become as much sought after in a war-ship as immaculate paint or high polish on the handles of the cabin doors. Now, I don't speak of this in satirical vein—I merely adopt, in contradistinction to our Transatlantic cousins, the usual blandishments of an Englishman.

GUNNERY STATISTICS.

Very interesting are the statistics which are published by the Washington Bureau of Ordance on the Spanish American War, and they show a record in dispatching two fleets at a mimimum of cost. Poor inert Montojo's fleet was settled with an expenditure of £9,000 worth of ammunition, at an average cost of £1 11s. 8d. per round. Obviously, at this price most of it would be from small calibre guns, as the large guns cannot be fed at anything like these figures. At Santiago they fired 7,000 shells at a cost of £20,000, the large calibres being mostly 8-inch and 6-inch, and a few 13-inch, the smaller being of the same calibre as our own Q. F. guns. Each round fired at the brave Cervera cost about £2 17s. 2d. This would also show a majority of smaller calibre rounds. Now we spend five and a half times as much annually on naval practice ammunition as this naval war's ammunition bill. Of course it would be impossible to take these figures as any criterion as to accuracy of fire. The circumstances are still fresh in our minds how in Manila the Spanish fleet were immovable targets, and were sunk or fired before there was enough steam to work the turrets, and at Santiago they were potted like inanimate birds from traps. But from what we saw of the American fleet off Stathen Island after the war, the Spanish seemed to have made a fair attempt at accurate shooting at some of the American ships; and we must not omit the fact that the Spanish ships ran the gauntlet along the shore at a known range from which they could not well be missed, whereas with the American fleet standing out to sea their range had to be discovered. I am not in any way desirous of attempting to prove that the Americans did not show excellent results, but I do not think I understate the case by saying they had exceptional opportunities which rendered their task one of the easiest in the annals of naval warfare.

GUNNERY TARGET RECORDS.

One must bear in mind that the Spanish fleet was not a large one in either case. We take Santiago for example. It consists of six ships. The proportionate number of rounds each ship would receive would be over 1,166. Unfortunately we do not know how many rounds were effective. We will look at our own figures, and see if our target shooting records would compare favourably. The circumstances are very similar: the range for practice being from 1,400 yards to about a mile, the speed of the ship from 8 to 12 knots, the target being represented by an area equal to about 50 by 13 feet—not a very big one—and this is reduced to nearly half for Q. F. guns. The last aggregate returns of target practice in the navy give an average of—

27 % of hits with the 12 in. gun.
30 % of „ „ „ 8 in. and 9·2 in. guns.
30·5 % of „ „ Q. F. guns.

29·17 % average.

These calibres may be readily compared with the United States ordnance. The Mediterranean fleet shows a better record with the heavier types:—

32 % with the 10 in. gun and upwards.
31 % „ „ 6 in. „ „ „
and 25 % „ Q. F. guns (all calibres).

29·3 % average.

Thus we show that under the aforenamed circumstances Jack Tar would put an average of 340 shots into each ship. The figures don't prove our naval gunnery practice is all it might be; but they go to show that in comparison we should not stand so bad a chance after all.

EXPLOSIONS AND HITS.

Having set our minds at ease that a ship which has been hit 340 times ought to be *hors de combat*, there is another question of even greater importance. How many of those shells which strike have fuses which act in a well-regulated manner? Assuming that the shells are all of the high explosive order, and are provided with positive action fuses, one may assume that 10% of these hits would be sufficiently effective to disable a ship. The most perfect type of fuse in existence (if any type is perfect) may leave the factory, so far as the examiners can detect, without flaw or blemish, yet, for some unaccountable reason, it will in action develop as many vices as the hopeful well-trained boy when his rich godfather happens to call. We should be greatly interested to see a detailed report upon the effect of firing upon the Spanish ships.

OFFICIAL SECRETS ACT.

What! never heard of it! Nevertheless, I can assure you it exists. What it's about I can't quite tell you, never having read it; what good it is I am equally ignorant, except that it gives the Civil Service clerks and other big-wigs an opportunity to cover their want of knowledge on any matter by smiting their unctuous breasts and expressing their sorrow that the exigencies of the Official Secrets Act debar them from giving any information. "Oh! yes!" "Please put your request in writing." No, I don't think any of the Government workpeople are sworn in under this Act; you see they would strike for £1 a week extra for the responsibility. I remember on one occasion, about the time of the Cordite trials, having visited a Government pattern room, accompanied by an officer, and having accomplished the object of my visit, my eyes happened to fall upon an unfamiliar object as to the use of which I enquired of the attendant. Fixing his eyes upon my attendant officer, he drew himself up and remarked:—"If ye want ony intelligence, sorr, ye must go to the War Office, ye'll get none here."

TO INVENTORS.

From time to time inventors bring me patterns of a new rifle or action for which they claim great advantages; but I find on investigation that the guns can't quite work the standard ammunition, or the standard gun will have to be entirely altered in order to introduce some trivial improvement in the action. Ever since the time of Noah, inventors seem to lose their reason on one point—their one idea—their grand invention! Now, my highly esteemed monomaniac, you may just as well throw your money into the wide, wide ocean as to spend a halfpenny on any apparatus which won't fit existing adjuncts or components. Do you think any Government will look at a gun which won't take standard cartridges? Think for a moment, my eccentric genius, what it means in expense. Think of the years it takes to effect even a small change. Why, the mere suggestion is enough to damn your chances for ever. But a word of consolation in your ear—you are only doing what nearly every other inventor does, and (don't repeat this) most of them get bust up at this stage. *Ergo*, use your best energies and cash to perfect your inventions to suit existing conditions. This advice is gratis.

LEAKAGE OF OFFICIAL SECRETS.

We were sitting over the wine discussing the Dreyfus case, and we not unnaturally turned our attention to the possibilities of such irregularities as *appear* to happen in other countries. We agreed, without wishing to be egotistical, that English officers are honourable in every sense, and that there is no officer in any position who would knowingly part with any information for illegal purposes. We were struck, however, on one very delicate point which cropped up. Is the War Office sufficiently careful in enquiring into the antecedents of all candidates examined and eventually passed into the Royal Military Academy. We referred particularly to the sons of naturalized subjects of recent continental nationality. It is quite possible for a man to have sons in continental and English armies at the same time. For instance, a continental subject comes to England representing a foreign commercial house, possibly a business having an interest in war munitions, etc. A son is born here, a former one on the continent. After living in England a statutory time, he takes out letters of naturalization. The younger son grows up and enters the English army. English born and English (?) parents. The elder, however, having been educated on the continent, joins a foreign army. What can prevent the brothers meeting and inadvertently letting out mutual points of interest? What can prevent the naturalized father from glancing through his son's note-books just to see how he goes on, or what can prevent the son answering an innocent question the anxious father is waiting to include in his continental mail? Under existing laws a foreigner can, if he so desire, work with this definite object in view, and it would be well to prevent this contingency by not allowing any sons of naturalized subjects to hold appointments of national or political trust, except when a rigid investigation has proved that there is no possible connection which may be detrimental to the service. A leopard cannot change its spots, and after our experience of continental spies, particulars of whom have come to light in the Dreyfus case, we almost ask, is a foreigner, whether naturalized or not, to be trusted?

MARK IV. AGAIN.

There was a very interesting match a fortnight ago, at Milton Range, between the R.A.R. District Staff and the 2nd Kent Volunteer Artillery, in which the much maligned Mark IV. cartridges were used, but of whose make history does not tell. The District Staff carried away the honours by 33 points. To give some idea of the excellence of the shooting, I may mention that 277 bull's eyes were recorded in a total number of 531. By the way, if the Mark IV. is withdrawn from service and only available for practice, what shall we do in case war breaks out? There seems to be no hurry at the Ordnance factories to create a reserve of Mark V., and so far as we can learn, the contractors are having an easy time, chilled game shot No. 5 being more important than Mark V. bullets. Yet, by the shade of Campbell-Bannerman, the fate of the last Government will descend upon the present one if some energetic steps are not taken!

CYCLOPS.

FRONTIER RIFLE THIEVES.

THE order of the Indian Government prohibiting the importation of fire-arms, which is referred to in another part of this issue, is evidently designed to provide some remedy for the state of affairs which is made clear in the following digest, by the *Indian Daily News*, of an official report dealing with the rifle theft problem of the Indian Army, especially those troops which are stationed near the frontier.

The recently-published returns of the number of fire-arms which have during the past year been stolen from regiments stationed on the frontier, shows that, in spite of all our efforts to the contrary, the Pathan rifle thief still flourishes, and that his risky profession is still, by no means, an unprofitable one. No fewer than thirty-eight Lee-Metford rifles, twenty-five Martini-Henry carbines, and twenty-five revolvers, through his instrumentality, passed last year into the hands of the Border tribesmen. The most elaborate precautions taken by the regimental authorities, the most untiring viligance on the part of sentries, have not been able to defeat his ingenuity. He appears to have devoted especial attention to British Infantry Regiments, as is evinced from the fact that so large a number of Lee-Metford rifles figure in the return of our losses. No thefts of Martini-Henry rifles from Native Infantry Regiments appear to have been successfully accomplished last year.

The reasons why rifle thieves more often select the lines of British corps to prosecute their nefarious profession in, are not far to seek. In the first place, the British soldiers are armed with the much-coveted Lee-Metford rifles, which command a far higher price across the Border than the Martini-Henri rifles of the sepoys. In the second place—and this is an even more important consideration—in British corps the rifles are kept in racks in the men's barrack rooms, whilst in the Native Army the general practice is to keep them locked up in the bells-of-arms. The bells-of-arms, it may be mentioned, are houses or huts in the lines. The doors of the bells-of-arms are securely padlocked, and they are under sentries both day and night. Except in camp—where, of course, the bells-of-arms system is impossible—the only chance rifle thieves have of securing the Martini-Henry rifles of our sepoys is by an attack on the sentries or guards.

The arm-rack system in force with British troops does not give anything like the same security as, at present, a pattern of arm-rack, which will defy the ingenuity of the Border thief to open and extract rifles from, has yet to be devised. Last year at Peshawar no less than nine Lee-Metford rifles were stolen one night from an arm-rack in a barrack-room, in which ten men were sleeping and a light burning. This was done, moreover, without any of the occupants of the room being awakened. All these rifles, it may be noted, were secured in the arm-rack by iron-rods passing through the trigger guards, the rods themselves being secured at the end of the rack by an iron key which prevents their withdrawal, and is padlocked. How, under these conditions, rifle thieves can succeed in removing rifles from the rack appears little short of marvellous; but the fact remains that they do so. The men, however, who accomplished the above-mentioned remarkable feat must have been veritable "top sawyers" in their profession. It is not, however, an unprecedented one; there have been instances before where nearly as large a number of rifles have at one fell swoop been removed from an arm-rack in a British barrack-room. Until some absolutely secure arm-rack is invented with which even the most clever Pathan rifle thief will find it impossible to successfully tamper, the Lee-Metfords of our British soldiers will continue to disappear.

Not only, however, to thefts from arm-racks does the really enterprising rifle thief confine his operations. To stalk and surprise a sentry and, having rendered him *hors de combat*, to make off with his rifle, is likewise a favourite trick of the trade. As we remarked above, native regiments, as well as British, are liable to thus lose rifles. There is one somewhat lonely post at Peshawar (now fortunately abolished) on which no less than three sepoy sentries have, at different periods, been shot by rifle thieves. The lot of the British soldier or sepoy on sentry-go at a frontier station is by no means an enviable one, and it may be truly said that he carries his life, as well as his rifle, in his hand. Little honour and glory, moreover, is there in being, in nominally times of peace, shot or knifed by a wretched rifle thief. At Peshawar and other border stations, the crack of a rifle by night is by no means an unusual occurrence, and excites little comment. Our sentries on the frontier are accustomed to shoot at sight, and at night anything suspicious moving in the vicinity of their post will be at once fired at, unless a satisfactory reply to their challenge is given sharp. As a writer on this subject aptly remarks, "If challenged at dusk on the border, it is always well to speak quick, and at one time the Peshawar tradition held it to be safest to fall down flat and then shout 'friend.'"

As regards rifle thefts from sentries, we cannot help thinking that the remedy is simple and easy. Why should we arm our sentries with valuable Lee-Metford and Martini-Henry rifles, thus offering a well-nigh irresistible temptation to rifle thieves? Why should we not, instead, give them old smooth bore fusils, equally effective at close quarters, and of little value to the tribesmen? The latter would certainly not undergo the risk that an attack on a sentry involves merely for an old smooth-bore. Lee-Metford and Martini-Henrys they regard as worth the desperate venture, but old pattern rifles they assuredly would not consider to be so. It is, however, from regiments in camp that the rifle thief expects to reap his richest harvest.

It is probably only the leading exponents of the profession who can manage successfully to negotiate a theft from an arm-rack in barracks; but to do so from the tents of a regiment in camp is a feat which the veriest tyro deems he can accomplish. It will be remembered that, just before the Attock Manœuvres at the close of the last cold weather, it was rumoured that rifle thieves in large numbers had come across the border, confidently expecting to reap a rich harvest in rifles whilst the troops were in camp.

An experienced authority on the subject of the Pathan gives it as his opinion that "it is no libel to say that, across the border, pillage and theft are to many the business of life." The successful rifle thief is probably, therefore, a man of mark in his native hills, and in consequence of his ability in his profession, held in much respect by his neighbours. The prayer of the Pathan mother is that her son may grow up a successful thief. Should she live to see him attain, so to speak, high honours in the art of rifle-stealing, she doubtless deems that her prayer has, indeed, been granted. Although, however, we acknowledge the rifle thief's daring and ingenuity, we cannot admire or respect him, as we do his countrymen who meet us in open fight. He is merely a thief, and (if necessary) a murderer who works in the dark, and there is no depth of savagery to which he will not stoop to gain his ends. We hope that the strongest measures will be taken to lay a few of these gentry by the heels, and meet out to them the punishment they so richly deserve.

NOTES.

REPORT ON U.S. WAR MATERIAL.—A report has been issued by a Board of Ordnance officers, which is the result of enquiries into the experiences of the United States troops with the arms and ammunition with which they were supplied in Cuba. It is reported that, as a whole, the entire ordnance equipment of the artillery, cavalry, and infantry stood its severe test admirably, and it was commented upon very favourably by the officers who observed it closely, both on the march and in action. Practical experience has, however, brought into prominence certain defects in the minor parts of the weapons in use. The Board, therefore, have recommended that the defects which have been pointed out should be remedied. The general behaviour of the new .300 calibre army rifle and its ammunition appears to have been generally satisfactory. Every officer who used this new rifle in Cuba, without exception, states his preference for it as compared with the old and larger calibre ·450 Springfield. It is rather curious, therefore, to read that the officers in the Phillipines are hostile to the use of the smaller calibre rifle and cling to the old one. A very probable explanation of this is that the Phillipine officers find the larger bullet more effective than the smaller one, especially as it is their invariable practice to rush a position and close with the enemy. It is obvious, therefore, that the longer range of the smaller calibre rifle does not count for much in such a campaign, while the flatter trajectory of the new weapon does not counterbalance the benefits of a heavy bullet for fighting at close quarters. The inconveniences of filling the magazine with cartridges, which require to be inserted one by one, indicate the necessity of providing some clip or other device by which the magazine may be filled by a single operation. It had been stated that a patent clip satisfying these requirements would probably be adopted. The extending rim of the ·300 cartridge presents special difficulties to the designer of such a clip, as far greater compactness is assured with

cartridges in which the rim is replaced by the groove such as is commonly found in continental service ammunition. It is obvious that any proposal to make this change in the ammunition involves an expensive alteration to the rifles, possibly far outweighing the advantage of having a clip to carry six instead of five cartridges. With regard to the ordnance used in Cuba, it is reported that the 3·2-inch gun, together with its carriage, has given every satisfaction, except in very few cases where the copper vent bushings were blown out. With these guns black powder was used, and it was the subject of general condemnation, since it reveals the position of the guns to the enemy. The American troops were thus put to a great disadvantage, as the Spaniards were using smokeless powder in their batteries, making it a matter of extreme difficulty to locate them. On the whole, the Board reports very favourably on the entire ordnance equipment, and is of the opinion that when the various alterations and changes recommended have been made in the various parts of the different arms, gun carriages and harness, it will be entirely satisfactory. Subsequently to the appearance of the above report the Ordnance Department of the U.S. Army has had an opportunity of considering the various proposals put forward. As might have been expected, it has been found that the expense attached to carrying out the proposal has proved to be prohibitive, and consequently the idea of making any radical change in the model of the service rifle has been definitely abandoned. The only change of any importance which it has been found possible to adopt is the fitting of a new back sight with a wind gauge attachment, which was reported as essential by the Board of Enquiry. The suggestions as to the use of a loading clip for filling the magazine and changing the form of the cartridge base from the rim to a groove have been dropped.

MULLERITE.—We understand that Messrs. Muller & Co. are inclined to drop, at any rate for the present season, any attempt to push their powder in the English market, as their attention is, for the present, fully occupied in attending to the requirements of their home trade.

A NEW U.S. SERVICE REVOLVER.—The *Army and Navy Journal* of New York states that experiments are being conducted by a Board of Ordnance officers looking to the adoption of a new type of revolver for use in the army. No special design has yet been selected for adoption, but the board is investigating different makes with a view of recommending for use a weapon that shows superiority over that now in use. The Colt revolver is the present service weapon, but a special board appointed to inquire into its use in the war with Spain has suggested many changes, although the intention is not to alter the calibre, which is ·38. New types of revolvers were called for by the board, and among the patterns submitted at Springfield Armory is a Smith & Wesson of new design. In this a solid frame has been substituted for the automatic lock at the top of the barrel, which has been such a distinguishing mark of the Smith & Wesson revolvers. Instead of breaking at the breech, the chamber of the revolver falls over to the left when a small thumb spring is pressed. The ejector is then struck with the left hand, and all the shells in the chamber are ejected simultaneously. From its action the weapon is to be known as the "hand ejector." It is built much heavier than any previous revolver turned out by the company, and is more rigid. The barrel is longer and the chamber also elongated to take the regulation ·38 calibre revolver shell used by the Government. The Colt Manufacturing Company have submitted in competition a new revolver in which a number of springs have been eliminated, the general tendency of the changes being to render the weapon more automatic.

MESSRS. VICKERS, SONS & MAXIM.—This company has declared interim dividends for the half-year ending June 30, of 2½ per cent. (less income-tax) on the preferred 5 per cent. stock; 2½ per cent. (less income-tax) on the 5 per cent. fully paid £1 preference shares; and 1s. per share (free of income-tax) on the ordinary paid-up shares of £1 each.

MR. C. E. ANDREWS.—We recently paid a visit to Mr. C. E. Andrews, of 15, Swallow-street, Piccadilly, who started business for himself some time ago in the premises vacated by Mr. Perkes. Mr. Andrews has had a long experience in the gun trade, having been for many years the right-hand man of Messrs. Adams and Co., whose business in Finsbury Pavement was sold some years ago. Mr. Andrews is making a speciality of a hammerless ejector gun with side locks, provided with interceptors, which he is selling at £30. This gun is well finished throughout, and is excellent value for the money. His best gun is sold for £42, and is fitted with Brazier's locks, and Whitworth steel barrels, the whole weapon being very carefully finished, and properly freed in all its movements. Mr. Andrews seems to be well employed with a number of orders from a good class of customers, while among other things he is making a speciality of carefully executed repair work in guns.

NOBEL-DYNAMITE TRUST CO., LTD.—An extraordinary general meeting of this company was held on the 18th ult., at Winchester House, Mr. T. Reid presiding, for the purpose of considering a resolution "authorising the directors of this company, who are also directors or managers of certain companies in which this company holds shares, to retain fees and remuneration paid to them for services rendered in these capacities, and releasing them from any liability to account to this company for the same." The chairman reminded the shareholders that at the ordinary general meeting, held on June 2 last, he stated that it was the intention of the directors to call a meeting to consider the question that arose in connection with the auditors' certificate, and to have any possible doubt on the subject removed. It was with that object, so far as regarded the past, that they had now met. As to the future, the articles of the company would require to be amended, and this it was proposed to do at a subsequent meeting. With regard to the past, the directors throughout acted in the belief that the articles fully covered them, and entitled them to receive and retain certain remuneration for the services that they were rendering to the subsidiary companies. They had taken the advice of eminent counsel on the question, and had received opinions which varied considerably. Wishing to err on the side of full and complete communication of all details to the shareholders, the directors followed the advice of the counsel holding the extremest view as against the board, and to the deed of release prepared by

counsel, a schedule was appended which disclosed the whole fees and managerial remuneration which any of the directors present or past had ever received from any companies in which this company had, at any time, held an interest. When the Trust Company was formed the shareholders of the subsidiary companies—who exchanged their shares in those companies for shares in the Trust Company—were informed that each of the subsidiary companies would continue to retain its own separate title, existence, and autonomy, and be managed and controlled by its own board of directors and managers. It was also understood, and was, indeed, an essential feature of the scheme, that the directors of the subsidiary companies who had in the past conducted the business of those companies should become directors of the Trust Company, and thus assist with their special experience and knowledge in the management and development of the business of the united companies. Those directors were, of course, in receipt of fees for their directorships on those companies, and as the work of the separate directorships was to go on just as before —quite apart from the work of the board of the Trust Company—it was accepted as a matter of course that for the work which the subsidiary companies' directors had thus to perform they would continue to be paid. The very inception and subsequent carrying on of the Trust Company involved the placing of directors of the subsidiary companies on the Trust Company's board, and it had been found equally indispensable, in order to keep the members of the Trust Company's board fully acquainted with the details of the manufacture and trade carried on by the subsidiary companies, that the general managers of the principal subsidiary companies should have seats on the board of the Trust Company. As the business in which they were concerned had developed, the number of companies in which they had become interested, and on which the directors served, had accordingly increased. In some cases the Trust held a comparatively small interest in those companies, but the benefit derived from some of their directors being on the boards of those companies was undoubted, as it had ensured harmonious working in many cases where otherwise that would have been impossible. The system of payment by results, so universally applied on the Continent, and which they had generally followed for the payment of the directors of their subsidiary companies, was one which made the board's remuneration dependent on the profits derived from the business, so that if it should be thought that the remuneration was large, it would be understood as being due to the exceptional and continuous development and prosperity of the business. That this system of payment by results had much to commend it he thought they would admit when he stated that, whatever profits were made, there must, in the first instance, be a sum, if available, of 5 per cent. on the capital set aside as a dividend for the shareholders, and it was only on the surplus that the directors' remuneration was based, so that the shareholders might be getting a dividend of 5 per cent. while the directors received absolutely nothing. On the other hand, when the shareholders were paid a large dividend, the remuneration, or *tantième*, as it was called, of the directors was correspondingly increased. The general managers were likewise paid by results; they received a fixed salary and a percentage on the income of the Trust Company. In conclusion, he stated, in order to show the success that had attended the board's efforts that, while in the first complete year of the Trust Company's existence the income amounted to £119,665, last year's income was £266,612.—The secretary (Mr. H. M. Savage) then read the deed of release and the appended schedule, after which, on the motion of Mr. T. W. Fullilove, seconded by Mr. Bonner Maurice, a resolution in accordance with the object of the meeting was unanimously passed, Mr. Crisp (the solicitor) stating, in reply to a question, that the resolution would be binding on all the shareholders.

THE WEST CALDER GUNPOWDER WORKS.—It is reported that the gunpowder works at West Calder are shortly to be closed. It will be remembered that the firms comprising the Curtis's and Harvey amalgamation included the Midlothian Gunpowder Co., Ltd., whose factory, situated at West Calder, will shortly be closed. The policy of the company, as foreshadowed in its prospectus, obviously included the closing down of unremunerative factories accompanied by the transference of their output to other factories having convenient access to the markets affected. For some time past it has been under consideration to close one of the Scotch factories belonging to the gunpowder amalgamation, and, unfortunately for the West Calder district, the local factory has been fixed upon, though no date has yet been announced for the actual closing of the factory.

SCHULTZE GUNPOWDER CO., LTD.—Owing to inconveniences attached to the utilization of this Company's premises at 32, Gresham Street, for the loading of sporting cartridges, the plant is now being transferred to the upper floor of 28, Gresham Street, which is over the Company's own offices, and therefore in a more convenient position for proper supervision than before. The change has come at a busy time, but the excellent accommodation in the new quarters fully justifies the step which has been taken. The loading rooms are being equipped on the most approved plans, and already opinions have been expressed that the Schultze Company's shops will serve as a model to all who possess loading rooms of any extent.

BULLDOG BLASTING POWDER.—In another portion of this issue reference is made to the removal of "Argus" powder from the permitted list of coal mine explosives, and the addition of a powder known by the name of "Bulldog." The removal of Argus powder results, we understand, from certain difficulties attached to maintaining the composition in form of the official specification. Bulldog powder has now been put forward by Messrs. Curtis's and Harvey, also the owners of the Argus powder, which has been withdrawn to take its place, and the new explosive possesses the advantages of the pellet form, and requires no detonator for its explosion. Bulldog powder, together with the Elephant and Earthquake powders, which are also made by the same company, is issued in addition in the form of mining cartridges, these cartridges being very convenient for mining work, as the required number can be threaded on the fuse by means of the holes provided in the centre for effecting the ignition. The fact that Messrs. Curtis's and Harvey have been able to introduce a form of black powder which satisfies the requirements of the tests made under the authority of the Coal Mines Act, is greatly to their credit. Miners appreciate the advantages of using an explosive which can be fired without

the use of a detonator, and now that the old charges as to the unreliability of gunpowder have been met by the introduction of a first-rate quality of explosive of this class, it will be seen that the Coal Mines Act has not struck the serious blow to this industry which it was first anticipated that it would. The new black powder explosives are naturally dearer than those of the older types, but this cannot be regarded as a hardship to the miner, because of the increased safety of his work under the altered conditions. On many occasions in the past we have deplored the ill results of competition in the black powder trade, the introduction of cheap and nasty powders to meet a popular demand having at one time gone much too far. The increase in price of the permitted black powder has of course improved the prospects of various safety explosives, as they have less competition to contend with than before in the matter of price. The explosive "Electronite," which is also issued by Messrs. Curtis's and Harvey, enables them to supply the popular demand for a nitrate of ammonia explosive, so that all round it appears as though the Coal Mines Act has done good rather than harm to the gunpowder manufacturers. At any rate, the few facts indicated in this note suggest such a reading of the present conditions of the trade.

ARMSTRONG, WHITWORTH & CO., LTD. *v.* U.S. GOVERNMENT.—An action has been brought against Rear-Admiral Charles O'Neil, the Chief of the Naval Bureau of Ordnance; Capt. A. H. McCormick, Commandant of the Navy Yard; and Commander Edwin C. Pendleton, superintendent of the gun shops at the Washington Navy Yard, by Messrs. Armstrong, Whitworth and Co., Ltd., of Newcastle-on-Tyne. The subject of the dispute is a patent relating to trunnion bearings for ordnance, which was originally granted to R. T. Brankston. This patent is the property of Messrs. Armstrong and Co., who charge the defendants with having infringed it in the manufacture of ordnance at the Washington Navy Yard. They claim damages amounting to 20,000 dols., and have also brought a supplementary action claiming 10,000 dols. against Rear-Admiral O'Neil, and Commander Pendleton.

MUSKETRY TRAINING OF VOLUNTEERS.—Early last month the long-expected amendments of the Musketry Training Scheme for Volunteers were issued from the War Office, and are to become obligatory from the beginning of the next official Volunteer year, on November 1st. For "recruits" it is directed that the course shall consist of deliberate individual firing from 200 up to 600 yards, instead of from 100 up to 500, as at present. At 200 yards the 21 rounds are to be fired by sevens successively lying, kneeling, and standing; at 300 and 400 yards, seven rounds at each, kneeling, and so for all at second-class targets, instead of third-class being used at 200 yards. At 500 and 600 yards seven shots at each distance are to be fired lying at first-class targets. Those recruits who with the 49 rounds obtain 100 points and upwards will be rated as first-class; 50 points and less than 100, second-class; and less than 50, third-class. There are modifications for cases where the range does not extend to 500 yards; but the former recruits' course with a "reduced charge" is abolished. In the new "trained men's" course, instead of Volunteers earning the capitation grant merely by firing 21 rounds in the third-class (200 yards) and obtaining 30 points, as hitherto, individual firing up to 600 yards is made compulsory, seven deliberate volleys at 500 yards are made obligatory, taking the place of the former "optional" volleys at 500 or 300, and seven rounds of rapid independent fire at 500 are also made compulsory. In the individual practice seven rounds kneeling and seven standing must be fired at 200 yards at a third-class target, and other sevens at 500 and 600 lying at a second-class target. The volleys and rapid independent fire must be from the knee. The classification is to be: Those who obtain 70 points and upwards marksmen; 40 points and less than 70, second-class shots; less than 40 points, third-class. To earn the full grant of 35s. a Volunteer must not only pass out of the third-class with 40 points or more, but must also fire in the collective practices, or, in the case of sergeants, must have commanded sections in those practices. As in the case of recruits, there are modifications of the scheme to suit ranges which do not admit of 500 and 600 yards firing, and the "reduced charge" course is abolished.

MR. J. F. BARKER.—We have received a series of circulars from Mr. J. F. Barker, which indicate that his arrangements are progressing rapidly in the direction of centering at his offices at 4, New London Street, a number of valuable agencies, which show every prospect of becoming highly remunerative. It is already fairly well known that Mr. Barker is occupying himself with the sale of an excellent cheap cartridge case, which appears to be well suited to English nitro powders. He is also acting on behalf of Messrs. Sellier and Bellot for their well-known brand of S. B. detonators. He is open to negotiate large and small export and other contracts for dynamite, gelignite, gelatine dynamite, and blasting gelatine at prices which offer a good prospect of business. These, added to cycle fittings, should certainly afford Mr. Barker many openings for working among his excellent connection of home and export buyers.

"THE BREECH LOADER."—We understand that the firm of W. W. Greener, of Birmingham and London, will shortly issue a fresh and revised edition of their book entitled "The Breech Loader, and How to Use It," which, however, must not be confused with the larger and more theoretical work issued by the same firm under the title of "The Gun and its Development."

MESSRS. McCARTHY, BUCK & CO.—We have received the present season's catalogue of this firm, which should be remembered as trading in the past as the Wholesale Arms and Ammunition Co. This catalogue, to which we have referred in past years, contains the usual particulars of the varied assortment of goods which are stocked by the gun dealer. The catalogues show evidence throughout of having been carefully revised. The sporting guns shown in the catalogue present a number of differences, both as regards construction and make, as compared with previous years, the prices also having been considerably modified, in most cases in the direction of greater cheapness. For instance, in the case of the ·303 service rifle the gross prices have been lowered about 30s., while the sporting type has been reduced about £3. The cartridges, which one would have expected to be increased in price, are also quoted at cheaper rates, the difference in many cases being upwards of a shilling per hundred.

A NEW EXPLOSIVES ORDER IN COUNCIL.

THE two orders of July 11 and December 28, 1898, relating to explosives in coal mines, which were dealt with exhaustively in our issues of August, 1898, and January, 1899, are repealed by a new order which has been made by the Secretary of State under Section 6 of the Coal Mines Regulation Acts of 1896. The new order embodies the contents of the old ones, but there are several additions and alterations.

The changes are connected with safeguarding the storage and use of detonators, the addition of three new explosives to the permitted list, and the removal from that list of one explosive. The names of the added explosives are Benedite, the Bulldog Brand Gunpowder, and Electronite No. 3. The composition of these explosives is dealt with below. The explosive known as Argus Powder, consisting of saltpetre, charcoal, and one to one-half per cent. of sulphur, is the one which has been removed from the list. Beyond these several modifications, the new order remains the same as its predecessors.

With regard to the storage and use of detonators, a clause is added in the new order prohibiting the use of detonators in any mine unless certain conditions are complied with. These conditions are added with a view to obtaining increased safety from accidents caused by the explosion of detonators. The first condition is that detonators shall be under the control of the owner, agent, or manager of the mine, or of some person specially appointed in writing for that purpose, and that the detonators shall only be issued to shot firers, or to other specially authorized persons. The second condition is that shot firers must keep all detonators in a securely locked case separate from any other explosive.

The specifications of the three new explosives are as follows:—

Benedite, consisting in every 100 parts by weight of the finished explosive of not more than 95 parts and not less than 92 parts of neutral nitrate of ammonia, with not more than 7 and not less than 5 parts of colophony, which does not melt below 200° F., and with no other ingredient. This explosive must only be used when contained in a paper case thoroughly waterproofed with ceresine, linseed oil, and resin, and with or without the addition of carbonate or bicarbonate of sodium or alum. A detonator or electric detonator fuze of not less strength than a No. 8 shall also be used with this explosive.

Bulldog Brand Gunpowder, consisting in every 100 parts by weight of the finished explosive of not less than 83·5 parts, and not more than 86·5 parts of pure saltpetre, with not less than 13 or not more than 14 parts of charcoal, and not less than one part and not more than 2·5 parts of moisture, and with no other ingredient, the whole being thoroughly well incorporated, and to be of such strength that 5 parts, when exploded in a lead cylinder as used at the Home Office testing-station, will give a result not inferior to that obtained by 4 parts of R. F. G.^{2} gunpowder, and to be in the form of grains of a size to pass through a sieve of 10 meshes to the linear inch, and to be retained on a sieve of 40 meshes to the linear inch. This explosive must, if it be required, be capable of being compressed into a pellet of density not exceeding 1·4. It shall not be taken into or used in a mine, whether in the grain or pellet form, unless it is contained in a spark-proof brown paper case or cartridge. When the saltpetre is washed out, the residue of charcoal, after being dried at 230° F., must not lose less than 22 per cent. of volatile matter other than sulphur when heated to redness in a current of coal gas, and that when the charcoal is burned in the air, the residue of mineral matter shall not be more than 5 per cent.

Electronite No. 3, consisting in every 100 parts by weight of the finished explosive of not more than 75 parts and not less than 70 parts of neutral nitrate of ammonium, with not more than 21 parts and not less than 16 parts of nitrate of barium, and with not more than 9 parts and not less than 6 parts of a mixture of wood-meal slightly charred, starch, and pure pine resin which does not melt below 200° F., and with no other ingredient, and to be in the form of grains of a size to pass through a sieve of 12 meshes to the linear inch. The explosive must be used only when contained in a paper wrapper waterproofed with ceresine or in a case of lead thoroughly waterproofed. To be used with a detonator or an electric detonator fuse of not less strength than a No. 7.

REVIEW.

Explosions caused by Commonly Occurring Substances. By Charles E. Munroe. Reprinted from the Journal of the American Chemical Society, Vol. XXI., No. 4, April, 1899.

WE have frequently referred in the past to the numerous scientific papers of unfailing interest which come from the pen of Professor C. E. Munroe. The present paper was delivered by him in the capacity of President of the New York meeting of the American Chemical Society, and the occasion was the inaugural address of that gathering.

The subject of his lecture is well expressed by its title, and in the course of his remarks he explained the numerous circumstances in every-day life in which explosive ingredients are accidentally assembled in such a manner as to cause an explosion. As a general rule, these explosions seem to arise from the accidental mixture of air with combustible bodies in such a way as to render them liable to a form of spontaneous combustion having the true features of an explosion. Any carbonaceous body, when separated into minute particles, and combined with a suitable proportion of air, satisfies the conditions for producing an explosive effect when ignition occurs. The carbonaceous material may occur in diverse forms, either solid or fluid. Flour mills supply in a marked manner the conditions essential to this form of spontaneous combustion. Flour in the solid mass is, of course, mixed with such a small proportion of air as to be practically inert, but when mixed up with a large volume of air, in which it is suspended in the form of dust, the characteristics of an explosive are fully satisfied, though, of course, the explosive effects would be different from those of a dense explosive, in which the oxygen is present in a more concentrated and solid form. Still, a chamber containing a sufficient volume of air and suspended flour is on all fours with a mine in which a coal-dust explosion occurs from the ignition of its dusty atmosphere. Certain conditions which occur in a flour mill favour the production of large explosions, as compared with a flash of small proportions, which may do no particular harm so long as the flash does not start a confla-

gration. It is only when there is a sufficient volume of flour-suspended air to represent a large explosive energy that real danger from explosion exists. This fact makes it clear that all possible forethought must be exercised to prevent chambers of considerable capacity being filled with flour-dust suspended in the air, for then it is only necessary for the igniting spark to arise to send the whole thing off.

Other analogous materials to flour produce the same results, and consequently the warning conveyed in the author's lecture should be borne in mind by all who conduct manufacturing operations where dry and finely-divided carbonaceous materials are used. To show the extent to which this caution should be borne in mind, we may quote a case where an explosion occurred in a mixture of finely-powdered metallic zinc and air.

Having dealt fairly exhaustively with explosions from finely-divided solids, the author proceeds to deal with liquids, which require even closer attention, because of their liability to leak from their containers, and pass away into unexpected places. This danger is the more serious in the case of volatile fluids, which commence to vaporize immediately they leave their proper receptacles. As a chemist, Professor Munroe indicates that many liquids which appear to have a very slow evaporation when exposed, say, in an uncorked bottle, enormously increase the volume evaporated when exposed in an open dish. This, of course, obviously arises from the difference occurring in the two cases in the conditions under which the air in contact with the fluid has been charged with the volatilized gas, and is changed for a fresh body of air not so impregnated. Consequently, the true power of a body to evaporate must be judged from the point of view of gas formation when exposed in a freely circulating atmosphere.

Professor Munroe has collected a good many facts from all parts of the world bearing upon this subject, and although many of them are already well known, considerable benefit may be derived from a study of the numerous cases which have occurred. The chief danger of all seems to occur in those cases where a slowly moving body of air, passing over the volatile liquid, creates a train of combustible air which forms a sort of fuse-connection between some distant point where a naked light may be and the actual source of this vapour, viz., the main body of highly combustible spirit. Though the explosive effects of the train of evaporated spirits may not be great, the fire resulting from the ignition of the parent mass of combustible fluid may be very serious in its effects. In one case, for instance, it appears that hydro-carbons contained in a cylinder which was being rolled about a yard were ignited, and yet the nearest source of ignition was found in the boiler fires some sixty feet away.

The danger from such explosions is largely accentuated by general ignorance as to the precise conditions under which combustion may be initiated. It seems that a glowing mass, such as a red-hot coal, or an electrically-heated wire approaching incandescence, is not sufficient to start the ignition, and yet the smallest spark may set the material aflame. For instance, an experiment by Mr. Boverton Redwood with Vesuvian matches is quoted. In this experiment it is completely demonstrated that the glowing mass of the match does not ignite the explosive mixture, but that the moment a flash is produced by the ignition of the lucifer tip the whole mass goes off. A series of explosions which occurred in various ships is also the subject of special comment. After several explosions had occurred, they were traced to a material used as a drier for paint known under the name of "Xerotine Siccative," which contained several highly volatile ingredients. Very special precautions appear to be required in all cases where volatile spirits are used for industrial purposes. A collection of waste from such fluids may occur in cellars, cisterns, wells, or sewers, and it is impossible, once these materials have got into such places, to ascertain how and where the manifestation of their power may occur. One case is quoted where a pipe used for the conveyance of such fluids had broken, with the result that the material leaked into the drains of the town, and an explosion occurred throughout a large system of sewers, with the result that streets were blown open, and man-hole plates were thrown into the air.

Of course, all these matters are well enough known among scientific men; and in industrial occupations conducted on a scientific basis there is but little danger, because those concerned are likely, in their own interests, to take adequate precautions. It is amongst those who use such materials without appreciating their potentialities of danger that the real risk occurs.

APPLICATIONS FOR PATENTS.

JULY 15TH—AUGUST 19TH, 1899.

14,692* Steering Mechanism for Torpedoes. J. T. Armstrong and A. Orling.
14,717 Projectiles. H. S. Maxim.
14,771 Telescopic Mountings for Ordnance. A. Reichwald (*Agent for Fried. Krupp, Germany.*)
14,814* Fuses and Tools for Sealing Caps. A. S. Williamson.
14,958 Aerial Navigation for Torpedoes. R. J. Stanley.
15,046 A Rifle Carrier for Cycles. F. Morley.
15,177 Automobile Fish Torpedo. J. H. S. Bradley.
15,198 Locking Device for Small-arms. H. H. Lake (*Agent for C. F. M. Gröschner and O. A. Lange, Germany.*)
15,231* Small-arms. T. Bergmann.
15,244 "Cordite Oil," for Cleaning Barrels after using Cordite. W. C Whiskin.
15,249* Illuminating Projectiles. W. H. Rose.
15,256 Explosives Manufacture. A. Luck.
15,312 Automatic Guns. Kynoch, Ltd., and E. W. Anderson.
15,597* Torpedoes. E. Gathmann.
15,638 Apparatus for testing the straightness of Gun-barrels, either smooth or rifled, and for straightening same. F. H. Langworthy and J. Jackson.
15,639 Automatic Guns. A. T. Dawson and L. Silverman.
15,715 Defence against attack by Torpedoes. G. H. Jones.
15,851* Torpedoes. E. Kaselowsky.
15,959 Ammunition Hoists and Armoured Turrets for War Vessels. A. Reichwald (*Agent for Fried. Krupp, Germany.*)
15,971 Apparatus for internally screwing holes in Gun Carriages and Mountings. Hulse and Co., Ltd., and H. Bates.
15,985* A means of obtaining a lower trajectory of Projectiles fired from Ordnance. V. Frühholz.
16,040 Electric Detonator Fuses. G. Smith, and D. Corrie.
16,089 Bullets for Small-arms, Machine and Automatic Guns. C. S. Walker.
16,122 Small-arms. T. Perkes.
16,152 Safety Mechanism for Small-arms. F. Neuber and T. Tambour.
16,157 Projectiles for Ordnance. H. S. Maxim.
16,294 Sights for double Sporting Rifles. W. Nobbs.
16,302 Gun-carriages. Hon. W. Rothschild, G. D. Smith, and J. A. Wilding.
16,383* Pigeon-releasing Apparatus. F. Baugniet.
16,431 Brakes for Gun-carriages. A. Stevens and W. S. Penny.
16,461 Means of increasing the range of Projectiles. J. A. Rowe.
16,558 Drop-down Small-arms. J. W. Smallman.
16,564 Production of Nitro-cellulose. W. A. E. Cromie.

16,595 Explosives C. H. Curtis and G. A. André.
16,596 Explosives Manufacture. J. Karstairs.
16,631 Explosive for Detonating Fog-signals. T. Jowett.
16,644* Shooting Seat. G. Becker.
16,649 Tripod Mounting for Machine Guns. Sir W. G. Armstrong, Whitworth and Co., Ltd., A. G. Hadcock, and R. T. Brankston.
16,734* Automatic Fire-arms. F. R. von Mannlicher.
16,778* Sights for Ordnance. W. H. Bevans.
16,813 Small-arms. R. Alty.
16,840 Device for Steering Torpedoes from a distance. H. W. C. Cox and C. F. Leighton.
16,842 Lock Mechanism for Fire-arms. W. Daly.
16,869 Automatic Guns. Kynoch, Ltd., G. Hookham, and D. Clerk.
16,886 Gun Carriages. C. A. McEvoy.

* These applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JULY 22ND—AUGUST 19TH, 1899.

8,470 (April 9, 1898). A. T. Dawson, London, and J. Karstairs' Crayford. An explosive which is manufactured from urea, ethyl alcohol, and nitric acid. A mixture of these compounds is concentrated until crystals are formed. The liquid is then decanted, and the crystals dried and pulverised. The pulverised crystals have then to undergo another operation to prevent damp or chemical reaction rendering them dangerous, and the finished explosive is made up in the form of compressed cakes. Accepted July 8, 1899.

15,157 (July 11, 1898). R. H. Whitcombe, Bewdley. A safety catch which is attached to the underside of the Lee-Metford breech bolt, the object of which is to prevent the bolt from being accidentally turned, thus preventing a premature discharge or a "hang-fire." Accepted July 8, 1899.

15,553 (July 15, 1898). F. W. Jones, Ware. A method of regulating the combustion of explosives by coating the grains with some mixture of wax, fatty acid, or resin. By this means the combustion is progressive throughout the charge, and it is claimed that although with a bigger charge than is ordinarily used the velocity is much greater, the initial pressure is not affected. Accepted July 15, 1899.

15,799 (July 19, 1898). Captain H. F. Woodgate, London. This patent relates to automatic recoil-operated pistols, and is principally connected with a modified form of breech bolt. This bolt slides in the ordinary casing, and has a rotative locking head embracing the fixed head. Accepted July 19, 1899.

17,152 (August 9, 1898). Captain W. B. Wallace, Enfield Lock. A compound bullet in which the lead core is split longitudinally with its axis from the nose almost to the base. This is enclosed in a nickel case which has a solid base, but which is hollow at the nose, the object of the hollow being to help the bullet to expand on impact Accepted July 8, 1899.

18,002 (August 22, 1898). C. F. Hengst, Plumstead. An explosive, the chief constituent of which is esparto fibre. This material in the course of manufacture passes through a great number of processes, and when completed is claimed to be waterproof, smokeless, and non-corrosive. Accepted July 8, 1899.

18,015 (August 23, 1898). G. B. Sparrow, Liscard. The object of this patent is to provide for the rapid reloading of revolver chambers. It consists of a magazine which has a number of barrels, relatively in the same position as the chambers of the revolver, and parallel to one another. Each of these barrels contains a number of cartridges, which are retained in the barrel against the pressure of a spring by a trap. By means of this trap one cartridge is dropped from each barrel of the magazine into the corresponding chamber of the revolver, thus loading the whole chamber by one movement. Accepted July 8, 1899.

18,273* (August 25, 1898). C. E. Bichel, Hamburg. An Electrical Explosives Tester.

18,901 (September 5, 1898). A. Buschmann, Prussia. A sight for rifles, the object of which is to indicate when the sights are in an exact vertical line over the axis of the weapon. Accepted July 15, 1899.

19,309 (September 10, 1898). J. A. Rowe, Forest Gate, and F. J. Trewent, London. The apparatus described in this patent is used for the purpose of firing the guns on a warship at any predetermined angle when the ship is in a heavy sea. By means of floats an electric current is automatically closed when the ship is at the angle at which the guns are required to be discharged. This current completes a circuit and fires the guns. Accepted July 22, 1899.

19,774 (September 17, 1898). A. Reichwald (*Agent for Fried Krupp, Germany*). This patent relates to a modified form of brake mechanism for ordnance, which was the subject of a former patent. In the former apparatus the brake mechanism required very long and heavy brake rods, and these are now done away with by having the recoil brake-spring between the cheeks of the gun-carriage, its power being transmitted upon the rod system by means of a lever. The rod system is, therefore, no longer required to adapt itself to the length of the spring, and may be made considerably shorter and lighter. Accepted July 22, 1899.

20,611 (September 29, 1898). A. T. Dawson and G. T. Buckham, London. A method for facilitating the loading of ordnance by utilising the recoil, which automatically raises a cradle containing the projectile to a position level with the bore when it is thrust into the breech by the rammer. Accepted July 29, 1899.

21,805 (October 17, 1898). R. A. Hadfield, Sheffield. A means of attaching caps to the noses of projectiles without weakening the latter by making two or three indentations in the head of the projectile in a position corresponding with the edge of the cap which is to be fixed. The edge of the cap is then pressed into the cavities, thus securing it. Accepted July 29, 1899.

23,518 (November 8, 1898). A. Reichwald (*Agent for Fried. Krupp, Germany*). A means of preventing the elevation of shoulder-piece guns from being altered when fired, by the provision of of a frictional locking device. Accepted July 8, 1899.

24,688 (November 22, 1898). W. H. Calkins, C. A. Lindberg, W. M. Butts, and A. K. Wheeler, U.S.A. A Modified Air-Gun. Accepted July 15, 1899.

25,176 (Nov. 29, 1898). A. Reichwald (*Agent for Fried. Krupp, Germany*). An automatic safety device for ordnance, consisting of a safety piece in the breech block, which is caused by a spring to snap into a notch in the breech block handle when the breech is closed. It may be disengaged either indirectly by the trigger or directly by hand. Accepted July 29, 1899.

25,177 (Nov. 29, 1898). A. Reichwald (*Agent for Fried. Krupp, Germany*). This patent relates to a system of breech-locking mechanism for ordnance, in which the locking is effected by means of a locking lever, upon which is arranged a nose, which is caused by a spring to snap into a notch in the rear wall of the wedge aperture when the breech is closed. A safety device is also combined with the locking lever. Accepted July 29, 1899.

25,364 (Dec. 1, 1898). A. Reichwald (*Agent for Fried. Krupp, Germany*). A wheeled gun carriage for high angle firing guns, in which the suspension of the carriage body from the axle is affected by being rotatively mounted on the central portion of the cranked axle. The cranked axle carries the carriage wheels. Accepted July 22, 1899.

25,365 (Dec. 1, 1898). A. Reichwald (*Agent for Fried. Krupp, Germany*). This patent relates to wheel brakes for ordnance, which are ordinarily operated by mechanism near the muzzle of the gun. This arrangement necessitates that the gunner shall go to the muzzle of the gun before he can apply the brake in firing. The present invention provides an arrangement by which the brake can also be operated from the breech of the gun. Accepted July 29, 1899.

2,947 (Feb. 9, 1899). P. Pondorf, Germany. This patent relates to a feeding device, which is used in combination with a self-feeding annealing furnace, employed for annealing metal cartridge cases, and consists of a ratchet mechanism, which conducts the cases to the heating apparatus. Accepted July 15, 1899.

8,409 (April 21, 1899). R. F. Leuschel, Germany. An explosive which is produced by impregnating muscineoe or spagnaceoe with solutions of carbon hydrates containing sugar in either of its various forms, caramel, dextrine, starch or glycerine, or with glycerine in combination with carbon hydrates. This compound is then dried and nitrated. Accepted July 15, 1899.

10,596 (May 19, 1899). J. Dömjen, Hungary, and C. Schotter, Austria. A target containing a bull's eye, which, when hit, automatically delivers a prize. The bull's eye is so arranged that when hit it completes an electrical circuit, thus setting some clockwork in motion, which delivers the prize. Accepted July 22, 1899.

12,222 (Date of application in United Kingdom, June 12, 1899. Date of application in U.S.A Nov. 26, 1898). J. W. Stockett, U.S.A. This patent relates to several modifications to the breech mechanism of ordnance, particularly of that type known as the "interrupted screw," the object of which is to simplify its construction. Accepted July 22, 1899.

12,603 (June 16, 1899). H. P. Holt, Oakham. The object of this invention is to provide a back V sight, which may be varied in accordance with the circumstances under which the rifle is shot. In the ordinary Lee-Metford the front sight is placed a little to the left, to allow for the natural tendency of the shot to throw to the left. For using Morris tube ammunition the sights require to be dead on, and it is for this purpose that the sight which is the subject of this patent is to be used. Accepted July 22, 1899.

* This Specification is more fully described under Selected Patent.

SELECTED PATENT.

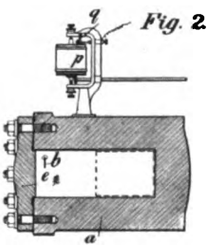
AN ELECTRICAL EXPLOSIVES TESTER.

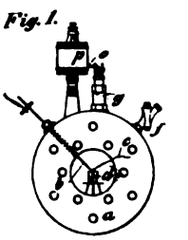
18,273 (August 28, 1898). E. C. Bichel, Germany. The object of the apparatus described in this patent is to provide means whereby the power of blasting explosives may be determined. The intention of t e patentee is to provide for the explosion of the blasting cartridge in the apparatus under as nearly as possible similar conditions to those which occur in actual blasting operations. To attain this object the explosive is ignited inside a thick-walled cylinder, to which is attached a valve. Through this valve the air may be exhausted from the interior of the cylinder, so that when the explosion takes place the effect of the gases of explosion upon an indicator, subsequently to be described, will not be complicated by the presence of air in the explosion chamber. The explosion of the test-charge or cartridge creates a pressure of gases within the explosion chamber, and these gases operate a piston which receives the pressure of the gases. According to the rate at which the gases are generated, and according to the force they exert, this piston is impelled outwards, and an indicator is provided outside the explosion chamber by which a time record is obtained of the successive stages in the movement of the piston. This record is in the form of a graphic curve produced upon a rotating drum by a scribing point attached to the piston. From this curve the character of the explosive is determined. A diagram of the electrical ignition device and various connections used in this apparatus is shown, and the arrangements include a magnetic coil, by the use of which the required strength of current is obtainable from a low power battery. Means are also provided for exploding the test charge when the drum has reached the required velocity of rotation.

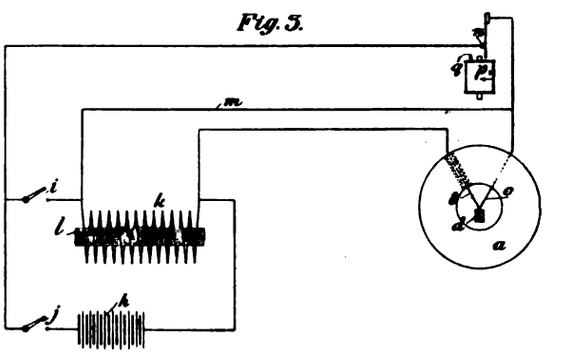
In the accompanying illustrations, Fig. 1 shows an end view of the cylinder with a charge of explosive ready for testing. Fig. 2 is a longitudinal section of this cylinder showing the method of attaching the cover, and Fig. 3 is a diagram of the electrical arrangements for igniting the explosive.

In testing an explosive a suitable charge is placed inside the cylinder *a*, as shown in Fig. 1. The two wires *b* and *c* are connected with the fuse *d*, and the other connections shown in Fig. 3 are duly made. The cover *e* is then bolted into place, and the chamber is exhausted of air through the valve *f*. It is explained in the specification that, instead of exploding the cartridge in a vacuum, the air in the chamber may be replaced by an inert gas such as nitrogen. It is stated, however, that there is a disadvantage in this latter method, because the expansion of the nitrogen due to the heat must be taken into account in making the calculations, and also that, taking into consideration the high temperature of the explosion, the oxygen contained in the liberated gases would have an oxydising effect upon the nitrogen. It is, therefore, found advantageous to explode the charge in a rarefied space, so that the gases may act independently upon the piston *g* without any complications due to the presence of air or other gases not arising from the explosion. The capacity of the cylinder is one of the factors in the calculations based upon the records obtained by this apparatus, and its capacity may be regulated by the insertion within the chamber of a metal body of the required size, such, for instance, as the one shown in dotted lines in Fig. 2.

The electrical connections shown in Fig. 3 provide for the firing of the charge when the drum, operated by clockwork, has attained a suitable speed. One of the circuits is automatically broken, and this results in a discharge of current which ignites the charge within the explosion chamber. It will be seen that the full current of the battery *h* can be turned through the magnetic coil *k* by closing the switches *i* and *j*, this serving to magnetise the iron core *l* of the coil. The switch *i* is then opened, and the current from the battery passes along the wire *m* and through the contact *n*, instead of, as







before, back to the battery through the switch *i*. Any current passing through the high-tension fuse may be ignored, as the resistance of this circuit would be too great for any material flow to take place with a low tension current. It should be clear that at this moment the current is passing through the magnetic coil *k* and the contact *n*, the two being in series. The contact *n* is automatically broken, as mentioned above, when the drum has attained the requisite speed. This throws the battery entirely out of the circuit, and the sudden stoppage of current through the magnetic coil produces the well-known effect of a strong though momentary discharge of current which, on account of the breaking of the contact at *n*, necessarily passes through the fuse circuit, and explodes the charge.

In Fig. 1, *o* shows the scribing needle which is attached to the upper end of the piston *g*, the drum being shown at *p*. The projection *q* on the drum, Fig. 3, always breaks the current at a certain point in the drum's travel. The needle *o*, therefore, commences the drawing of the diagram upon the drum at the same place, this being essential for the proper working of the apparatus. Accepted July 22, 1899.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The New Indian Arms Order.—Now that gunmakers have had an opportunity of enquiring into and considering the recent Order of the Indian Government regarding the importation of certain rifles and ammunition, opinions have crystalised upon several peculiar characteristics of the situation. One essential point is that the resolution not to issue further permits for ·303, and other rifles and ammunition, does not touch the large class who do not require permits. Certainly the rights of those who import rifles for their own use, in reasonable quantities, require more careful definition. It has been authoritatively stated that a reasonable quantity will be held to be one arm. Does this mean one arm must only be imported at a time, or one arm a year, or one arm in a lifetime? Also, it should be made clear whether the one arm restriction applies to the newly prohibited calibres or to all others. Whatever may be the refinements of this particular point, it is clear that it leaves a free hand to the purchaser who buys on his own account from countries outside India. On the other hand, it affords little or no loophole for such firms as Manton, whose business is the purchase of arms wholesale from abroad for the purposes of private sale in India. This working of the new Order is not surprising, since it is largely against the operations of such firms that the order is directed. Another point is that the order is so worded that the restrictions only apply to certain specified rifles and ammunition, and to such other rifles and ammunition as may be used interchangeably with specified types. In other words, ·256 Mannlicher rifles and ammunition could not be used with ·303 ammunition and rifles respectively. Consequently, the old order of things applies to the Mannlicher rifles and ammunition, and, in fact, to all other types such as present a sufficient difference from the service munitions. In some cases the difference is somewhat finely drawn. For instance, the difference of only ·003 of an inch between the United States Army rifle might permit interchange. There are slight differences in the chamber, following from a different shape of cartridge, comparing the ·300 and ·303 rifles and ammunition. The American cartridge might not fire from the English rifle, but the English rifle might fire the American cartridge, or *vice versa*. In fact, it would require an expert commission to unravel all the intricacies which arise. But here, again, we have a broad general rule, independent of logic chopping, to use a phrase associated with the present Viceroy of India, whose hand many believe they can trace in the new order. It is that the Indian Government has sanctioned an Order which severely prejudices the productions of British firms, and which at the same time specially relieves foreign productions from the effects of the enactment. We profess free trade principles of an enlightened order; but surely the Indian Government, inadvertently perhaps, have carried the principle a stage further than it should go. A correspondent, writing in the columns of the *Globe*, points out that the Indian Government "is straining at the gnat of Messrs. Manton's and Rhodda's shipments while gulping down the camel—nay, a whole string of these laden quadrupeds that are filing past Jamrood at this moment, bearing into the rocky fastnesses of our trans-frontier neighbours rifles and ammunition, the profit on the selling of which is but the greater for the efforts now being made to put down a competing traffic on the Indian side." Our contemporary is referring to the facilities which appear to exist for the open and unrestrained importation of modern rifles into the territory of our friendly neighbour, the Ameer of Afghanistan. One might well echo the question as to what precautions are taken to prevent the leakage of rifles from Cabul to the hostile tribes of the frontier.

Explosions in Coal Mines.—In the *Times* of the 27th ult. appeared an article, the first apparently of a series, dealing with the whole subject of coal mines legislation from the point of view of explosion risks. There is every promise, from the first article, that the many aspects of the question will be exhaustively considered, we trust from an impartial standpoint, but even in Part I. there appears to be a certain tendency towards special pleading. Perhaps this is a question in which "views" in one direction or the other are inevitably taken by anyone who has been intimately connected with the controversy, which has found its up-to-date solution in the Coal Mines Act, and the attendant orders based upon the work of the Testing Station at Woolwich. The author, although anonymous, has evidently an intimate knowledge of the whole question from the time of Prof. Galloway's earliest researches down to the present time, such a knowledge, in fact, as none but one who had been professionally connected with this specialised section of the coal mining industry could possess. It is impossible, however, and to some extent unfair to the author, to attempt to criticise but a part of a series of articles on a highly technical subject. After their conclusion we shall probably be favoured with a leading article having that brilliant power of exposition, in the treatment of scientific material for the lay mind, of which the *Times* alone seems to know the secret. The author of the articles has a responsible task to perform, and, judging by the instalment which has been published, he is fully equipped with a detailed knowledge of all the relevant facts.

Cartridge Loading by Powder Companies.—About two years ago we were allowed to inspect a very fine presentation arm which had been forwarded to a prominent official of one of the powder companies, and when we asked for an explanation as to the reason of so handsome a gift, we were told that American cartridge companies anticipated a time when English powder companies would load cartridges, and the gift was a compliment to pave the way to pleasant relations at a time when the above contingency should develop into an actuality. To us, at the time, it seemed that it would be long before there would be any return for this casting of the bread upon the waters, but recent developments in the powder and ammunition trades have hastened the conditions anticipated by the long-headed ammunition maker in the States. The earliest move in this direction occurred with condensed powders, for it was soon found that these required a specialized form of loading, in many cases beyond the facilities possessed by retail dealers. Consequently, some of the companies interested in condensed powders found it to their advantage to load cartridges and place them upon the market in a form doing full justice to the productions. This at once established such companies in the position of very large purchasers of cases, and the large orders which they were in a position to give enabled them to purchase cases manufactured to a specification giving the best obtainable results. In this way the market was thrown open to foreign cases in a manner which had not previously been experienced. The demand for a cheap cartridge, to sell in competition with the finely cut ammunition, which is so generally sold by miscellaneous dealers, constantly spur the powder companies to look out for cheap components. Unfortunately, it is foreign cases, of American and continental manufacture, which appear to be best fitted to meet this demand. It is not a big step from this state of affairs to the giving of an order conditionally upon the fulfilment of a certain specification, and time will show the true scope and dimensions of a movement, the first indications of which are clearly apparent.

THE SCHULTZE AND SMOKELESS COMPANIES.

Within the past few days circulars have been issued by the above two companies to their respective shareholders concerning a scheme of amalgamation which is strongly recommended by both boards of directors. At first sight the proposed scheme is a little difficult to understand; but in reality it is very simple if all the facts concerned are carefully borne in mind.

As is well known, the Smokeless Powder and Ammunition Co., Ltd., was formed for the purpose of taking over various assets of the old Schultze Company which were not transferred to the new Schultze Company when the latter was formed. Among the assets which thus form the property of the Smokeless Powder and Ammunition Co., Ltd., is a certain proportion of the new Schultze Company's shares, being a part of the purchase consideration. Another asset is a large block of shares in the American E. C. and Schultze Gunpowder Co., Ltd., and the final asset is the works at Barwick, together with various trading stocks and cash in hand and at the bankers.

With these assets the Company commenced business with a board of three directors, who were also directors of the new Schultze Company. It will be understood that under the circumstances the hands of the Smokeless Powder and Ammunition Co., Ltd., were tied to a great extent, in so far as competition against the Schultze Gunpowder Co. was concerned. This rendered it somewhat difficult for the Smokeless Company to do justice to its business, since rifle and other powders, except sporting, were the only directions in which it had a really free hand.

The present scheme will serve to get rid of these anomalies. It provides for the separate existence of the two companies from one point of view, and their amalgamation from another point of view. In other words, the scheme provides for the handing over of the whole of the assets of the Smokeless Company to the Schultze Company, the shareholders of the former company receiving as consideration shares in the Schultze Company. By this means the Schultze Company will become practically the only holder of the Smokeless Company's shares; but in order not for the time being to increase the dividend calls upon the Schultze Company, the new Schultze capital to be created will be in the form of deferred shares. The present shareholders of the Smokeless Company will, therefore, transfer their rights as shareholders to the Schultze Company, and in return they will receive specially created deferred shares in the Schultze Company.

The assets to be handed over by the Smokeless Company under the proposed arrangement are as follow:—

Factory at Barwick with Patents, &c.	£22,500
Stock of Powder (at cost)	12,000
American E. C. & Schultze Company's Shares (at par)	37,596
Schultze Gunpowder Co.'s Ordinary Shares (at par)	16,610
Schultze Gunpowder Co.'s Preference Shares (at par)	16,360
	£105,066

It will be seen that their total value is placed at £105,066. The capital of the Smokeless Powder Company issued as fully paid up is £60,000; and the above assets, valued at £105,066, will be exchanged for £120,000 in Schultze deferred shares. In this way the par value of the Smokeless shares will be exchanged for double that value of Schultze deferred shares. The deferred shares in the Schultze Company will not be entitled to any dividend until after 5 per cent. has been paid on the Schultze preference shares and 8 per cent. on the Schultze ordinary shares. After that all further distributions of dividends will be appropriated for the deferred shares until the latter have received 8 per cent.; after which further profits will be divided among the ordinary and deferred shares at an equal ratio. A saving clause is inserted for the protection of the deferred shares to the effect that not more than 20 per cent. of the profits in any year shall be carried to reserve or carried forward, unless in that year the whole 8 per cent. has been paid on the deferred shares. It is also provided that so soon as 8 per cent. has been paid for two consecutive years on the deferred shares they will henceforward rank as ordinary shares for all purposes.

The business of the two companies will be carried on quite separately, and as distinct organizations, and in order to provide capital for the carrying on of the Smokeless Powder and Ammunition Co. the proposed agreement includes an arrangement by which the Schultze Company will raise £50,000 in debentures, which is to be handed over to the Smokeless Company for the purposes of developing their business. In this way the Smokeless Powder and Ammunition Co., Ltd., will take charge of the first two items of the above list of assets, and the £50,000 will be the working capital for carrying on the business.

Putting aside all consideration of the interests of the Smokeless shareholders in the proposed arrangement—for we may assume their satisfaction at having attained a *modus vivendi*—we may proceed to examine the position from the point of view of the Schultze Company. We will examine it on the basis of the Schultze Company paying 8 per cent. on the ordinary shares. The present position of the Company is as follows:—

TABLE A.

Dividend on £162,500 of 5 % Preference Shares ...	£ 8,125
Dividend on £162,500 of Ordinary Shares at 8 % ...	13,000
Total	£21,125

Deducting from the above shares the Schultze shares to be transferred by the Smokeless Company, we obtain the position under the new arrangement which is as follows:—

TABLE B.

Dividend on £146,140 of 5 % Preference Shares ...	£ 7,307
Dividend on £145,890 of Ordinary Shares at 8 % ...	11,671
	£18,978
Add Debenture Interest on £50,000 (say)	2,000
Total	£20,978

It will be seen that we have added interest charges at 4 per cent. on the £50,000 of debentures to be created, making the total dividend required under the new scheme £20,978, which gives the following comparison:—

Dividend Required with Present Capital	£21,125
Dividend Required under the Amalgamation Scheme	20,978

The difference between the two is but slight so far as the figures are concerned. On the other hand, we have made no allowance for the earning capacity of the other assets upon which the present shareholders of the Schultze Company will have the first call until the above dividends have been paid. The position of the American E. C. and Schultze Gunpowder Co., Ltd., is, according to all reports, improving considerably, the sales of powder increasing by leaps and bounds. Supposing, therefore, that the American Company pays a dividend for the current year, the amount so received will contribute towards the required dividend fund of £20,978. Again, the position of the Smokeless Company as a profit-making concern will be greatly improved under the new conditions. It will have a free hand to push its wares in the market, and it will have £50,000 with which to develop its earning capacity. Here, again, therefore, is a prospective, if not immediate, source of revenue to the Schultze Company, further contributing to the required dividend of £20,978.

If the foregoing facts have been carefully followed, the improved position of the Schultze Company will be obvious. Table B shows that under the new scheme rather less dividend will be required to provide the same interest to the shareholders than under existing conditions, while at the same time two additional sources of contribution to profit have been opened up, one of them almost immediate, the other perhaps less immediate by comparison, but none the less substantial.

We have so far not referred to the dividend on the deferred shares, which will be paid out of any distributions in excess of the amounts shown in Table B. This, however, may be left to the future, since the shareholders of the Schultze Company will have no cause for grumbling with their investment when Table B is realised. The divisible profits over and above the £20,978 of Table B will be absorbed by the deferred shares until the limit of £9,600 has been reached, this latter sum being 8 per cent. on the £120,000 of deferred shares. The Schultze ordinary and preference shareholders need not begrudge this payment, since the holders of the stock in question may have to wait some time before their wishes are accomplished; while in the meantime the ordinary and preference shareholders have been deriving an immediate advantage from the assets represented by the deferred shares.

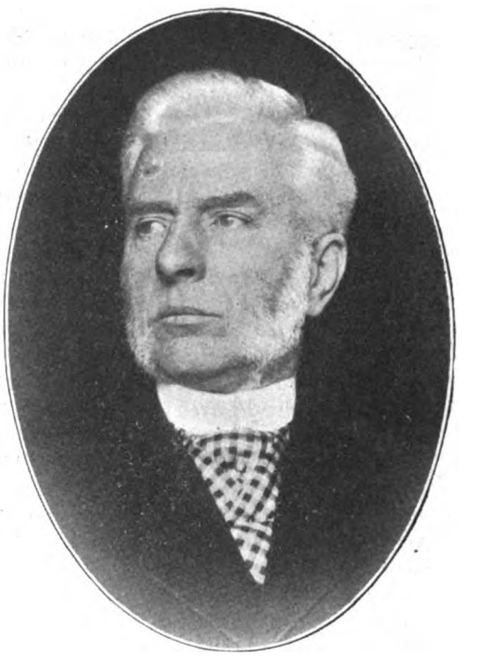
We cannot make the position more clear than above, but even in this general statement we have left out various subsidiary details, which do not, however, have any material effect on the scheme as a whole.

The proposed arrangements are down for consideration at an extraordinary general meeting of the Schultze Gunpowder Co., Ltd., which will be held at Cannon Street Hotel on the 2nd inst., at 12.45 in the afternoon, when a resolution embodying this scheme will be submitted for the approval of the shareholders. A special meeting of the preference shareholders of the Schultze Company is also called for the same day, and it will be held at the same place at 1.15, the object being to secure the authority of the preference shareholders, under the Articles of the Association, for the creation of £50,000 of debentures. A meeting of the shareholders of the Smokeless Powder and Ammunition Co., Ltd., will be held at 28, Gresham Street, on the same day, at 3 o'clock in the afternoon, when a resolution giving the directors power to carry the scheme into effect will be submitted for approval.

MESSRS. CHARLES OSBORNE & CO., LTD.

Mr. Charles Osborne Ellis.

The Founder of the Firm,
The Late Charles Osborne.



Mr. Edward W. Wilkinson.

It was announced about the middle of last month that the firm of Charles Osborne & Co. had been formed into a limited liability company, with Mr. Charles Osborne Ellis and Mr. Edward W. Wilkinson as permanent managing directors. The formation of the company is purely due to private family reasons, and consequently no portion of the £50,000 capital has been offered for subscription to the public. The shares, which are £5 each, would no doubt form a very nice investment to anyone favoured with a chance to purchase them, but such bargains as this do not come upon the market. In fact, the smallness of the capitalization of such an important business is in itself proof positive of the private nature of the registration, as also is the fact that the list of signatories is made up exclusively of members of the two families.

The original founder of the business was the late Charles Osborne, who started operations in a comparatively small way in the early part of the present century. We reproduce in this article an excellent photograph of the late Charles Osborne, who died in the year 1871. Mr. Charles Osborne was the first Birmingham gunmaker to carry his manufactures to Liverpool, Manchester, and other large provincial towns; and the reputation he established so long ago has not only been maintained, but greatly enhanced, especially since Mr. Osborne's death, when the combined efforts of Mr. Ellis and Mr. Wilkinson in partnership have added modern methods to the old traditions of a long-established firm. Mr. Ellis was the grandson of the late Charles Osborne, and Mr. Wilkinson was apprenticed to Mr. Osborne in 1854. During the last quarter of a century, which covers the period of the present management, the business of the firm has increased probably fourfold, and there is every evidence of continued growth on a similar scale.

The firm's works were rebuilt, partly on the old foundation, some twelve years ago, and our two illustrations show the vast difference between the old and the new; though the real extent of the present works is hardly sufficiently expressed by the corner view shown in our photograph. The works are built round an open square, which provides excellent light for the shops and warehouses on either side.

Besides the manufacturing portion of the business, which is one of the most extensive of its class in England, the firm holds various important sole agencies, which include such concerns as the Union Metallic Cartridge Co., the Ideal Manufacturing Co., and Messrs. Smith and Wesson, the revolver manufacturers of world-wide renown. From this it will be seen that the firm has specialized in agency work for American companies; and in order to carry this policy to its utmost extent, the firm also represents, and holds large stocks of the output of, such firms as the Marlin Fire-arms Co., the Stevens Arms and Tool Co., Colts and H. M. Quackenbush.

It will be seen that such a business requires considerable thought and work in its administration. The large staff at Birmingham is personally directed by Mr. Ellis and Mr. Wilkinson. In London the firm has a depôt with large stores in Great Scotland Yard, which has been for many years under the able management of Mr. S. R. Hollick, who deals with the very large miscellaneous wholesale connections of the firm in the metropolis. The Scotch interests of the firm

have been thoroughly well looked after by Mr. H. C. Marston, who resides in Edinburgh, and has acted on behalf of the firm for nearly thirty years. The country trade is under the care

The Old Works

of Mr. Charles McLoughlin, formerly of Cheltenham, a well-known genial gentleman.

We have previously remarked upon the present movement in the direction of turning the old gun firms into limited

The Present Works.

liability companies. The energy with which a private firm is worked generally depends upon the activity of the partners for the time being; and it frequently happens that a fine business is allowed to lapse when it has satisfied the aspirations to wealth of its proprietor. In the case of limited liability companies, there is far better provision for the continuous and satisfactory working of the business. These remarks have but little application to the present case, where the two partners have always been, and promise to continue for many years to come, the moving spirits of the enterprise. The organisation is nevertheless nicely rounded off, and effective means have been taken for securing to those who have borne the brunt of the battle the full benefits in the future of their work in the past.

EXPLOSIVES STORAGE IN NEW SOUTH WALES.—There is at present much dissatisfaction existing among the explosives dealers of New South Wales and South Australia regarding the explosives storage regulations. According to an article dealing with this subject, which appears in the *Australasian Ironmonger*, the dealers are seriously agitating to secure an improvement in these regulations, which seem to be in a state not only seriously affecting the explosives trade, but also the mining industry, which has to pay for the increased cost of handling explosives. The dealers in these two colonies have extra reason for agitating, since the regulations governing this branch of the trade in Victoria work smoothly and satisfactorily under the supervision of Mr. C. Napier Hake, whose report for 1898 appears in another part of this issue. As may be seen from this report, there are 21 Government magazines existing in Victoria, whereas the Government of New South Wales refuses to consider the question of erecting public magazines anywhere. Moreover, it is stated, the administration of the Explosives Act in the latter colony is in the hands of an officer who does not claim to have any expert knowledge in either chemistry or explosives. All explosives for this colony are stored in lighters, situated at the heads of the harbour at Sydney, and a charge is made for storage in these magazines, which is three times as great as that made in Victoria. The New South Wales Government reserves the right of lightering the explosives from the magazines to the shore, and also of carting from the landing place to the railway. For both these transportations very heavy fees are charged. It is generally alleged that explosives are very frequently condemned which would be passed in Victoria, or which, at least, would be allowed to undergo a course of treatment with a view to a subsequent re-examination. The severity with which cases of exudation are treated inflicts great loss upon importers. Should a consignment, after its passage through the tropics, prove to be in this condition, the whole would be condemned in New South Wales. This trouble is subject to simple treatment by clearing away the exuded material and repacking the cartridges in a cleaned condition in the cases. To avoid the penalties of condemnation it is necessary, at heavy freight charges, to transport such explosives to Victoria, where they undergo the above treatment, which is authorized by the inspector of that colony after he has satisfied himself as to the general good quality of the consignment, further tests being made after the treatment to establish its effectiveness. There does not appear to be any evidence that the extreme severity of the explosives regulations in New South Wales provides any degree of exceptional safety for the public. Notwithstanding that, in Victoria, the losses to the trade, due to the rejection of bad samples, are reduced to a minimum, the regulations of the explosives industry in this colony provide a much higher standard of safety than in New South Wales, where annoyance and loss to traders is accompanied by inefficient protection of the public.

THE LATE MR. WILLIAM BLANCH.

A few days before our last issue went to press we paid a visit, for the purpose of gaining certain information, to the premises of Messrs. J. Blanch and Son, at 29, Gracechurch Street. There we saw Mr. William Blanch hard at work attending to the rush of duties which fall upon every gunmaker in the early part of the shooting season. We little thought that we had seen him for the last time. But such was the case, for a fortnight later we received news of his death on the 8th ult., at the ripe old age of 77 years.

The firm of Blanch & Son are the only gunmakers carrying on business at the extreme eastern end of the City of London. The firm was originated by the late John Blanch, father of Mr. William Blanch, in the year 1809, in premises at 39, Fish Street Hill, which is but a stone's throw from the present

The Late Mr. William Blanch.

place of business. John Blanch was apprenticed to Mortimer, whose daughter he afterwards married. Later on he worked for John Manton, and having gained great experience, he considered the time to be ripe for starting business on his own account.

In the course of time the business was firmly established, and the son, William Blanch, learnt the intricacies of a gunmaker's calling from his father, by whom he was ultimately taken into partnership. The most noticeable portion of the late Mr. William Blanch's career as a gunmaker is inseparably connected with the all-important development of the breech-loader. While the original invention of this system of fire-arm was due to a Frenchman, it rested with the English firms to apply the invention to English fire-arms. The Lefaucheux system of breech-loader was brought prominently forward in the 1851 Exhibition. The invention was not received with open arms, and it practically rested with three enterprising gunmakers to fight the battle of the breech-loaders against the inert resistance of conservative influences, and also against the active opposition of those who have eyes only for the objections to the system. At this time of day it is difficult to realize how great these objections really were. The gas-tight cartridge had not yet been evolved, and the difficulties of construction were thereby increased many times. A little thought will, therefore, manifest the wide sympathies of the gunmaker who pledged his reputation on the soundness of the breech-loading system. This honour is divided between the firms of Lang, Reilly and Blanch,. though, of course, others joined in as time went on.

It was in the year 1855 that the late William Blanch sent to Paris and purchased of Beringer, for £27 odd, one of the new-fashioned guns. This he set to work to copy and improve. But he had also the even more arduous task of teaching his men to make the new gun. The barrel maker had to be instructed how to make the lump instead of the screw breech-plug. The percussioner had to be broken in to the task of making actions on Lefaucheux's system. Everything was new, and the only moral support in the task arose from the fact that Joseph Lang had some time previously entered the same field of research. The cartridges of Chaudun and Gevelot make were imported from the continent, English cartridge makers not then being in existence. The following extract from the *Field*, of October, 1858, shows the stage at which matters had arrived some three years later:—"Lang, Reilly and Blanch have been overdone with orders, and more than one gentleman, we know, has had great diffieulty in meeting with what he wanted. It is, therefore, simply absurd to attempt to pooh-pooh the invention." For the next ten years the capacity of the business to turn out guns was taxed to the utmost, and throughout that period, and, in fact, for many years after, the late Mr. William Blanch supervised every detail of the business personally. In later years he has received an increasing amount of assistance from his son, Mr. Herbert J. Blanch, and we feel every confidence that the business, which has been so ably conducted for two generations, will be worthily carried on by Mr. H. J. Blanch, who will face his increased responsibilities with the best wishes and sympathy of all who have come into contact with him.

The portrait we here reproduce is an excellent likeness of Mr. William Blanch as he was known to his numerous circle of customers and friends in the City.

AUTOMOBILE GUN CARRIAGES.—One of the latest American fields of research connected with ordnance consists of an automobile gun carriage. One of such, it is stated, has been designed by Major R. P. Davidson, of the U.S. Army, and is constructed to carry a Colt automatic gun. The weight of the complete carriage is about 1,000 lbs., and it is propelled by a six-horse power gasoline motor. It has three india-rubber tyred wheels, and provides seating accommodation for four gunners. The gun is situated on the carriage in such a position that it may be operated when the latter is travelling at a rate of thirty miles per hour. Of course, this new device is as yet in its infancy, and although one such carriage has been completed and tested, it has yet to prove its efficiency over rough country such as would have to be traversed in the course of warfare. On the other hand, it might do very well for use in civilized countries or in cities against mobs in the case of a riot or any disturbance of that kind—apparently one of the functions of the American army, which even recent triumphs do not appear to have obliterated from the official mind.

NOTES.

THREE LONDON GUNMAKERS.—We have pleasure in recording that three new firms have started in the London gun trade within the past few weeks. Messrs. J. Mortimer and Sons are established in New Bond Street; Mr. Thomas Jackson has taken eligible premises in Wigmore Street; and Messrs. Blissett and Sons have found suitable accommodation in High Holborn. Our authority for the above statements is obtained from the names engraved on various guns exposed for sale in the Strand, in two bag and portmanteau shops, of Messrs. S. Goff & Co. The guns in question are marked with the above names, but curiously enough the engraving has that shiny appearance which one associates with "reach-me-down" guns which are christened after purchase. On the label attached to one of the guns it is described as a very fine gun by Mortimer. This, at first, and before making a close examination, led us to suppose that the weapon was by the celebrated makers, Messrs. Mortimer and Son, of Edinburgh. We, however, wrote to this firm, and they inform us that they have no connection with any London firm of the same or similar name, and are, in fact, not aware of the existence of any such firm of makers. Messrs. Blissett and Son, of Liverpool, have written to us to a similar effect; and consequently we issue the news as to three new firms in the London gun trade with all due reserve, and subject to confirmation by Messrs. S. Goff & Co., of portmanteau fame. Some people might be inclined to repeat a historical remark to the effect that they don't believe there ain't no sich person.

SOCIETE FRANCAISE DES GLYCERINES PURES, LTD.—A company under the above title was registered last month with a capital of £80,000 in £1 shares. The object of the Company is to adopt an agreement with Messrs. George Blackwell & Co., Ltd., and to carry on the business of manufacturers of, and dealers in, glycerin, nitro-glycerin, dynamite, guncotton, detonators, etc., etc. The signatories are Messrs. F. Winter, C. D. Buckley, H. A. Mabey, J. Rundle, G. H. Sawyer, P. Mitchell, P. P. Ornshin.

AN OSBORNE CATALOGUE.—We have received from Messrs. Charles Osborne & Co., Ltd., a copy of their season 1899-1900 trade catalogue. We are beginning to accustom ourselves to the use of somewhat superlative terms in referring to gun catalogues, but each one appears to merit some exceptional meed of praise. The present catalogue possesses the distinction of emanating from a firm who possibly make a greater variety of guns and gun materials than any other firm in the trade, while in addition they have an unrivalled number of exclusive agencies for leading houses abroad. The catalogue appeals especially to working gunmakers doing a retail trade. In it will be found, besides the ordinary finished goods which are stocked for sale, numbers of gun parts and accessories for the carrying out of repair jobs. The pages devoted to Quackenbush, Stevens, Marlin, Winchester, and other rifles, and goods for which the Company acts as English agents, all contain many details which do not appear in the ordinary catalogue. The show of Smith and Wesson revolvers is particularly complete, and the beautiful finish of these arms receives full justice from the excellent engravings and printing of the catalogue. The twelve-bore shot guns in the catalogue, of course, represent Messrs. Osborne's chief field of manufacturing activity, and here we find a number of well-finished arms in all qualities, ranging from the sixty-guinea gun down to the twelve-guinea hammerless, or the cheaper hammer gun. Illustrations and specifications tell but little about the real working and finish of a gun, but Messrs. Osborne's business with all classes of the trade is the true gauge of the qualifications of their weapons.

THE ASHTON MAGAZINE RIFLE.—It is reported from Birmingham that the firm of Webley have been experimenting with a magazine rifle invented by a Mr. Ashton, who, we may presume, is the T. R. R. Ashton that, as joint inventor with a Mr. E. J. Kelly, came over from Australia about the year 1894 to introduce his rifle in Europe. Those who have long memories for such matters will remember that about that time the Australian papers had a good deal to say about this rifle of local production; and the opinion was freely expressed that what we had still to learn about magazine rifles would be demonstrated to us by the Ashton and Kelly arm. Our own interest in the rifle was somewhat cooled when the patent was published; for the magazine was upstanding above the receiver, not vertical so as to obstruct the line of sight, but very nearly so. The cartridges fell into the receiver by gravity, and were thence carried into the chamber by the movement of the bolt. At about that time it will be remembered the Spanish Mauser was under consideration, and the projecting magazine of the ordinary type below the receiver was shortened so as to be flush with the stock. In fact, it seemed then, as now, to be generally recognised that all excrescences beyond the natural lines of a military rifle should be curtailed as far as possible. Consequently we did not pay any considerable attention to a rifle which had the whole of the magazine upstanding from a part of the rifle which preferably should be left clear so as not to obscure the firer's field of view; and further, we regarded the position and form of the magazine as especially inviting damage in the rough and tumble of campaigning, and even also in the routine work of peace. With a gravity feed of cartridges from the magazine there is obviously a less positive action than with a spring, and again the available power is limited to the weight of the cartridge. Also the rifle requires to be in a vertical position at the moment of reloading for the full weight of the cartridge to be effective. It will be interesting to see how these points have been dealt with, and how they work out in actual practice. The following are the patents standing in Mr. Ashton's name, and it will be noticed that Mr. Ashton appears to have pursued his more recent investigations independently of Mr. Kelley:—16,861 and 16,862 (1894) Ashton and Kelly; 8,408 and 26,872 (1896) Ashton.

BIG GUN LATHES.—During the past two or three years Messrs. Vickers & Sons, and Maxim, of Sheffield, have considerably increased the amount of machinery at their works. Among numerous other heavy tools recently laid down by them is a lathe of 36-inch centres, which was specially designed and built by Messrs. Meyer Peacock & Co., Ltd., of Manchester. A short article was published in a recent issue of the *American Machinist*, which gives a good description of this lathe and the power required to work it. The article is accompanied by two illustrations, the first showing the lathe

in the shops of its builders while in course of construction, and the second showing the lathe at work shaping a big gun. Some small idea of the size of the lathe may be gained from the fact that the bed, which is built in three sections, is 90 feet long. Its total weight is 99 tons.

MACHINE GUN STATISTICS.—The following order has recently been published in India regarding machine guns "A memorandum of examination, or history sheet, will accompany each machine gun when issued for service. It will be kept in a paper packet in the gun chest; it will be carefully preserved, and will be handed over with the gun to which it relates whenever the latter is transferred from the charge of one officer to that of another. An immediate record will be made thereon (in the column 'remarks') of of any accident which may occur to the gun, and of the result of each official examination which it may undergo. On every occasion on which the gun is fired the number of rounds will be inserted on the inner sheets provided for the purpose."

BLASTING POWDER IN VICTORIA.—According to the *Australasian Ironmonger* a good deal of inconvenience is being caused by the refusal of the railway companies to allow that blasting powder is included in the term gunpowder, for which special facilities are granted for the transport of small quantities by ordinary trains. This does not effect cases where large consignments of blasting powder are made, but in instances where small quantities are required the result is that the law is evaded right and left. Generally it would seem to be better to include blasting powder as gunpowder, since this would obviate the unsatisfactory state of affairs which now appears to exist, due to a reputedly large illicit traffic of blasting powder.

BIRMINGHAM SHOOTING RANGES.—The new protected shooting ranges, to which special references were made in the report of the Guardians of the Birmingham Proof House, and subsequently at the meeting of the Birmingham gun trade, have now been completed, and the official opening ceremony has been fixed for Wednesday, the 4th inst., at midday. The Lord Mayor of Birmingham has consented to perform the ceremony, and a number of invitations have been sent out, both among members of the gun trade and to prominent citizens of the Midland metropolis. There is every reason to anticipate a good attendance, and as the invitation refers to a luncheon afterwards, the comfort of the guests is evidently being carefully studied.

BIRMINGHAM SMALL ARMS CO. LTD.—The accounts of the above company for the year ending July 31st last show a trade profit of £51,984, which, with dividends on investments, £4,448, and the amount brought forward from last year, £3,919, makes a total sum at disposal of £60,351. Full allowance has been made for depreciation. Interim dividends at the rate of 10 per cent. per annum on the ordinary shares, free of income-tax, and 5 per cent. per annum on the preference shares, were paid on April 1st last. The directors now recommend that a further dividend of 15s. per share, free of income tax, be paid on the ordinary shares, and 2s. 6d. per share on the preference shares, payable on October 4th next. These payments, amounting together to £50,448 18s. 4d., will make a total dividend for the 12 months of 20 per cent. on the ordinary shares and 5 per cent. on the preference shares. The directors further recommend that the sum of £5,000 be added to the reserve fund, raising this fund to £55,000. There will remain to be carried forward the sum of £4,902 11s. 8d. The contract for rifles, on which we were engaged last year, was completed in February. Two further contracts for the British Government have been undertaken, which will give employment till next March. The rifle plant is maintained in full efficiency, and is capable of largely increasing the supply of rifles when necessary. The cycle fittings department has been highly successful, and the directors anticipate an increased demand for the coming season. The directors record with regret the death of two of their colleagues, Mr. Playfair and Mr. Abraham. Mr. Playfair was one of the band of associated gunmakers who in 1861 founded this company. To the last the company largely benefited by his experience as a gunmaker. Mr. Abraham was formerly the proprietor of the Adderley Park Works, which were purchased from him in 1872. These works, as will be remembered, were sold to the Nobel's Explosives Co., Ltd., in 1896. The vacancy created by the death of Mr. Playfair has been filled by appointing Mr. Hubert Wallis to a seat on the Board, with the title of managing director. This step the directors have great pleasure in taking, as, while strengthening the management, it recognizes his long and valuable services to the company from the year 1866. The directors do not recommend that the vacancy caused by the death of Mr. Abraham should be filled up. Mr. Wallis retains his full salary, but will not receive any fees as director. The fees to which he otherwise would be entitled, and those received by the late Mr. Abraham, will be saved to the company. The office of secretary, hitherto held by Mr. Wallis, has been taken up by Mr. Kenneth R. Davis, who during the past few years has acted as assistant secretary. The directors are of opinion that the movement for establishing a local University is of the highest importance to the manufacturing interests of Birmingham, and in particular to industries such as those carried on by this company, which depend for their success so largely on the intelligence and ability of the superintending staff. They therefore recommend that the sum of £2,500, in five yearly instalments, be given as a donation in aid of the proposed University, and that the first instalment of £500 be paid at once. The following are the leading items in the balance sheet, some of the details of totals having been omitted :—

Liabilities.

	£
Capital paid up	406,300
Sundry creditors	22,422
Reserve fund...	50,000
Profit and loss account	45,284
	£524,006

Assets.

	£
Land	29,361
Buildings and fittings...	116,510
Engines, boilers, and machinery	172,948
Sundry stores and tools	55,164
Work finished and in progress...	29,813
Sundry debtors	21,065
Investments	83,710
London City and Midland Bank, Ltd.	14,493
Cash and bills in hand	942
	£524,006

THE EXPLOSIVES IN COAL MINES ORDER.—In the report of the Home Office for 1898 on coal mines, which has recently been issued, it is stated that during the year the South Wales anthracite colliery owners applied to the Government for the relaxation of the Explosives Order in Coal Mines in certain of their mines. In order to ascertain whether such an action would be safe, some experiments were carried out at the testing station to determine the inflammability of anthracite. Major Cooper-Key, the Chief Inspector of Explosives, states, in his report on the experiments, that the general result proved to everyone present that, although steam coal was undoubtedly more inflammable than anthracite, the difference between the two was purely one of degree. The anthracite dust, even when mixed with over thirty per cent. of foreign matter which was taken from the main haulage roads, gave a large volume of bright flame in every instance when a non-permitted explosive was used. He states, moreover, that experiments in which a permitted explosive was used there was absolutely no appearance of flame whatever, showing very conclusively that any relaxation of the order, so as to sanction the use of non-permitted explosives in dry and dusty mines, would be attended with grave risks.

SIR W. G. ARMSTRONG, WHITWORTH & CO., LTD.—The annual meeting of the shareholders of this company was held on the 27th ult. at Newcastle. Sir Andrew Noble presided, and moved the adoption of the report for the year ended June 30, which showed that, after deducting depreciation, and adding £2,626 from last year, there remained a profit of £658,674 on the year's operations. A dividend of 3s. per share, and a bonus of 1s. per share, both tax free, was recommended.

EXPLOSIVES REPORT FOR VICTORIA, 1898.

We have received a copy of the report dealing with the working of the Explosives Act in Victoria during the year 1898. It bears the signature of Mr. C. Napier Hake, the Chief Inspector of Explosives for this Colony, who, in opening the report, states that no alteration has been made during the past year in the law which governs the explosives industry.

Importation.

Although the local manufacture of explosives has considerably increased during the past year, the importations do not appear to have been affected. In fact, a material increase is shown on the total quantity of explosives imported as compared with 1897.

A table given in the report shows the quantity of each of the different explosives imported during the past 10 years, and among other things, this table makes it clear that the demand for Dynamite has been gradually lessening year by year in favour of Gelatine Dynamite. Although the quantities of Dynamite imported during 1898 show an increase over the returns for 1897, the fact remains that the present amount is only about one-tenth of what was brought into the colony during 1889. The demand for Gelatine Dynamite is increasing every year, the imports of this explosive during 1898 being about 30 times more than in 1889. Blasting Gelatine imports are also greatly on the increase; and yet, in spite of the competition of chemical high explosives, the imports of ordinary blasting powder remain practically unaltered in volume. A great drop may be noticed in the amount of sporting powder brought into the colony during the past year. This is explained as being mainly due to the number of droughts and bush fires which have been so prevalent in the colony during the past three years. This continuous destruction of game and the disturbance of the breeding grounds has now seriously affected the sport obtainable in the colony, and these adverse conditions react upon the consumption of sporting powder.

The following table shows the quantity of the various explosives which have been imported during the past two years, and also gives the percentage of the increase or decrease in 1898 as compared with 1897:—

Explosive.	1898. lbs.	1897. lbs.	Increase per cent.	Decrease per cent.	Value for 1898. £
Dynamite	28,851	19,650	47	—	2,493
Gelatine Dynamite	767,410	650,130	18	—	59,103
Blasting Gelatine ...	129,850	53,550	143	—	12,187
Blasting Powder ...	334,000	323,100	3	—	5,437
Sporting Powder ...	72,366	122,125	—	41	3,923
Total ...	1,332,477	1,169,555			£83,143

Besides the above, 469 packages of other explosives, including caps, cartridges, detonators, fuses, etc., were imported to the value of £5,607.

Testing.

During the past year 784 samples of explosives were examined in the laboratory, and of this number 117 were rejected. The principal explosives examined were Blasting Gelatine, of which 66 samples were passed and 35 rejected, Dynamite No. 1, 43 passed and eight rejected, and Gelignite, of which 266 were passed and 40 rejected. A very large number of samples of explosives were tested for their physical condition only, but these are not included in the above 784 examinations.

The general condition of Blasting Gelatine is reported as satisfactory, the rejected samples referred to being consignments imported in 1896. It is stated in the report that the conclusion arrived at from repeated experiments is that Blasting Gelatine possesses an abnormally low heat test, and does not improve (in Victoria, at any rate) by keeping; that is to say, the duration of the heat test without a reaction is not materially increased.

A consignment of Cannonite was placed under seizure for being imported overland without an importation licence, but it was eventually released on receipt of a satisfactory explanation. Twenty cases of Cannonite imported from Great Britain were also placed under seizure, because they were insecurely packed. They were, however, released after having been repaired at the Government magazine, at the importer's expense.

The Collodion Cotton importations were found to be generally satisfactory, but in one case the size of the boxes, each of which contained 150 lbs. of wet Collodion Cotton, was made the subject of comment by the Government. An arrangement regarding future importations was made with the importers, and the affair was thus satisfactorily settled.

Of the Dynamite imported, 6,050 lbs. were rejected, owing

to exudation of the nitroglycerin, but they were eventually treated at one of the local factories. It is stated that, on the whole, the importations ofG elatine Dynamite were most satisfactory, and only one complaint was made during the year. This arose through a certain consignment showing a test too near the minimum standard of purity required, but the matter was dropped after a warning had been issued to the importer.

The condition of the Gelignite imports during the past year were not up to the usual standard. The principal cause of the rejections was due to the exudation of nitroglycerin. In some cases the nitroglycerin exuding from the cartridges had spread all over the outer wrappers of the other cartridges packed in the same case. No less than 16,400 lbs. of imported Gelignite was placed under seizure upon arrival and destroyed.

Of the safety Fuse importations, seven consignments, which were manufactured in Britain, were rejected, the reason being that they were not in accordance with the regulations; the samples, in undergoing the test of burning, either exploded or communicated laterally with other fuses.

MANUFACTURE.

There are now eight licensed explosives factories in Victoria, this number being an increase of two on those licensed in 1897. It is pointed out that the most important factory in the colony, that of the Australian Explosives and Chemical Co., Ltd., has, during the past year, largely extended its plant for the manufacture of nitroglycerin compounds.

A similar system has been adopted to that which exists in England for licensing factories, which insures a thorough investigation of all the technical details when the draft licence is under consideration, and it also affords protection to the local interests concerned.

Two new explosives have been authorised for manufacture and importation, but the licences have not yet been applied for. These explosives are "Kallenite" and "Normal" powder. The first belongs to the first division of the nitro-compound class, and has a composition somewhat similar to that of Gelatine Dynamite, the ingredients being nitroglycerin nitro-cotton, potassium nitrate, and wood pulp. Normal powder is sufficiently well known in this country to require no special description. The explosive, Rendite, was amended by the addition of graphite to its previously authorised constituents. A further application has been received to amend the composition of this explosive, but it is still under consideration. The Rendite factory was established during the past year, and it is reported that the officers of this factory were severely censured by the Government last year for disregarding certain important regulations bearing upon the work of the factory.

In another case connected with the manufacture of explosives, it was found necessary to take proceedings against the manager of the Colonial Ammunition Co., Ltd., for illegally manufacturing ammunition. This factory was brought under the Explosives Act in December, 1897, but early in the following year the manager applied to the Government for a postponement of the issue of the licence pending various alterations which were to be made in the factory. The manager undertook not to carry on the work of manufacture in the meantime. An inspection of the premises some little time later, however, revealed the fact that ammunition was being manufactured in a building just outside the factory and adjoining the manager's private residence. Proceedings were instituted, but the maximum penalty was not pressed for on the Company undertaking to complete their licence, and a small fine was imposed.

STORAGE.

There are now 89 magazines under licence in this colony, and 21 Government magazines. These were periodically inspected during the past year, and one or two cases of illegal storage are reported. In one instance 150 lbs. of Gelignite were discovered illegally stored in a disused tunnel. This explosive was in a very dangerous condition, and was at once seized and destroyed. Various other instances are reported where the inspectors have discovered explosives in a dangerous condition, stored on licensed premises. Altogether, 2,300 lbs. were exposed, which were placed under seizure and destroyed.

ACCIDENTS.

Several accidents have occurred during the past year, the principal one of which took place at the works of the Australian Explosives Company. This accident happened in the final washing-house, where a man was engaged thawing some Nitroglycerin in a leaden trough. The Nitroglycerin had accumulated from a filter which was situated immediately above the trough, and was being washed with hot water when it exploded. The Chief Inspector of Explosives investigated the affair, and came to the conclusion that the man must have been engaged in preparing the filter for a fresh charge of Nitroglycerin, and in some way or other must have dropped one of the copper rings covered with wire gauze, which forms one of the beds of the filter, into the gutter of the trough. The ring weighed about 4 lbs., and might have fallen a distance of 18 inches from the filter to the gutter. The Nitroglycerin, which had just been through the process of washing with hot water, was probably heated above its normal temperature, and, therefore, more sensitive to concussion. This, it is suggested, is the most probable cause of the accident, which resulted in the loss of one life and the destruction of the surrounding buildings.

COMPARATIVE STATISTICS OF AUSTRALASIAN COLONIES.

Of the two appendices with which Mr. C. Napier Hake concludes his able and masterly report is one which is o especial interest, in that it gives the importations of explosives of all the other Australasian Colonies, and so affords an opportunity of comparing these useful statistics. We have not included the figures for Western Australia, as these were given in our last August issue; sufficeit, the refore, to remind our readers that the gross value in the case of this latter colony for the year 1898 was £85,357, which was below the figures for the preceding two years.

NEW SOUTH WALES.

Nature of Explosive.	Quantity.	Value.
		£
Dynamite	92,800 lbs. ...	5,800
Gelatine Dynamite ...	109,150 lbs. ...	9,096
Gelignite	385,550 lbs. ...	24,096
Blasting Gelatine ...	101,200 lbs. ...	88,500
Sporting powder ...	112,748 lbs. ...	11,275
Blasting powder ...	311,800 lbs. ...	5,197
Blasting cartridges ...	502,550 lbs. ...	10,470
S.A. cartridges ..	4,439 boxes	Not obtainable.
Detonators	187 boxes	
Lithrotrite	432 boxes	

Electronite	275 lbs.	...	17
Rendite	5,000 lbs.	...	250
Roburite	1,500 lbs.	...	100
Carbonite	250 lbs.	...	13
Miners' safety squibs	40 boxes	...	80

NEW SOUTH WALES.
(Borderwise.)

Nature of Explosive.	Quantity.	Value
Dynamite	312,940 lbs.	Not obtainable.
Sporting powder ...	2,520 lbs.	
Blasting powder ...	116,225 lbs.	
S.A. cartridges ...	41 boxes	
Detonators	85 boxes	

SOUTH AUSTRALIA.

Nature of Explosive.	No. of Packages.	Quantity.	Value. £
Dynamite	779 ...	38,950 lbs. ...	2,948
Gelignite	3,800 ...	190,000 lbs. ...	14,630
Blasting Gelatine ...	2,425 ...	121,250 lbs. ...	12,670
Gelatine Dynamite...	1,364 ...	68,200 lbs. ...	6,189
Detonators	89 ...	8,900 lbs. ...	1,662
Blasting powder ...	9,945 ...	213,125 lbs. ...	4,371
Sporting powder ...	617 ...	15,425 lbs. ...	1,350
Totals ...	19,019 ...	655,850 lbs. ...	43,760

QUEENSLAND.

Nature of Explosive.	Quantity.	Value. £
Cartridges, sporting and blasting	912 packages	5,995
Detonators	211 packages	2,379
Dynamite	149,050 lbs. ...	9,882
Gelatine Dynamite	95,000 lbs. ...	7,030
Gelignite	417,745 lbs. ...	31,881
Rackarock	20,612 lbs. ...	1,505
Roburite	250 lbs. ...	15
Powder, blasting	55,470 lbs. ...	1,319
Powder, sporting	49,485 lbs. ...	3,434
Other explosives	27,500 lbs. ...	2,175
Total value		£65,555

TASMANIA.

Nature of Explosive.	Quantity	Value. £	s.	d.
Gunpowder, blasting... ...	237,910 lbs			
Gunpowder, sporting ...	29,320 lbs			
Amberite	630 lbs	... 6,379	3	8
Schultze and E.C. powder ...	415 lbs			
Dynamite	7,750 lbs			
Gelignite	226,000 lbs			
Blasting Gelatine	2,500 lbs	... 18,606	0	0
Rackarock	37,516 lbs			
Detonators	741,000 No			
Cartridges, safety, and M.-H. rifle ball	Not obtainable	... 1,429	0	1
Total value		£26,414	3	9

NEW ZEALAND.

Nature of Explosive.	Quantity.	Value. £
Cartridges	9,015,293 No.	901
Dynamite	139,100 lbs.	11,277
Detonators	1,571,990 No.	3,108
Fuse	158,726 coils	4,818
Cordite	4,750 lbs.	574
Percussion caps ...	5,799,800 No.	901
Gunpowder, blasting	334,000 lbs.	7,506
Gunpowder, sporting	37,217 lbs.	3,870
Other explosives ...	250,950 lbs.	19,040

LIQUID AIR AS AN EXPLOSIVE.

FREDERICK H. M'GAHIE, writing in the *Scientific American*, gives the following interesting remarks on the use of liquid air for explosives:—In a previous article it was pointed out that its theoretical value lay in the fact of its affording a source of highly condensed oxygen, and that, on account of the lower boiling point of nitrogen, liquid air could be profitably concentrated to a point where the percentage of oxygen ran from 50 to 75 per cent. The mixture of this oxygenated fluid with a proper combustible gives a powerful and simple explosive capable of detonation. It was further pointed out that the volatility of the liquid precluded its use in all but the large contracts where a liquefying machine could be installed as part of the contractor's plant. Even here, the practice generally accepted in blasting work as conducive to economical results, that of firing a large number of holes at once, put it out of consideration, since a delay in firing at once a hole, after charging with a liquid air explosive, entailed an amount of evaporation that was fatal. How this limitation entered into the problem was illustrated by the unsuccessful trial of the system at a coal mine in Europe, where prepared cartridges standing 15 minutes lost all or nearly all of their explosive power.

This oxygenated fluid is receiving another trial in Europe under conditions meeting its limitations as far as possible. The facts have been communicated to me by an eminent expert on explosives who has recently returned from Europe, and will be undoubtedly of much interest to the readers of this paper. Work is progressing simultaneously at both ends of a tunnel that is being put through the Alps. On the southern side the usual explosives for hard rock, blasting gelatine, and gelatine dynamite, are being used. On the northern side liquid air is being tried with concessions to its characteristics that afford it every chance of demonstrating any value it may have. In the first place, one hole, or a few at the utmost, are charged and fired at a time. This reduces the time in which the oxygen has a chance to evaporate, the method of charging a hole being, in addition, very simple and rapid. A cartridge, containing the combustible element in a form permitting rapid absorption of the liquid, is slipped into the hole, the oxygenated liquid poured into the cartridge, a cap with fuse put in, a light tamp inserted, and everything is ready for lighting the fuse. However, the firing of single holes means increased expense in the item of total idle time of the men during the explosions for a given amount of work. In the second place—and the most important side of the matter—much larger boreholes are being employed than are found advantageous with nitroglycerine explosives.

The problem in blasting work is generally to dislocate, per pound of explosive, the greatest possible amount of rock in fragments convenient for handling and removal. If the blasted material is to be used specifically for any purpose, blasting condi-

tions must be varied to give it in the desired sizes. Now, the character of the material determines the explosive to be used. In earth work the dynamites are outclassed by black powder, which develops its pressure comparatively gradually and dislocates or disturbs a large amount of earth, while the sharp action of the dynamites leads to compression of the material around the charge and strong wave movements in the total mass, but gives little useful work. In rock of any degree of hardness the reverse is true.

Here the black powder calls for tamping of fissures and boreholes to the extent that they are not the weakest points. The rock is removed in large masses, needing further breaking up. The dynamites do not require such heavy tamping, since they detonate and tend to crush the rock into small fragments. In the range from the soft to the hardest rocks there arises a similar need for variation in the action of dynamites, which is met by the admixture in various proportions of nitroglycerin with inert bodies, combustibles, or oxygen-bearing salts, alone or together. Such admixture not only changes the force but varies the sharpness of the explosive blow. The softer the material in which work is being conducted, the greater the need of an explosive giving a pushing rather than an impulsive shock. An apparently strange fact is that wet guncotton has a greater shattering effect than dry guncotton. Though wet guncotton has the lower explosive force, the detonative wave is propagated more rapidly in it, giving a sharper and consequently more destructive blow. This will illustrate why the various grades of dynamite have different effects. So it may be that liquid air explosives combine power and degree of sharpness of detonation in such a manner as to be well adapted to the hard rock met in this tunnel. The explosive employed should certainly have as high a strength as the gelatine dynamites. Being a mechanical mixture of combustible material, it would seem that it should not detonate as sharply as the gelatine dynamites. These conditions would seem to indicate that the borehole could be economically enlarged. But the results of long experience must settle the matter, especially the question as to what extent can a supposed decrease of blasting expenses under favourable conditions counterbalance the many disadvantages involved in such a volatile explosive mixture. It is apparent that operations must run very smoothly and everything held subordinate to exploding the charges as soon after the holes are ready as is possible. Now, delays must occur, and a weakened charge may produce undesirable effects, such as enlarging the borehole.

A Linde machine is made use of. Another point of interest is that a heavier cap than usual is required.

However, the phase of the question upon which these experiments bear is not the value of liquid air for general blasting work, but its value for certain classes of work under special conditions. The parties from whom the information came originally claimed success, but, as they were interested in the matter, the statement must be taken with the usual grain of salt. The history of explosives is full of wonderful compounds that perished prematurely through a thorough trial. I have in mind a non-freezing dynamite that was going to revolutionize things a few years ago. It strangely blossomed in summer time, when it proved part of the claims made for it, that of strength. Naturally, since it was a powerful dynamite, the first frosts wilted it badly. In most profane language irate contractors began asking what kind of a non-freezing dynamite was one that froze quicker and harder than their old friend, and in addition "busted" the cases and became very coy about exploding after being thawed out.

APPLICATIONS FOR PATENTS.

AUGUST 21st—SEPTEMBER 16th, 1899.

16,911. Universal Coin Cartridge. M. Kirwan.
16,931. Apparatus for Communicating Turret Movements independent of the Rotation A. T. Dawson and J. Horne.
17,041* Shrapnell Shells. B. W. Dunn.
17,055 Gun Mountings. Sir W. G. Armstrong, Whitworth & Co., Ltd., and Sir A. Noble.
17,103 Small-Arms, Machine, and Automatic Guns. C. S. Walker.
17,297 Breech Adaptors for Small Arms. L. B. Taylor, and E. H. Parsons.
17,378 Automobile Fish Torpedo. J. H. S. Bradley, and P. Nisbet.
17,400 Machine Guns. J. Formby.
17,425* Projectiles. J. Luciani.
17,458 Clutch Cartridge Gun. F. Bent, and T. Bent.
17,517* Machine Guns. E. M. Capps.
17,520* Fire-Arms. J. Rupertus.
17,660 Mirrors for attracting Birds for Shooting. L. A. Villard.
17,769 Armour Plates. J. L. Benthall.
17,863 Manufacture of Cartridges. P. Du Buit.
18,115 Range Finders. A. A. Common.
18,127 Fuses for Projectiles. Sir W. G. Armstrong, Whitworth & Co., Ltd., and A. G. Hadcock.
18,337 Sliding Target. O. Williams.
18,376 Turret Lathes. H. Austin.
18,389 Rapid Fire Pyrotechnic Guns. W. Teale.
18,501 Percussion Fuses for Projectiles. T. R. R. Ashton.
18,503 High Explosive Projectiles. T. R. R. Ashton.
18,516 Blasting Composition. S. Fülöp, and M. J. Luckovic.
18,520 Appliance for use with Igniting Fuse. E. Fox.
18,569* Illuminating Projectiles. T. Toccaceli.

* These applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

AUGUST 26th—SEPTEMBER 16th, 1899.

16,087 (July 23, 1898). J. Formby, Formby. An automatic rifle, provided with a falling block breech action combined with a vertical type of magazine. This arrangement allows the rifle to be used either as a single loader or as a repeater. Special apparatus attached to the rifle shows at a glance whether it is being used as a repeater or not, and it is claimed that by another special device which is provided it is impossible for the arm to be accidentally left loaded. Accepted Aug. 23, 1899.

18,935 (Sept. 5, 1898). J. Akell, London (*Agent for H. Pipitz, Austria*). A modified process of manufacturing gunpowder, which is adapted for use as a sporting powder, or in rifles or artillery. It consists mainly of nitrocellulose, which is prepared by a special process, and the explosive is finished by coating the grains with collodion, driving out the superfluous solvent, and then condensing the powder and finally coating it with paraffin. Accepted Aug. 26, 1899.

19,074 (Sept. 7, 1898). W. H. Cromie, London. The manufacture of explosives from nitrocellulose, which is produced by a special process, and which can be completely dissolved in ether or alcohol. The explosive, which is gelatinized by means of this solvent, is claimed to be of great purity and density. Accepted Aug. 5, 1899.

19,349 (Sept. 12, 1898). T. B. Burns, Bristol. A method of lowering or raising targets by means of a treadle, which acts upon a lever communicating with toothed wheels. Accepted Aug. 12, 1899.

20,983 (Oct. 5, 1898). R. A. Hadfield, Sheffield. A method of attaching caps to the noses of projectiles by hydraulic pres-

sure. This process, it is claimed, does not weaken the projectile so much as in cases where grooves are cut for the reception of a cap. Accepted Aug. 5, 1899.

21,477 (Oct. 12, 1898). A. T. Dawson, London, and J. Horne, Barrow-in-Furness. This patent relates to secondary mechanism to the ordinary hydraulic or electric operating gear, which is used for running out the gun after recoil, and for elevating the gun slides with the gun and cradle either before or after running out to the firing position. This independent mechanism may be operated by hydraulic or electric power, or by hand, or by a combination of the two. Accepted Aug. 12, 1899.

21,844* (Oct. 17, 1898). Kynoch, Ltd., Witton, and G. Hookham, Birmingham. Kynoch Waterproof Cartridge Cases.

21,946 (Oct. 18, 1898). A. T. Dawson, London, and J. Horne, Barrow-in-Furness. A device connected with the braking and rotating mechanism of heavy turntables or turrets, which consists of a single brake, which is always in action, no matter whether the rotating mechanism is operated by power or by hand. It is always in connection with the rotating operating shaft, and is so arranged that no disconnecting gear is required when a change is made from power to hand-working. Accepted Aug. 12, 1899.

22,398 (Oct. 25, 1898). H. S. Wilson, Blackrock, and W. G. Wilson, London. A time and percussion fuse, which is screwed into the projectile, and which consists of two parts. The top part of the fuse can only turn in one direction, and the position of the top in relation to the bottom governs the length of time which elapses before the fuse ignites the explosive in the projectile. Accepted Aug. 26, 1899.

22,438 (Oct. 25, 1898). A. T. Dawson, London, and J. Karstairs, Crayford. This patent is based upon the discovery that if, as a projectile is leaving the bore of a gun, it is subjected to a more powerful impulse, greater velocity is obtained. The patent, therefore, relates to a charge made up of discs of explosives, the outer portion of which is of a lesser explosive power than the inner. Accepted Aug. 19, 1899.

22,492 (Oct. 26, 1898). T. Andrews, Woolwich. This patent relates to self-lubricating projectiles for small-arms or machine guns, and is a modification of a former patent. The lubricant in this projectile was originally forced out of passages in the nose by atmospheric pressure. But the passage of air through the empty passages greatly increased the resistance, and this patent deals with an air-check, the object of which is to obviate this difficulty. Accepted Aug. 12, 1899.

22,528 (Oct. 26, 1898). A. Reichwald, London (*Agent for Fried. Krupp, Germany*). The apparatus dealt with in this patent is provided for use in quick-firing guns of large calibre, for facilitating the operation of opening and closing the breech. The wedge, which heretofore existed in wedge breech-closing mechanism, slid over the face opposite it, but in this apparatus it is mounted on rollers, with the object of reducing the friction. Accepted Aug. 19, 1899.

22,535 (Oct. 26, 1898). Sir W. G. Armstrong, Whitworth & Co., Ltd., Sir A. Noble, and G. Stuart, Newcastle-on-Tyne. This patent relates to a modified pattern of time fuse, and it is claimed that the alterations provide for increased delicacy in the setting, increased power in rotating the fuse ring, and does away with the key, which is not required for tightening the nut. Accepted Aug 26, 1899.

22,606 (Oct. 27, 1898). A. T. Dawson and G. T. Buckham, London. A safety arrangement, which is attached to breech-loading mechanisms of the interrupted screw type, and also a special apparatus for opening and closing the breech. Accepted Aug. 5, 1899.

26,864 (Dec. 7, 1898). A. T. Dawson, London, and J. Horne, Barrow-in-Furness. Various modifications to gun mountings and recoil gear attached to heavy and medium-sized guns. Also a method of controlling the run out of a gun which, when in horizontal positions, generally runs out with objectionable violence. Accepted Aug. 19, 1899.

8,679 (April 25, 1899). T. H. Kelly, G. W. Bell, and N. Kirk, Sydney. An explosive compound, consisting of nitroglycerin, containing spirit of eucalyptus leaves, mixed with nitrate of potash, calcined leaves, and cork dust. Accepted Aug. 5, 1899.

10,799* (May 23, 1899). G. D. Potter, U.S.A. Ejecting Mechanism for Shot Guns.

11,294 (May 30, 1899). J. P. de Braam, Paris. This patent relates to a machine for loading sporting cartridge cases, and has several important modifications on the ordinary machine now in use. The cartridge is loaded by six successive operations, and is ejected from the machine completely loaded and turned over. An important feature claimed for this machine is that it may be adapted to load cases of various calibres. Accepted Aug. 12, 1899.

12,147 (June 10, 1899). H. P. Hurst, U.S.A. This patent relates to a number of modifications in explosive projectiles and fuses, the objects of which are to provide greater security to the explosive charge as a whole, by splitting it up, and to prevent any accidental explosion of the fuse charge from detonating the main charge in the shell. There are twenty-five claims to this patent. Accepted Aug. 5, 1899.

12,824 (June 20, 1899). W. R. Benjamin, U.S.A. Mechanism is described in this patent, the object of which is to provide improved means for charging the air reservoir, which in this instance forms part of the stock, in pneumatic rifles. It also describes a modified form for holding the air in check, and releasing it to discharge the projectile. Accepted Aug. 5, 1899.

13,021 (June 22, 1899). H. H. Lake, London. (*Agent for R. T. Coleman, U.S.A.*). This is another patent relating to a machine for loading cartridge cases, in which numerous modifications are described and set out in the twenty-three claims attached. Accepted Aug. 12, 1899.

13,027 (June 22, 1899). P. M. Justice, London (*Agent for the Driggs-Seabury Gun and Ammunition Co., U.S.A.*). This patent relates to the breech mechanism of ordnance, and describes several modifications to the present method of rotating the breech block, for opening and closing the breech, for firing the gun, for preventing premature discharge, and also for ejecting the empty cartridge cases. Accepted Aug. 12, 1899.

13,214 (June 26, 1899). G. Langer, U.S.A. A range finder which is comprised of two telescopes so fixed that they may be directed to a common point of the object sighted. The two telescopes being directed at the same object, converge towards one another, and form two sides of a triangle, which is the basis of the calculations. Accepted Aug. 5, 1899.

13,636 (July 1, 1899). H. Hammond, E. Hammond, and F. Hammond, Winchester. A wad composed of linseed, or any seed which contains oil, for use in loading cartridges. On discharge the oil is pressed out of the wad and lubricates the barrel. This, it is claimed, prevents leading or fouling. Accepted Aug. 5, 1899.

13,890 (July 5, 1899). W. H. Chambers, U.S.A. A combination of sights, which when in alignment form a circle through which the target may be clearly seen. Accepted Aug. 19, 1899.

14,692 (July 17, 1899). J. T. Armstrong and A. Orling, London. A method of steering a torpedo from a distance and operating its pistol firing apparatus. This is effected by a beam of light which is projected from the controlling station in such a manner as to influence a selenium cell, and so improve the conductivity of a distant closed circuit, of which the cell forms a part. Accepted Aug. 19, 1899.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

WATERPROOF CARTRIDGE CASES.

21,844. (October 17, 1898). Kynoch, Ltd., Witton, and G. Hookham, Birmingham. This patent deals with a modified process of manufacturing and waterproofing sporting cartridge cases. The object of the present mode of manufacture is to secure more perfect cohesion of the strip of pasted paper which is rolled into the tube. At times it has been found that defective cohesion of the layers of paper composing the tube is liable to occur, and this leads to blistering of the case.

This specification describes a tool which it is claimed obviates the difficulty. It consists of a roller which is of a size to suit the diameter of the tube to be rolled. By means of this roller pressure is applied to the pasted strip as it is wound upon the mandrel, and the paste is uniformly spread between the layers, while the effect of the squeezing is to spread the paste and at the same time

repel all that is superfluous together with any air that may have been imprisoned. By this method better adherence between the ayers is obtained.

A system of waterproofing is also described in this specification. The first process is the drying of the cases after manufacture; they are then glazed by forcing them through a die in the usual manner, after which they are thoroughly impregnated with paraffin or other wax by an immersion for about two hours in a bath heated to about 160 degs. F. The cases are then placed in an oven and heated to about 180 deg. F. to remove the surplus wax from the surface. After this the cases are capped, and are packed in trays. They are then immersed in a bath of celluloid or other varnish up to the metal caps, and are afterwards dried. By these means the thoroughly waterproofing of the cases is effected. Accepted August 12th, 1899.

EJECTING MECHANISM FOR DROP-DOWN GUNS.

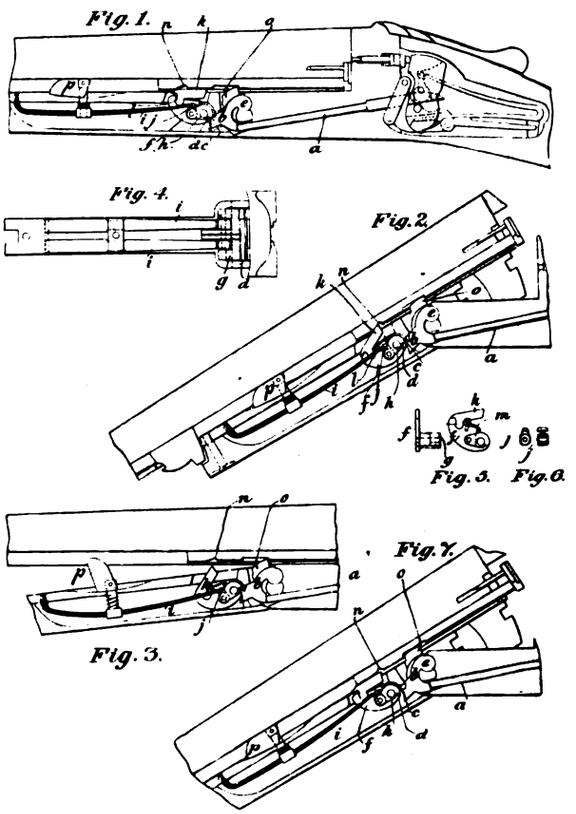
10,799. (May 23, 1899). G. D. Potter, U.S.A. The present patent deals with a modification of the ejector mechanism described in the earlier specification of the same inventor (Patent No. 13,251, 1895), which was described in our January, 1896, issue. As will be seen from the accompanying drawings, the cocking mechanism consists of a cocking rod which is actuated in the closing of the barrels. The forward end of this cocking rod serves to set the ejector mechanism in a state of tension ready for the expulsion of the spent cartridge cases.

Referring more particularly to the illustrations, Fig. 1 shows a side view in section of the left-hand barrel mechanism, the parts being in the position after firing and before opening the gun. Fig. 2 is a view of the same parts, not, however, including the lock mechanism, and in the position where the barrels are partially dropped, and just before the ejection of the spent cartridges takes place. Fig. 3 shows the same parts as Fig. 2 after the ejection has taken place. Fig. 4 is a plan view from underneath of the ejector mechanism. Figs. 5 and 6 show individual parts of the ejector mechanism. Fig. 7 shows a special attachment on the fore-end.

When the parts are in the position shown in Fig. 1, the gun having been fired, the cocking rod *a* is acting upon the cocking lever *b*, holding it in a forward position so that its notch *c* engages in a corresponding recess *d* of the hub of the ejector hammer *f*. It should be understood that the cocking lever *d* is pivoted at the top of the bearing of the circular part *e*, partly within the body of the action, and partly within a recess in the joint pin. It should also be understood that the ejector hammer *f*, and its attached hub *g*, which is separately shown in Fig. 5, is pivoted at *h*, and that the ejector spring *i* is attached to the hub, so operating the ejector hammer by means of the stirrup *j*, which is separately shown in Fig. 6.

As the barrels are dropped to open the gun, as shown in Fig. 2, the cocking lever *b* is withdrawn back into the slot in the fore-end by reason of its movement on *e* as a centre. By this movement the ejector hammer *f* is also rotated against the pressure of the spring *i*, and in this way the ejector hammer is cocked as shown in Fig 2. Unlike other ejector mechanism, the ejector hammer does not strike directly against the extractor rod, but it acts through the plunger *k*, which is pivoted at *l* on to the ejector hammer. It will be seen in Fig. 1 that the plunger *k* lies flat beneath the extractor rod. The gradual turning of the ejector hammer *f* *p* carries the plunger *k* with it until, by the action of the spring *m*, the plunger *k* rises into the bent *n* cut in the extractor rod. This cocking of the ejector hammer proceeds simultaneously with the gradual forward movement of the extractor rod under the influence of the pressure exerted during the opening of the gun by the post *o*. When, therefore, the parts have arrived at the position shown in Fig. 2, the mechanism is ready to effect the ejection of the empty cartridge. Consequently, at the required moment, the hook *c* of the ejector lever *b* slips out of engagement with the corresponding recess *d* on the hub of the ejector hammer. The ejector hammer is then free to respond to the ejector spring *i*, which latter imparts a sudden impulse to the ejector hammer and throws the extractor rod backwards by means of the plunger *k* acting against the notch *n*.

The blow given to the extractor rod carries it some distance, as shown in Fig. 3, this distance being sufficient to cause the plunger *k* to be bent downwards out of engagement with the notch *n*. When the gun is closed, the standing breech carries the extractors and the extractor rods into their closed position, and the extractor rod slides over the plunger *k* without meeting with any resistance, and the parts are once more in a position for the firing of the next shot. It should, however, be understood that before the barrel has been fired, viz., when the tumbler is in a cocked position, the cocking rod *a* is so placed as not to set the cocking lever *b* in a position to operate the ejector mechanism, when the gun is opened. The dotted lines in Fig. 1 show the position of the ejector lever before the tumbler falls. It is not until the tumbler has fallen that the cocking rod sets the locking lever *b* in a position to engage the ejector hammer *f*.



Special arrangements are made in the construction of this mechanism to provide for the putting together of the gun, no matter whether the tumblers are cocked or not. The tension lever *p*, which is seen in an upright position in Fig. 7, is an arrangement for taking the tension from the ejector spring when the gun is in pieces. In putting on the fore-end, as shown in Fig. 7, the tension lever *p* is in an upright position, and the act of pressing the fore-end against the barrels presses this lever downwards, and the position of its fulcrum is such that the ejector spring is at full tension, as shown in the other drawings, as soon as the fore-end is home. Accepted August 5th, 1899.

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CURRENT TOPICS.

Three London Gunmakers.—A note which appeared under this heading in our last issue noted the birth of three new houses in the London gun trade—Messrs. Mortimer & Sons, New Bond Street, W.; Messrs. Blissett & Sons, High Holborn, W.C.; and Mr. Jackson, of Wimpole Street, W. Our authority for this announcement, as was stated at the time, was the marks which appeared upon certain guns exposed for sale in the Strand at the premises of Messrs. S. Goff & Co., portmanteau manufacturers. At the time we expressed some doubt as to whether the names on the guns coincided with business establishments at the addresses named. Since then our enquiries go far to show that such places of business have no existence in fact. As was also mentioned in our last issue, two of the guns in question have no connection with the houses of Mortimer of Edinburgh, nor Blissett of Liverpool, respectively. The Gunmakers' Association appear disposed to investigate the anomalies, and with a view to that end they applied at Bow Street for the granting of five summonses under the Merchandise Marks Act, and one under the Trade Marks Act. The whole of the summonses were granted, the information being sworn by Mr. Max Baker, as secretary of the Gunmakers' Association, and Mr. Henry Alfred Alexander Thorn, trading as Charles Lancaster, as a member of the Executive of the Gunmakers' Association. From the short statement made by Mr. R. T. Woulfe, the solicitor of the Gunmakers' Association, it appears that the informations were based upon a gun, worth about 35s. wholesale, which was bought from Messrs. S. Goff & Co. for £6 10s. as a "Mortimer" gun, and which bears the name "J. Mortimer & Sons, New Bond Street, W." He further stated that he did not think the case would be contested, since the salient points of the offences specified in the various summonses had already been admitted by the defendants, the chief point being that the guns were acknowledged not to be the manufacture of the person or persons, if such exist, whose trade description appears upon the barrels. The case is down for hearing at Bow Street on Saturday, the 4th inst., at 2 p.m.

The Kynoch Journal.—It gives us great pleasure to extend the right hand of fellowship to the *Kynoch Journal*, which no doubt a number of our readers have seen by this time. The Kynoch Press has been an institution for some time past, and from it have been evolved many of those high-class pamphlets relating to the Kynoch productions. Now a more ambitious effort has been made, and the *Kynoch Journal* is the result. At first sight it seems strange that a journal, emanating from a place chiefly noted for its cartridges, should contain scientific essays on the most approved lines. The literary standard maintained in the various articles is distinctly good, and when it is remembered that one member or another of the Company's staff is responsible for everything which appears, surprise gives place to astonishment. It is to be hoped that future issues will be marked by the same high standard of material, and that we have the considered opinions of such high authorities upon matters of passing interest. In the time of Dr. Walsh, editor of the *Field*, the whole trade of guns, powders, and ammunition could barely claim the extent of scientific knowledge now possessed by the staff of the Kynoch Company. All credit is due to Dr. Walsh for leading the way towards the scientific treatment of these subjects, and the

trade have not been remiss in following the lead of this distinguished authority. The *Kynoch Journal* is a sign of the developments which have taken place. The scientific knowledge of gun questions has passed from the professional journalist to the gun and ammunition manufacturer. In the conduct of our own paper we have realised this; for we fully understand that a writer, or in fact any single individual expounding from his own inner consciouness, cannot teach manufacturers their business. The attempt to do so only stultifies the writer. The only safe plan in these days is to be in the closest touch with the various authorities on each subject, and to publish their views with such additional information as may be necessary for the enlightenment of the non-expert. The contents of the October-November issue of the *Kynoch Journal* are of distinct interest. The portrait gallery series opens appropriately with Mr. Arthur Chamberlain, J.P., as its subject. Then we are told about the recent rifle and ammunition prohibitions in India. After that is a disquisition upon cap development leading up to the introduction of the medium nitro. Technical Education—Glycerine—Modern Rifle Shooting—Mark IV. Bullet Scare—Projectiles for Large Guns, are some of the articles which catch the eye. Even the funny man of the staff has a turn on the back cover, though we fear that he sadly misrepresents the Scotch gunmaker when he puts into his mouth such words as the co-efficience of air pressure. Personally we never heard a Scotch gunmaker talk about the co-efficience of air pressure, or in fact of the co-efficience of anything else. Personally we would say to the *Kynoch Journal* what the schoolmaster said in his testimonial of a clerk we engaged some years ago, "I say unto him, go forth and prosper."

The Birmingham Proofmastership.—Some apology is needed for referring to the pending appointment of a new proofmaster to occupy the place of the late Mr. Allport at a time when the tolling of the bells has hardly died away in the distance. But the preliminaries to a sort of miniature presidential election are already in full swing, and we feel called upon to do a little plain speaking. Names are already mentioned, and are canvassed about the trade, and many hungry eyes are turned upon the soft and well-lined arm-chair which has come to be regarded as the last resting-place of good gunmakers. The salary of £600 per annum makes many mouths water, and competition for the post becomes keen. Personally we do not think that anyone able to fill the all-round position of the late proofmaster can be found; so that it becomes necessary to examine the true aspect of the position. The proofmaster is primarily supposed to stand between the trade guardians on the one side, and the public, whose interests the Proof House was established to protect, on the other; and in this capacity the Act of Parliament enables him to override the views of the Guardians. From other points of view the proofmaster is simply the general factotum and clerical chief of the Proof House. His duties in this direction are mainly routine and of small value commercially. It is only by accident that the proofmaster is a scientific expert; but even then such technical questions as require settling from time to time should be referred to a special committee, as is done with all the other special departments of the work of the Proof House. The life-long tenure of the position of proofmaster gives rise to grave scandals. Mr. March, the predecessor of Mr. Allport, was only at the Proof House a few days during the last year of his life, and yet he absolutely refused to contribute any portion of his salary towards the cost of the deputy whom the Guardians found it necessary to appoint. Fortunately, Mr. Allport's intellect remained in all its freshness to the very end, so that no reflections of this character can be held to refer to his tenure of office. We place it on record as our deliberate opinion that means should be found to limit the tenure of office by the proofmaster to the time that he can do justice to the calls of his position. This opinion is held among those in the gun trade of Birmingham who are the active workers of the present day. They want to buy the best services that the available funds will command, and to break up the arm-chair traditions of the post. When our military weakness as a nation began to perturb public opinion, it was left to the Secretary of State for War to remove the incubus which stood in the way of effective reform. In due course, the Commander-in-Chief "retired," and a new order of things was put into force, viz., the five years' tenure of office. This principle ought to be adopted in the appointment of the new proofmaster; and, if the Act of Parliament stands in the way, it ought to be made a condition of appointment that the new proofmaster should agree in writing to give every assistance to the passing of a new Act embodying such a provision. Furthermore, the proofmastership duties should be defined. At the present time the work is not worth the pay of a bank cashier; and though the Act specifies a minimum salary of £400, this could be got over by the appointment of an honorary proofmaster, as is allowed by the Act, and the creation of a deputy proofmaster at a salary commensurate with the work required. We look on the whole matter as one requiring strong action on the part of those who have a real stake in the success of the trade, and we make an appeal to those who, while practically retired from active work, have retained their influence on the Proof House by reason of the elastic system of registration, which allows directors of public companies to be registered as gunmakers. The class who wish either to make the proofmaster a useful man of all-round utility in the trade, or to reduce the salary to a figure commensurate with the strict requirements of the position, are those whose real grip of affairs arises from active work as manufacturers. The conservative element, which is credited with a desire to continue the policy of providing a nice pension for one of their number out of the funds of the Proof House, should be guided in the present crisis at least by the views of those who seek to maintain the Birmingham gun trade in the pre-eminent position it should occupy.

THE sympathy of his many friends will be accorded to Mr. Charles Eley on the recent death of his wife.

The Henry Rifled Barrel Co., Ltd., is entering upon a fresh career of usefulness in the way of extending its series of manufactures, so as to include general engineering work. Mr. Watson Foggo has been appointed general manager of the Company.

The trade has probably heard of Mr. R. W. S. Griffith's entire restoration of health. After a course of strict medical treatment he is discharged as cured, and has announced to his many friends that he is once more in a position to act as their guide, philosopher, and friend in expert gun questions. It is even rumoured that another of his lectures in the coming year will advance exact knowledge of small-arms yet another stage onwards.

THE LATE SAMUEL BLAKEMORE ALLPORT.

It is with no ordinary feelings that we record the death of a loyal and dear friend in the person of the Birmingham Proof Master. At any time it would be difficult to find the material wherewith to give any idea of the work to which he has devoted a lifetime. His retiring nature led him to discourage any attempt to connect his name with what he had accomplished. Within a week of his death he wrote to us, in reply to a request for the use of his portrait in connection with our account of the recent opening of the new ranges:—"To tell you the truth I would *rather not* be immortalised in your pages, but am at your mercy." Such account, therefore, as we are able to give of his life work, especially at a time when the grief of those who have lost a friend prevents our enlisting the help of those who have known him well, must necessarily be of a fragmentary nature.

Whatever might be his dislike to ordinary publicity, as a correspondent he could open his heart; and it is among the many thousands of letters he has written to his intimates, that his real achievements and true character come forth.

For instance, on June 3, 1893, he wrote:—"I have made "the very best work in Birmingham for thirty-five years, and "supplied every best London house all the time, and after "offering my complete plant and a splendid connection every-"where in vain, it will all be sold under the hammer in a fort-"night. Having built it up with much care and invention all "that time, it is a real grief to me, but I lost my only son "eight years ago, who was a nice lad, and would now have "been 25. I may send you some thoughts on 'Crushers' (on "which I have read your papers with interest) when I am a "little relieved from the above matter."

A few days later he writes:—"I duly received your kind "letter. I must ask you to excuse my replying to it definitely "for a fortnight; for on the 20th inst. a three-days' auction "begins of all my business effects, the accumulation of 50 "years, and it is a great trial to me every way."

A few months later he writes:—"A controversy is going on "between the two proof companies on a question of principle "in imposing the proper stress on sporting arms. The "London Company want to prove all guns for nitro powders "with a fine black powder, I contending that they shall be "proved with the powder declared to be used in them, and "in 1887 a 'Rule' was specially and deliberately formulated "to that end, and approved by the Secretary of State. Of "course, now so many new powders have sprung up, this "gives a lot more trouble, and we have to keep a lot more "powders carefully, but I go for a true principle and no "'fudging.' They contend the nitros are too variable, more "so than black. To the latter I agree, but reply, if a powder "is too variable to prove with, it is too variable to shoot with. "Then they give enormous differences under like conditions "to an extent which is crass nonsense, and I say so as "politely as patience will permit. I have challenged them "all round to prove the expression 'tons per square inch.' "No one can do it; they all shirk it. Presently I will send "you my view after months of reflection and experiment. "During the month I shall have been visited by the principal "or chief representative of every nitro powder-making firm, "and I must express my pleasure at the very courteous will-"ing way in which every one lays himself out to help me in "exhibiting the best regularity they can effect. Roughly "speaking, the slow-burning, more bulky nitros, are most "irregular, especially at the extreme breech; the more quickly-"burning, violent, less bulky powders, are the more regular. "I have crushings and measurements of every powder, and "every shot fired with it all down the gun (3 at each point) "laid out materially on a large sheet with thickness of crush-"ing subscribed, and I mean to get a more satisfactory solution "of this subject than has hitherto been exhibited, if I "can."

We remember once seeing him off by his afternoon train home, and he appeared to be on the best of terms with the boys of King Edward's School, who travelled with him day by day. He explained with great glee that some of these youngsters once asked him whether he was the father of Mr. Hunter Smith (one of the masters). Truly, the resemblance was marked, as will be apparent to all who knew the two by sight.

We have endeavoured to show the true personality of Mr.

The Late Samuel Blakemore Allport.

Allport from his own mouth, and we believe that the real lovableness of his character is fully expressed. He had no patience with what he considered "humbug," and here we can account for the few cases where relations had become strained by scientific controversy. Cases are, however, very rare where the highest esteem for the personality of Mr. Allport has given place to less friendly feelings engendered by his uncompromising exposure of fallacy, or what seemed to him as such.

As a man of cultivation his company was always a charming experience. Once the writer visited the United Service Museum with him, and was astonished that he recognised every part of the ground, and every section of the forces by name on the large model of the battlefield of Waterloo. That day he told us many things of his early career. Like Metford he was engaged in early life as a civil engineer; like Metford he worked under Brunel; but, unlike Metford, he refused the inevitable offer of a foreign appointment, and so was enabled to enjoy good health for the remainder of his life instead of returning a physical wreck, as did Metford. While referring to Metford it will be interesting to point out that these two

met, as is shown from the following extract of a letter, previously referred to as having been written to us by Mr. Allport just before his death. He says:—"I see the obituary of Mr. Metford in the *Times*. I cut most of his early rifles. He and Halford haunted my workshop for weeks. (Not for publication)." We trust there is no breach of confidence in publishing these words, now that their author is no longer in a position to bind one to confidences which only have for object the concealing of the origin of his good works.

It may be asked what was accomplished by a man having this great power of original work. We can only say that his good deeds are to the credit of other persons. It was, for instance, an Allport rifle which obtained second place in the *Field* rifle trials, under rather unfavourable conditions, and yet no one ever heard of an Allport rifle, and Mr. Allport never wished that they should. Again, we have Mr. Allport as a collaborator with Metford and Sir Henry Halford. Few knew of such a connection, and yet we may be sure that Metford did not go to the most experienced rifle manufacturer in the country without inviting and making use of his very special knowledge. This is the secret of Mr. Allport's career. It is in the good work of others that his own accomplishments became known to the world. We have certainly heard of the Allport barrel gauge, the few surviving specimens of which are still practically the only ones of their kind. But this was a special tool appealing only to the trade, and in this way his name became connected with it. The full scope of his knowledge was available to all, and few failed to seek it when in doubt. Henry, of Edinburgh, was among these, and the name Martini-Henry is evidence that the co-operation was a fruitful one for Mr. Henry.

His career, in summary, is as follows:—He was apprenticed to his father in 1836; between then and 1858 he took up the profession of a civil engineer, but in the latter year he returned to his father's business. He was elected a Guardian of the Birmingham Proof House in 1867, and became chairman of its board in 1887. He continued in this position until 1892, when, as his letter already quoted shows, he retired from the business and took up the position of proof-master. On Tuesday, October 24, 1899, his career ends with his death from pneumonia, at the age of 76. He died literally in harness, and he lived long enough to see the latest of his enterprises completed, the new closed ranges at Small Heath.

It is futile to ask where another Allport may be found. There has been but one, and there never will be another.

INCIDENTAL JOTTINGS.

WOOLWICH AND THE WAR.

The excitement of the war is at its highest. At every street corner are busy men and women snatching a moment to scan the latest edition with hungry appetites for the feast of war details so lavishly manufactured or supplied by the enterprising evening papers. At such a time it is a relief to go to the great emporium of war material, Woolwich Arsenal, where, throughout the factories, that characteristically calm, methodical person, the English workman, is manipulating his material as though it were simply a matter of filling up his time till the vesper bell shall release him. The exigencies of the Boer War, except in a few cases, do not demand any special effort in the manufacturing departments. In the Ordnance Store and Clerical Department it is different. Stores are being issued and shipped in such large quantities that the British taxpayer may well feel proud of his enormous stock in hand. It is an agreeable surprise to the visitor who imagines a scene somewhat suggesting the Army and Navy Stores in a Christmas week, or Whiteley's during a remnant sale. There is something so charmingly reassuring in this apparent nonchalance in the factory to which all our eyes are turned, and upon which so much depends at this time of war.

MANUFACTURE OF TIME FUSES.

We are at all times so ready to condemn, that in reparation we owe it to Woolwich experts to congratulate them upon their splendid fuse work which is so highly effective in South Africa. The Woolwich shrapnel has always held its own; and if we are to believe the war telegrams, what comes next to the splendid accuracy of our gunners is the time fuses which have acted with a precision unparalled in any former action, and which have been greatly instrumental in our success. This should come as a warning to those who are seeking to introduce a different system of manufacture. The actual money saved in the more economical manufacture of a fuse is nothing, if extreme accuracy, the all-essential point, is to be sacrificed in any way whatever. Hitherto the trade has failed to supply the War Department with time fuses which can pass inspection. It is complained that they are submitted to a hypercritical examination, and the proof is very severe, the permitted variations in their dimensions being so very small. Woolwich has always conformed to its own tests, and has now vindicated its superiority in that most critical test of all actual service. We are constrained, therefore, to ask whether it is wise to change the satisfactory existing system for another, which is the system generally adopted by the trade, and which has caused them to despair of ever making time fuses to pass Government inspection with any commercial result.

HIGH EXPLOSIVE SHELLS.

It makes us all the more pleased with our own munitions to read of those used by the enemy. We are told that their missiles are "plugged shell," which means they have no explosive in them. But if our own information is correct, this is not the case, for they are mostly high explosive shells with percussion fuses. These fuses are fairly simple to manufacture, but they have the defect of not always exploding on impact, especially with certain high explosives, such as Lyddite, which is not easy to detonate. This will account for the low percentage of bursts. At Elands Laagte the Boer shells were more successful; but when we captured the position the guns were found to be those which were taken in the Jameson Raid and of British manufacture. We have yet to learn how the heavier artillery of Krupp manufacture behaves.

HOWITZER LYDDITE BATTERY.

We are not impressed with the seven, nine, and 12 pounders on the Western Frontier. By the bye, our enemies will get their first taste of Lyddite when our 5-inch Howitzer Batteries arrive. These magnificent weapons will show to greatest advantage in storming the towns. They should also prove effective in destroying fortifications on the hills govern-

ing those passes in which the enemy hope to entrap our soldiers in their forward march. As Sam Weller would say, "You needn't open your mouth so invitingly wide, Mr. Boer, we can draw your teeth well from the outside." These high explosive shells were used for the first time at Omdurman, but the shells did not burst as satisfactorily as could be wished. This time we trust that the improvements recently introduced will enable the guns to demonstrate their true worth.

JOURNALISTIC WAR YARNS.

We read in the daily papers of "Lyddite Mines" being laid, and of "Lyddite Shrapnel Shell," and of many other appliances unknown to the War Office. We also read, with feelings of grave concern for the effectiveness of home manufacturers, that an American firm has received an order for 10,000,000 cartridges loaded with Cordite, and this while our own great Arsenal, together with the private manufactory concerns, are working on short commons as regards work in hand. It is a trifling detail that Cordite has not yet been made in the States, and that the intricacies of our Imperial pattern of cartridge have yet to be studied and grasped across the water. My dear friend, Mr. "Special Edition," we decline to swallow quite all of these fancy stories. Our "splendid isolation" makes us quite independent of any nation for war stores, except in the eating line; and you will doubtless have the felicity of recording the cases of ptomaine poisoning from tinned goods, which may occur if our wily inspectors happen inadvertently to pass any of the "Special Cuban Brand," as this might even affect the cast-iron stomach of Tommy Atkins, as it did Cousin Jonathan's tender vitals.

THE NEW "FAWN" COLOUR.

What is the new colour which all our transport wagons, limbers, etc., are painted? We are told it is the "Brown Paper" colour of the Veldt; again, the "Kharki" colour of the soldier's uniforms. The stores drapery department calls it a "biscuit colour," whereas in Regent Street it is "*café-au-lait*." My house decorator man maintains it is a dark "stone" colour, whilst my artist friend protests that it is a raw umber. This should be brought before the Nomenclator-General at the War Office, and the matter set at rest. Inspired by the weather we have lately experienced, I would suggest that we call it "atmospheric brown." Whatever the correct designation of the colour, it is an exceedingly good move to adopt the monotone of the South African Veldt. For years this has been talked about; yet our soldiers have had their scarlet coats and black trousers, giving every chance for the enemy to spot them at great distances. Will someone now invent an innocuous dye to paint the horses and all accoutrements, and we shall then be complete.

SMALL ARMS PROJECTILES.

Are the Boers using explosive bullets? We hear of such being picked up in the field, but up to now we do not hear from the army surgeons, who ought to know, of any cases where such have occurred. It is doubtless the variety of bullets which the Transvaal officials indulge in that perplexes our soldiers. The bulk of the Boers have the German Mauser with steel-covered envelope, the noses of which have been found, in some instances, to have been filed away. This is a doubtful advantage, as this amateur operation sacrifices accuracy in flight for mushrooming upon impact, though perhaps in volley firing at short range the bullets may be more death-dealing, while for "Dopping" it would render them less effective. The machine gun cartridges are of the Martini-Henry type, loaded with Cordite, and having nickel-covered bullets. A large number of the old Boer Free Staters stick to the Martini with black powder and lead bullets, and I'm not sure that their chances of doing execution are the least. The Boers also have some 37 mm. automatic Maxim guns, which fire 400 1-pounder percussion-fused charged shell per minute. These are not small arms nor field pieces, and they are the sort of gun which is not likely to be of great value owing to its short range. Their Schneider-Canet field guns should be of much greater value. The whole of our own small arm ammunition for rifles, carbines, and machine guns, is the ·303 calibre Mark II., though whence all the Mark II. ammunition came or comes from is a wonder, seeing how long it is since it ceased to be manufactured.

MAUSER *v.* LEE-ENFIELD.

This small arms ammunition question will be well worth watching since the enemy have bought largely from many Continental firms and from America. Already those cartridges with "N.F." and "D.M.Y.A." on the base are withdrawn, as they appear to burst the rifles, but whether this has been entirely the fault of the ammunition is not yet known. I don't in the least wish to brag on behalf of our country, but I opine that our Cordite cartridges will show splendid comparative results. Though the Mausers used by the Spanish are of different pattern to those now being used by the Boers, I trust we may say, as the American lady did, who naïvely remarked to me after the Cuban War, "Let us be thankful our poor soldiers were shot with nothing worse than Mausers, as nearly all of them have recovered."

Cyclops.

We understand that the affairs of Mr. J. R. Hanson, of Lincoln, have been placed in bankruptcy.

We understand that Mr. D. Watson, of Inverness, is retiring from business, and that his late manager is taking over the concern.

We have received the second edition of Mr. Charles Lancaster's pamphlet of Pygmy testimonials. Those who do not know Mr. Lancaster might smile at the fact that the testimonials are signed with various letters of the alphabet; but we have had proof that genuine originals can be produced in the case of every quotation.

Mr. K. D. Radcliffe is now the proprietor of the business carried on under the name of J. S. Boreham, of Colchester. Mr. Radcliffe, the son of a military officer, started as a sort of shop boy, and his great industry and shrewdness in business matters enables him to take up the business of proprietor now that Mr. Boreham is retiring.

The gunmaking firm of F. T. Baker, in Fleet Street, has liberally bedecked the windows with notices announcing expiration of lease, and that the premises are coming down. For many months past the building has been supported with external timber, and its doom is now signed, and its demolition will commence after the turn of the year.

Mr. W. R. Hillsdon, who has been away from the Kynoch London office for the past six weeks, has been suffering with a return of an old trouble in the knee. He is now taking a course of brine baths at Droitwich, and it is hoped that this will effect a speedy cure. During Mr. Hillsdon's absence Mr. H. T. Whitfield has taken charge of the interests of the London cartridge trade.

MR. THOMAS TURNER.

MR T. W. WARD,
(Chairman of the Trade).

MR. J. C. SCOTT.

THE NEW RANGES IN BIRMINGHAM.

A LARGE, and we may add a distinguished, company of visitors accepted the invitation of the Birmingham Proof House to be present at the opening of the new rifle ranges at Small Heath, just outside Birmingham. The ranges are situated upon a large piece of ground, the bulk of which has been sold to the Great Western Railway. A strip of land was reserved for the erection of covered ranges, and it was to view these in their completed state, and to drink prosperity to the enterprising venture of the Birmingham Proof House, that the ceremony had been arranged.

Among those who accepted invitations were the following officers and guardians of the Proof House:—Messrs. J. W Ward (Chairman), E. W. Wilkinson (Chairman of Finance Committee), W. Powell (Treasurer), C. G. Bonehill, W. Cashmore, J. Deeley, E. James, W. H. Hughes, W. P. Jones, T. G. Bentley, W. L. Powell, J.P., J. C. Scott, C. R. Smith, T. Turner, T. N. Tait, T. W. Webley, Councillor M. Kelley, Councillor T. W. Walthall, J. Rowlands (Law Clerk), E. M. Carter (Accountant). The guests included the following:—The Right Hon. the Lord Mayor, Alderman Beale, Sir James Smith (*ex* Lord Mayor), John Middlemore, Esq., M.P., Colonel F. W. J. Barker, R.A. (Superintendent of the Royal Sparkbrook Factory), Major Tisdall, Capt. H. Pollard, and Messrs. E. Anson, George Bate, Max Baker, H. Buckley, A. A. Bonehill, C. G. Bonehill, Jun., Thomas Bentley, E. J. Bland, J. Batt, T. D. Cross, James Carr, G. D. Delley, H. L. England, C. O. Ellis, C. O. Ellis, Jun., J. Foulkes, George Gibbs, F. B. Goodman, C. E. Greener, Edgar Harrison, A. V. Hughes, W. James, F. James, A. W. Lorton, Charles E. Martineau, John J. Moffat, H. Mason, R. G. Northwood, *ex* Alderman M. Pollack, T. Portlock, Horatio Phillips, Hubert Rowlands, John Rigby, W. A. Remmett, W. M. Scott, Martin Scott, Dr. Sumpner, Frank C. Scott, W. Tolley, J. S. Turner, W. Tolley, Jun., Hubert Wallis, John Wilkes, H. A. Wiggan, A. B. Ward, J. B. Ward, W. N. Whitehead, Arthur Wilkinson, F. F. Walker, and F. Williams.

After the party had made a preliminary inspection of the ranges, the Lord Mayor fired the first shot, and declared the ranges open. A succession of other gentlemen tried their hand, and the shooting was concluded with a demonstration of off-hand shooting at 100 yards with the Spanish Mauser rifle.

The party then adjourned to lunch in a well-appointed marquee, which was only equal in style to the good fare provided. It was communicated to the gathering that the respected Proof Master, Mr. S. B. Allport, had been forbidden by the doctor's orders from leaving the house. A high tribute was paid to the onerous work which had been entailed upon Mr. Allport by the erection of the new ranges, and keen regret was expressed that he could not be present in person to receive the congratulations of those present upon the successful completion of the work. We heard many evidences of the feeling among those present that indisposition to one so aged as the Proof Master was a matter of special anxiety. While this feeling was uppermost there was certainly no thought that the end was so near. Anxious feelings were relieved when about a week later the Proof Master returned to his duties, but this was only a rally, as his subsequent decease has shown.

After the patriotic toast had been duly honoured, the Lord Mayor proposed the toast of the occasion, "Success to the Gun Trade and the Shooting Range." He explained that one of the sources of success of the City of Birmingham was its multitudinous lines of manufacture, and among the more important the gun industry stood out prominently. He referred casually to the rivalry between Birmingham and London in

the production of high-class fire-arms; and he expressed the view that Birmingham workmanship was better than ever, and that it could at least hold its own by comparison with other work. He then proceeded to lay stress upon the great importance of improving the scientific knowledge of the workers in the trade, in order that the position of Birmingham should remain unchallenged; and he indicated as a means to this end that the younger members of the trade should be encouraged to make themselves proficient in the technical study of their work. He instanced as a difficulty in this direction the deficiency in that class of knowledge which should form the groundwork of technical training. He pointed out that the City Council and other bodies interested in education in Birmingham would be able to assist them in that matter. He was referring, of course, to the technical schools, which are an important feature in the public work of the City Council.

Mr. J. W. Ward, the Chairman of the Birmingham gun trade, who presided over the gathering, spoke in a sanguine manner of the prospects of the Birmingham gun trade. The expenditure upon the ranges, amounting to several thousands of pounds, had, in his opinion, been well laid out, and he trusted that the efforts to render the ranges perfectly safe would be appreciated.

Mr. Joseph Rowlands proposed the "City of Birmingham," and Sir James Smith responded.

The toast of proposing the "Visitors" was entrusted to Mr. W. L. Powell, and he called upon Mr. John Rigby and Colonel Barker to respond jointly for the numerous guests who had accepted the hospitality of the Proof House. Mr. John Rigby made a speech which carried conviction to many minds. He explained that there were many points upon which the gun trade required that instruction, which could only be obtained from exhaustive experiments conducted with adequate appliances. The need of such facilities was one which constantly blocked the development of the industry upon scientific lines. He considered that Birmingham and London would do well if they could co-operate in the formation of such a laboratory of research. Colonel Barker, in his response to the same toast, necessarily spoke with a certain amount of departmental reserve, but even this did not prevent him from referring to certain steps taken by the Government, which were undoubtedly beneficial to the trade, and of a character to prevent undue competition by service arms which have passed out of use. Having assured the meeting of the unfailing good wishes of his department towards the gun and rifle industry of the city, he gracefully thanked the members of the Proof House for the hospitality which had been shown to himself and to his fellow-guests.

The special labour connected with the new ranges has fallen particularly upon the Ranges Committee, of which Mr. J. C. Scott, whose name is indissolubly connected with the firm of W. and C. Scott and Son, is chairman. Now that Mr. Scott has retired from active business he has found pleasant occupation in the work of the Proof House, the new ranges having provided an exceptional field for his surplus energy. Mr. Thomas Turner, a director of Messrs. T. and J. S. Turner, Ltd., is in a like position, and has been a most active member of the Ranges Committee. Mr. E. W. Wilkinson, whose portrait appeared in our last issue, was no less an important individual, since, as Chairman of the Finance Committee, he has a firm grasp of the purse strings. Mr. Allport, by his position and experience, necessarily kept touch with all that was done, while with Mr. W. Hawley Lloyd, the architect, rested the responsibility of rendering the miscellaneous and somewhat novel requirements of a closed shooting range consistent with sound building construction. How admirable these combined efforts have succeeded will be shown in our next issue, since the exceptional calls upon our space have forced us to postpone a full description of the ranges to our next issue.

Last, but not least, we desire to call attention to our portrait of Mr. J. W. Ward, the Chairman of the Birmingham Gun Trade. The present occasion gives us the opportunity of making good our omission in this respect when he was appointed to his present office. Mr. Ward's special interests embrace everything connected with the Proof House—the ranges not more nor yet less than other things. The opening ceremony connected with the inauguration of the ranges was a fit occasion upon which to make his acquaintance. He presided over a gathering unique in the history of the trade, and his name will ever be prominently connected with a great achievement, conferring credit upon all concerned.

We regret that the London trade was only represented by Mr. John Rigby and Mr. Edgar Harrison, worthy representatives, we admit, but hardly sufficient for the occasion. It was a matter of keen regret to Mr. Thorn (Charles Lancaster) that a prior engagement prevented his attendance, Mr. Holland for similar reasons being unable to be present.

LECTURES TO YOUNG GUNMAKERS.

It has frequently been remarked in public and elsewhere that the technical education of the embryo gunmaker is neglected, and that his hunger for scientific training is not catered for as it is, for instance, in the case of the electrical engineer or the chemist. And yet there is no less of science than of art in the proper exercise of his profession. There are few models upon which to base an attempt to cater for this need. Still we have the temerity to put forward the first of a supposed series of lectures of a kind which it seems to us would be of value to one actively engaged as an apprentice in the gun trade. We shall, as far as possible, avoid the use of the higher mathematics, so that whatever may be the appearance of the first lecture, we guarantee that knowledge no more profound than the correct multiplication and division of decimals is required. The first lecture will deal with

SECTIONAL DENSITY.

In a planet having no atmosphere, the sectional density of rifle bullets or other missiles would be of no interest to gunmakers, were such able to exist. Rain would fall with the velocity of pellets of shot fired from the muzzle of one of Greener's or Purdey's best 12-bore guns. But the atmosphere lies upon our planet as a heavy pall; the pressure is 14·2 lbs. on every square inch, and the weight of every cubic inch of air is ·00004655 of a pound. The weight of air is apparently but a trifling matter, and yet when it has to be moved in order to allow the passing of a rifle bullet travelling at 2,000 feet a

second considerable force is required, and correspondingly the bullet loses a lot of its energy in overcoming the resistance of the air.

The whole principle of bullet construction, and of shot construction also for that matter, is to avoid all unnecessary disturbance of the air. The problem so stated involves finding out the best means for passing a projectile of a given weight through the air with the smallest possible loss of energy due to air resistance. The following are the various ways which are open for effecting the required purpose:—

1. To use a material of high specific gravity.
2. To give the surface of the bullet cutting the air a suitably rounded form.
3. To arrange the form of the bullet so that it shall present the smallest possible area in the direction of its flight relatively with its weight.

The first requirement is met by the use of lead, since it is the heaviest available material for the purpose. Lead is just over eleven times heavier than water. Gold or platinum would certainly be an improvement upon lead, since the one is eighteen times heavier than water and the other twenty-one times, but, generally speaking, expense may be held to stand in the way of the adoption of either one of them. The choice is, therefore, confined to lead. As regards the proper formation of the bullet, one may take it that the most suitable shape for passing through the air, consistent with the various conditions of each case, is adopted.

Hence it follows that there is little opening for wide divergence in methods 1 and 2.

There are endless combinations and variations of the weight and sectional area of projectiles, and the mathematical relation of the one to the other is known as "Sectional Density." We know generally that the heavier the bullet for the same area or calibre the greater is its ranging power, and *vice versa*. But this does not provide any common ground of exact comparison between say a ·303 Lee-Enfield bullet having a weight of 215 grains, and a ·256 with a bullet weighing 156 grains. As a matter of fact the relation of weight to sectional area of the two bullets is very nearly the same; but the figures representing bore and weight give little indication of that fact. One might guess that they were about the same since they are of about the same length, for each has, therefore, about the same driving power in the form of metal behind a given area of cross section. The length of the Lee-Enfield bullet is 1·25 inches, and that of the Mannlicher 1·236 inches. But this method of comparison is by no means exact. Furthermore, a very simple calculation enables us to reduce the two measurements to a common level of comparison.

The diagram here reproduced (Fig. 1) shows a number of different bullets placed base downwards upon a space one inch square, and enlarged to make the contrasts more prominent. We have a ·500 bore express rifle bullet; a ·400 bore bullet, which is interesting on account of its recent introduction by Mr. W. R. Jeffery; a ·311 German Mauser bullet; the ·303 English service bullet; the ·275 Spanish Mauser bullet, which is being used by the Boers in the Transvaal war; the ·256 Roumanian Mannlicher; and finally the ·236 Lee rifle bullet, which is the smallest bore of service rifle in the world, the American navy being the users. The square has been divided into smaller squares each one-thousandth of a square inch in area, or rather this would be their size were the diagram reproduced to the exact dimensions. The sides of these squares measure ·0313 of an inch. Could one count the number of these squares in each bullet, and piece together the fragments of squares cut off by the circle of the bullet the area could be found. But this would be a tedious operation, since the area of the bullets can be obtained by the following simple calculation:—

Diameter × diameter (both in decimals of an inch) × ·7854

Or working out the sectional area of a ·303 bullet as an example we may get the following:—

·303 × ·303 × ·7854=·071 of a square inch.

Without counting the squares enclosed by the ·303 circle, we now know that there are seventy-one of them, since the squares each represent one-thousanth of an inch area, and the answer to our sum expressed in fractions is $\frac{71}{1000}$.

In considering the sectional area of a bullet, we must remember that what we want is its area when it leaves the muzzle. Now the diameter of a ·303 bullet before it is fired is ·311 of an inch. The calibre of a rifle is "the diameter of the bore as measured across the lands." Hard-jacketted bullets like the ·303 do not expand under the influence of the gases pressing upon the base to anything like the extent of ordinary lead bullets. Consequently the bullet must be made large enough before firing to reach to the bottom of the grooves.

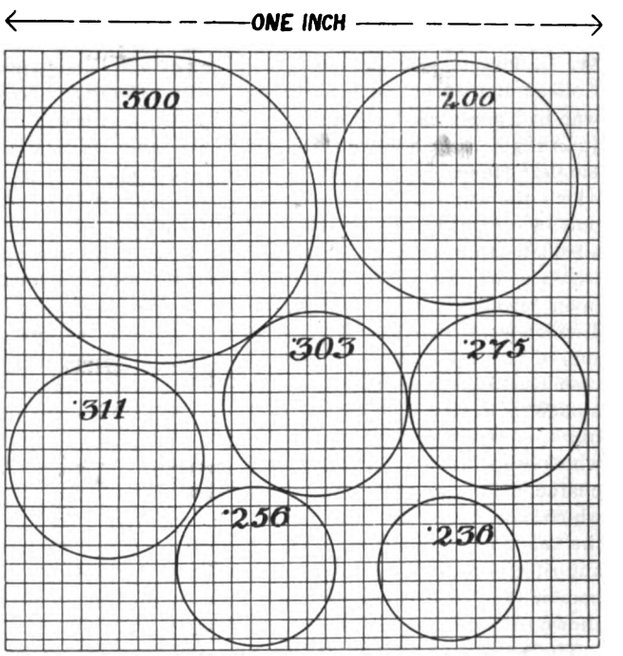


FIG 1.—COMPARISON BETWEEN DIFFERENT BULLETS.

From the top of the lands to the bottom of the grooves in a ·303 rifle is ·004 of an inch, and since the grooves are on both sides of the bore, the bullet must be increased ·008 of an inch in diameter in order to reach to the bottom of every groove. Thus the diameter of the bullet before firing is ·303 + ·008 =·311.

The sectional area of the bullet before and after firing is not, however, the same thing. The bullet comes out of the muzzle with a section bearing the marks of the rifling. The following diagram (Fig. 2) expresses this with sufficient clearness. The sectional area of the bullet after firing is the area of the por-

tion having a diameter of ·303 plus the area of each of the upstanding portions which are moulded to the grooves of the rifling. It would be a somewhat complicated proceeding to arrive at the sectional area of each of these upstanding portions, but, on the other hand, a very fair approximation of their dimensions may be obtained by supposing that a mid-

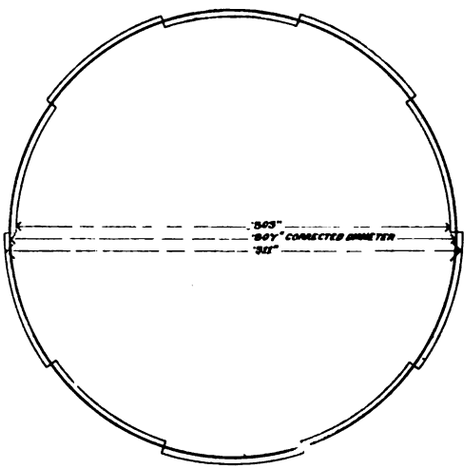


FIG. 2.—SHOWING CORRECTED DIAMETER ON BULLET.

way circle be drawn with its circumference half way up these extensions. Since these extensions or upstanding portions are ·004 of an inch high, the *radius* of such a circle would be ·002 of an inch greater than that of the circle of ·303 diameter. In other words its *diameter* would be ·303 + ·004 = ·307 of an inch—or the calibre plus once the depth of the rifling. Now that we have arrived at the corrected diameter of the ·303 bullet, we must revise our calculation of its sectional area, and we shall then obtain its true area after firing. Thus:—

·307 × ·307 × ·7854=·074 of a square inch.

This means that the combined sectional area of the grooves of the rifling is ·003 (·074—·071) of a square inch, in other words, equal to three of the squares shown in Fig. 1.

Having considered the question of the sectional area of rifle bullets, it now remains to consider that area in relation to weight. The weight of the ·303 bullet is 215 grains, and the sectional area after firing is ·074 of a square inch. This means that for every thousandth of a square inch area there are 2·9 grains (215 ÷ 74). Thus for every unit of area shown in Fig. 1 there is a driving power or weight of 2·9 grains. The real diameter of the so-called ·256 rifle is nearly ·257, or, to be exact, ·2569 of an inch. The depth of rifling is ·0059 of an inch, so that the corrected diameter is ·2628 (·2569 + ·0059) of an inch. The sectional area is therefore:—

·2628 × ·2628 × ·7854 = ·054 of a square inch.

With a weight of 162 grains, and a sectional area of 54 thousandths of a square inch, division gives us a driving power of three grains to every thousandth of an inch sectional area in the Mannlicher bullet. A similar calculation applied to the ·500 bore express rifle, having a lead bullet weighing 340 grains, gives us an area of ·202 of a square inch and a driving power of only 1·7 grains for every one-thousandth of sectional area. The last column but one of the accompanying table gives a number of these values, and the figures merit careful study.

The calculations which have so far appeared express the sectional density of projectiles in terms stating the amount of weight distributed over each ·001 of a square inch of sectional area. This serves to convey a clear impression of what sectional density means, but it must be remembered that a purely arbitrary standard has been selected, and that the sole object of the calculation has been to obtain a common ground of comparison between bullets of varying size and weight. For instance, the same relative values could equally well be obtained from the weight allotted to every *tenth* of an inch sectional area.

Our choice of a unit expresses the sectional density in the following manner:—Lee-Enfield 2·9, Mannlicher 3. The Government text books express sectional density as follows:—Lee-Enfield ·326, Mannlicher ·335. If we multiply two numbers by the same number, the resulting numbers bear the same proportion to one another. Thus:—

Lee-Enfield, 2·9 × ·1117 = ·324

Mannlicher, 3 × ·1117 = ·335

Multiplying the number of grains by ·1117 in each case has practically reproduced the Government figures in the case of the Lee-Enfield, and it has entirely done so in the case of the Mannlicher. The slight divergence is wholly due to the elimination of decimal points beyond certain limits in the various stages of the calculations, with the result that slight inaccuracies have crept in. Substantially, however, it will be seen that 2·9 bears the same proportion to 3 that ·326 does to ·335.

It is now time to consider a more simple way of arriving at figures to represent the sectional density of the bullets than by considering it in terms of grains per ·001 inch sectional area. It has already been shown that the sectional density is inversely proportional to the area, and also that the area is proportional to the square of the diameter. Hence, it is quite clear that sectional density is inversely proportional to the square of the diameter. Weight, as has already been shown, is directly proportional to the sectional density. The above proportions are expressed mathematically in the following way:—

$$\text{Sectional density is proportional to } \frac{W}{d^2}$$

where d = diameter and W = weight.

But the correct, though not often used, manner of expressing sectional density is:—

$$\frac{\text{weight in lbs.}}{\textit{area} \text{ in square inches.}}$$

Weight in both cases is the numerator, because the density varies *directly* as the weight, and area and d^2 are the denominators, because both vary *inversely* with the sectional density

The following calculation, based upon the second of the two equations above, resolves the true sectional density of the ·303 bullet:—

$$\frac{215}{\cdot307 \times \cdot307 \times \cdot7854 \times 7000} = \cdot415$$

where 215 is the weight in grains and ·307 × ·307 × ·7854 is the area of the bullet after leaving the barrel. We divide by 7,000 in order to express 215 grains in fractions of a pound.

It will, however be noticed that in every calculation for sectional density we divide by ·7854 in order to arrive at the area, which cannot affect the actual *proportion* existing between the results of one bullet and of another. Consequently it has become usual to express sectional densities by weight in

pounds divided by diameter squared, viz., the small formula already given.

$$\frac{W}{d^2} = \frac{215}{\cdot307 \times \cdot307 \times 7000} = \cdot326$$

The result obtained from this formula when weight is in pounds is exactly the same as the true density, except that we have not divided by ·7854, and the answer is what has already been quoted from Government text books.

Before proceeding to consider the practical relation of sectional densities to actual shooting results with the gun or rifle, it would be well to make clear the relation of sectional density to the retardation of the air. Sectional density expresses the power of the bullet to overcome air resistance, while air resistance is the power of the air to overcome the driving force of the bullet. They are, therefore, equal and opposite, and the formula expressing air resistance is therefore:—

$$\frac{d^2}{W}$$

It was originally the custom to judge the driving power of the bullet by the resistance set up by the air against its passage. The above formula is justified by this consideration; for the air resistance is directly proportional to the square of the diameter of the bullet, and inversely proportional to the weight. The obsolete method of expressing the driving power of the bullet in terms denoting the resistance of the air is not now used, and may be dismissed from consideration; but its mention is rendered necessary by the clinging of the old school to an ancient custom.

Description.	Nominal Bore.	Corrected Diam.	Weight	$\frac{W}{d^2}$	Area $d^2 \times \cdot785$	Weight per 001" area	Approximate Velocities.
inches.	inches.	inches.	grains.		sq. in.	grains.	ft.-secs.
No. 6 Shot ..	·100	—	1·6	·023	·0079	·2	1,150
Colt ·22 Rim ..	·220	·226	30	·084	·040	·75	1,300
Lee U.S. Rifle ..	·236	·240	112	·278	·045	2·5	2,500
Mannlicher ..	·256	·2628	162	·335	·054	3·0	2,395
Spanish Mauser	·275	·2809	173	·313	·061	2·8	2,288
Rook Rifle ..	·300	·308	80	·120.	·074	1·1	1,036
Lee-Enfield ..	·303	·307	215	·326	·074	2·9	2,000
German Mauser	·311	·3157	227	·325	·079	2·9	2,034
Jeffery	·400	·406	400	·346	·129	3·1	2,200
Martini	·450	·457	480	·328	·164	2·9	1,350
Webley Man-Stopper ..	·455	·461	215	·144	·167	1·3	725
Express	·500	·508	340	·188	·202	1·7	1,817

There is material in the table of different bullet values appearing above to justify many hours of careful study. The whole of the particulars of each bullet are contained in the various columns, and it would be time well spent to verify all the calculations in order to arrive at a true understanding of sectional density in its relation to actual firing results.

A pellet of No. 6 shot is the first projectile to be considered. It has a very low $\frac{W}{d^2}$ and hence its effective range is limited. In fact, although the velocity is equal to that of other of the bullets quoted, its effective range is known to be about 40 to 50 yards at the outside. Incidentally we might examine mathematically the reason why an amalgamation of shot pellets has a range far exceeding that of the separate pellets composing the "ball." Suppose that 30 pellets leave the muzzle of a shot gun amalgamated into a ball, and that the area they present to the air is ·074 of a square inch, viz., that of the ·300 rook rifle bullet. Their weight is 48 grains, so that the W divided by d^2 of the ball $[48 \div (7000 \times \cdot308^2)]$ works out at ·072, which is over three times that of the single pellets.

The ·22 bore rifle, with its short cartridge, is known as the most accurate arm for ranges up to about 50 yards which exists. Its comparatively low velocity and the low sectional density account entirely for this limitation of its powers.

The ·236 American navy rifle is a most interesting example among military service rifles It is the smallest bore among such rifles, and its sectional density shows signs of its degeneration. In its case the reduction of bore has, for practical reasons connected with the difficulty of spinning the bullet, necessitated a reduction of its length in proportion to its calibre, as compared with other bullets of a service type. It will be noticed that this bullet has the highest velocity of any of those quoted. In this way it may travel a considerable distance with a very straight course before its velocity is reduced to that say of the ·303 rifle. Its sectional density is, however, low, and consequently at long ranges it falls short of the results obtainable from other service arms of higher density. As a matter of fact, it is better than the ·303 at short ranges, about equal at 500 yards, and beyond that distance it is inferior.

The ·256 Mannlicher is a favourite weapon among all shooters. It combines a high density with a high velocity, and this is one of the secrets of its success.

The Spanish Mauser has a fairly high sectional density, and its comparatively high velocity brings it at least to a par with the ·303, but it is obviously not equal, especially at the longer distances to the Mannlicher.

The rook rifle, like the ·22 bore, is of low density and low velocity, and hence it is a short range arm.

The Lee-Enfield ·303 rifle has a sectional density nearly equal to the Mannlicher, but it is inferior in velocity, which is its chief point of inferiority as a shooting weapon compared with the Mannlicher. We have put the velocity at 2,000 foot seconds, but in reality this velocity is not often attained in practice.

The German Mauser, although of different bore to the ·303, compares with it in density and velocity, and other things not here dealt with being equal, the results from the two rifles would be about the same.

The Jeffery ·400 bore rifle has the highest density of any small-arm we are aware of. With its high density and comparatively high velocity, it is *par excellence* a long range weapon, while its high velocity gives it a flat trajectory at short ranges. The recoil of a ·400 grain bullet propelled at such a velocity might be high unless the arm is of considerable weight. Should the 300 grain bullet be used in place of the 400, then, of course, the sectional density would be reduced by one quarter.

The Martini, with its low density and its low velocity, is obviously an inferior military weapon to the more modern service weapons quoted.

The Webley Man-stopper, most curious but effective revolver bullet, has a low density and a low velocity, hence short range. Its square nose also limits its range; but as revolvers are purely for self defence, these points do not detract from its efficiency as a man-stopper.

The Express rifle is a flat trajectory arm for very short ranges. The high velocity gives the flat trajectory, the low density limits the range.

There is another side of sectional densities which involves

many questions beyond the scope of the present enquiry. That is density in its relation to powder pressure. If the pressure inside the barrel of the ·303 is 14 tons on the square inch, there is a pressure upon the base of the bullet proportional to 14 tons as its sectional area, ·074 is proportional to one square inch, viz., 1·036 tons (14 × ·074). In other words, ·074 is about one-fourteenth of a square inch. The considerations of such matters as this may be left to a future occasion.

The lecture is concluded. A proper consideration of all that has been explained will go far to enlighten the embryo gunmaker upon the mysteries of sectional density in its relation to range.

THE LATE MR. H. T. WITHERS.

For some years it has been known that Mr. H. T. Withers has been in a failing state of health, and certainly during the past six or more years very little has been seen of him in the trade. His recent death has, therefore, but little surprised those who knew of his delicate state.

To those who have recollections of the Schultze Gunpowder Company, especially in the earlier days of its career, Mr. Withers is a well-known personality. The earlier part of the Schultze Company's career was such as a prize fighter turning to business affairs would have enjoyed; but Mr. Withers's methods were not those of a prize fighter. He received the most hostile fulminations with a calm gentlemanly aspect of complete repose and self-contained assurance. His imperturbable manner soon gained him the advantage in a discussion, and in this way he frequently turned hostile critics into the closest of his personal friends. The cutlass was not his weapon, the rapier was better suited to his style; but even here it was rather on the lines of defence that his powers were exercised, and he took the earliest opportunity of convincing his opponent that an honourable peace was the most advantageous policy for both parties. The fighting of the battle of smokeless powders was very keen while it lasted, and Mr. Withers retained his activity well up to the time when the full fruits of his earlier work became apparent. His colleagues admit to this day that none of them would have liked to tackle some of his tougher jobs, and they even go further and admit their doubts as to whether they could have carried them through at all.

Among the trade Mr. Withers had many intimate and trusted friends. Those who remember the *Field* trials of 1878, where smokeless powder first gained its ascendancy, will probably remember Mr. Withers in his silk hat and carrying an umbrella. Thus arrayed, he would march up and down on a sort of quarter-deck parade arm-in-arm, either with Mr. William Powell, of Birmingham, or Mr. James Purdey. Both of these were Mr. Withers's special friends, and have remained so ever since.

Personally, the writer did not get the opportunities he would have liked of studying the gentler aspects of Mr. Withers's character. The first interview, the object of which was to secure the introduction of this paper to the good wishes of the Schultze Company, was a disastrous failure. Mr. Withers evidently felt the old spirit rising within him, and in calm measured tones he expressed his indifference to trade papers in general, and our paper in particular. We failed to see any reassuring twinkle in his eye, giving an opening for further conversation, and we hastily withdrew after a very short five minutes. Had we but known, as we now do know, that Mr. Withers had bet the office boy, who carried our name forward, the price of a new bowler hat that he would bow the representative of this paper out of his office within five minutes, we should have known what course to take. Unfortunately, not knowing this, we were not smart enough to save that office boy a three-and-ninepenny investment at Dunn's.

In spite, however, of Mr. Withers himself, we have had many opportunities of appreciating his good qualities, and it

The Late Mr. H. T. Withers.

is with the sincerest regret that we place on record the fact of his death. It took place on the 8th ult. Mr. Withers joined the Schultze Gunpowder Company as Secretary on June 14, 1876, and he retired on the formation of the new Company last year.

There has recently been an all-round rise in the price of blasting powder, and with the briskness of trade now generally experienced it is hoped that the profit-earning capacity of the black powder interests will be materially increased. Against this we must put the constant demand for an improved quality of materials arising largely from the operation of recent coal mines legislation.

According to the *Scientific American*, the United States Government recently ordered some tests to be carried out with the Mauser repeating pistol. These tests were made with targets and human bodies at various ranges from 50 to 500 yards. The results were stated to be very satisfactory, and it is thought that up to the maximum range at which it was tried, the pistol is practically as good in the hands of a marksman as a Krag-Jorgensen or a Lee rifle. The United States Government is stated to be considering the adoption of the pistol.

NOTES.

THE INDIAN ARMS PROHIBITION.—The two Associations of London and Birmingham gunmakers are at present engaged in framing a memorial containing their views upon the recent prohibition, and it is hoped that, in spite of the somewhat different style of trade of the representative members of the two Associations, a common ground of action may be defined.

THE SCHULTZE GUNPOWDER CO., LTD.—In our last issue we gave full particulars of the proposed scheme of amalgamation between the Schultze and Smokeless Powder Companies. The entire scheme was unanimously approved by all the shareholders concerned, and a subsequent extraordinary general meeting has similarly provided for requisite alterations in the Articles of Association for carrying the scheme into effect.

THE LATE VICE-ADMIRAL P. H. COLOMB.—The death, at the age of 68 years, of Vice-Admiral P. H. Colomb, which took place on the 13th ult., has served to remind us of the notable services which the gallant Admiral rendered to his profession. It is possibly not so generally known that two firms thus lose the services of an active director on their board. We refer to Messrs. Greenwood and Batley, Ltd., and the Roburite Explosives Co., Ltd.

SHORT CARTRIDGES.—An American contemporary states that whilst short cartridges appear to be enjoying an increasing popularity in England, the demand for long cartridges in the States has not diminished in the least. Despite this fact, however, the opinion generally expressed is that the short cartridge has come to stay, and sooner or later will be largely used in America. With this possibility in view, several of the American case manufacturers are experimenting with the object of ultimately making short shells.

NEW POWDER FACTORY IN THE UNITED STATES.—A new smokeless powder factory is now in the course of erection at the Indian Head Proving Grounds, near Washington, U.S.A. Several of the buildings, including one which contains plant for electric lighting the whole of the factory, are nearly completed, and most of them will be connected by an electric car service. It is expected that the factory will be completed and ready for service some time this autumn, and when operations are in full swing some 2,000 pounds of powder a day will be turned out. This new plant, added to that which is already established, will supply the navy with about four or five thousand pounds of powder a day.

RIFLE THEFTS IN INDIA.—Several cases of daring rifle thefts from barracks and encampments on the Indian frontier have been recently reported. An article dealing with this subject was published in our last September issue. These thefts are, however, put completely in the shade when compared with the latest report, particulars of which were published in a recent issue of the *Pioneer*. It would appear that a large consignment of arms, consisting of eighteen rifles, seventy-eight shot guns, and six revolvers, was despatched from England by the steamer *Malda* to that well-known firm of Calcutta gunmakers, Messrs. Rhodda & Co. On arrival at Calcutta the consignment was passed from the *Malda* to the Custom House. Six days afterwards, when the goods were being cleared to be passed on to Messrs. Rhodda & Co., it was discovered that all the revolvers had disappeared.

CALCULATING CORDITE VELOCITIES AND PRESSURES IN ORDNANCE.*

By A. Bremberg.

INTRODUCTION.

To ascertain the velocity of a projectile during its flight through the air is a fairly simple matter. To ascertain the velocity without firing the shot is a more complex problem. It may, however, be resolved, provided certain *data* are available, and also provided that such *data* are accurately handled.

The calculation of velocities obtainable from black powder charges is an operation well known to artillery experts. With the advent of Cordite, velocities could only be worked out from the black powder tables with the help of a constant, which required to be separately ascertained for every class of gun. In this way an additional operation was necessitated; and further, it became impossible to work directly from the gun to the velocity unless someone had previously determined, by actual firing, the particular constant applying to the gun.

Like black powder, Cordite follows definite laws of combustion; and in order to provide facilities for the calculation of Cordite velocities, similar to those applying to black powder, it is necessary to build up a mathematical structure of relative values, which may be used for the direct translation of certain available *data* into certain equivalents that can be resolved into terms of velocity. This is the task which the author has set himself to perform. The result of his work is a table, specimens or sections of which have been reproduced for the purpose of this description. How the table has been built up, how many examinations of actual firings have been carried out, how many times it has become necessary to enter into fresh lines of enquiry to clear up certain moot points, are not matters of present concern. The table having been put together, it only now remains to describe its application to actual problems, and to work out a series of examples. By this means the equivalent values given in the table may be checked against results obtained by direct measurements.

Root Principles of the Calculation.

On ignition of the charge in a gun, the pressure on the base of the shot will rapidly rise until it is powerful enough to overcome the friction between the copper driving band and the rifling, and the shot is started and moved along the bore of the gun with an accelerated velocity. During the earlier stages of the shot's forward movement the powder pressure continues to increase, and goes on increasing up to a certain point. When this point of maximum pressure has been reached, the whole of the charge has been consumed and

* When this article was first submitted to us the material seemed to be more suitable for production in permanent book form. After careful consideration, we decided to publish particulars of the system of calculation, together with sections of the Table which accompanied the letterpress. We have also decided to republish the complete description and Table separately at the price of 10s. per copy, and we anticipate having the book ready towards the end of the current month. [Ed. *A. & E.*]

transformed into gas provided (*a*) that the diameter of the cords is not abnormally large, or (*b*) that the maximum pressure is not very low.

The powder chamber represents so much lost power in the propulsive effect of the powder charge. Hence it follows that the volume of the air space in the chamber must be ascertained, and the work represented by the pressure produced in the chamber must be deducted from the total energy produced by the combustion of the powder charge.

The total expansions in the bore represent the expansion of the powder charge from its original bulk up to the moment when the shot leaves the muzzle. The *effective* portion of this expansion is obtained by deducting the *ineffective* portion represented by the expansion in the chamber. The effective portion of the work done by the powder charge is, therefore, the expansions which take place beyond the chamber and up to the muzzle. These expansions have a definite energy value, which are governed by the inherent properties of Cordite as an explosive. The table shows the energy values of a number of different expansions of one pound of Cordite. The expansions within the chamber are a minus quantity, and from the energy value of the total expansions up to the muzzle this minus quantity must be deducted. The effective energy of the powder charge is not wholly transmitted to the shot, and the amount so transmitted depends upon the rapidity with which the charge is resolved into gas—in other words, upon the position the shot has reached when the gases have attained maximum pressure. This position is expressed for the present purpose in terms of the number of expansions which have occurred up to the point of maximum pressure. By allowing for the position of maximum pressure the amount of energy transmitted to the shot by each pound of the charge is available. This is muzzle energy, and muzzle energy is readily converted into terms of velocity.

Essential Factors of the Calculation.

The velocity of a projectile is the product of a number of conditions which require to be considered in detail, viz.:—

Weight of Shot.
Weight of Charge (Cordite).
Size or Gauge of the Cordite.
Capacity of the Chamber.
Capacity of the Bore.
Sectional Area of the Bore.

From the data quoted above the three following factors, which are necessary for the calculation, may be found:—

Number of Expansions in Chamber.
Number of Expansions in Bore.
Number of Expansions at Maximum Pressure.

The number of expansions in the chamber is obtained by dividing the total capacity of the chamber (in cubic inches) by the weight of the charge (in lbs.), and by 27·73. Thus:—

$$\frac{\text{Capacity of chamber (in cubic inches)}}{\text{Powder charge (in lbs.)} \times 27{\cdot}73}$$

The value 27·73 is a well-known standard, and represents the conventional volume in cubic inches of 1 lb. of water. It is here taken as the capacity of one pound of Cordite at unit expansion.

The total expansions in the bore are obtained from the total capacity of the bore in the same way as the expansions in the chamber, viz.:—

$$\frac{\text{Total capacity in bore (in cubic inches)}}{\text{Powder charge (in lbs.)} \times 27{\cdot}73}$$

In this way the numerical values of two of the factors in the second list are resolved. The next and last factor to determine by calculation is the number of expansions of the gases behind the projectile which have taken place up to the point of maximum pressure. Before dealing with the calculation of expansions at maximum pressure, it will be necessary to refer to the table.

The Table.

In the complete table (portions only of which are here reproduced) column No. 1 gives a number of expansions from 3·2 volumes up to 30 volumes. Column No. 2 gives the work in foot-tons which one pound of Cordite performs in expanding from 3·2 volumes (the starting point of the table) to any other number of volumes which are recorded. Intermediate values are obtained by subtraction. For instance, the expansion from 3·45 volumes to 5·35 is obtained by deducting the equivalent in foot-tons from 3·45, viz., 13·86 foot-tons, from the equivalent in foot-tons of 5·35, viz., 90·70 foot-tons. Thus:—90·7 − 13·86 = 76·84 foot tons.

Column No. 3 gives the pressures in tons per square inch, corresponding with the various numbers of expansions shown in column No. 1. The pressures given are not closed-vessel pressures, but are rather less, since they represent the pressures of Cordite while expanding and doing work.

Column No. 4 contains a series of constants depending upon the number of expansions at maximum pressure, as used in the calculations.

The equivalents in columns 3 and 4 are only carried as far as experience shows to be necessary.

Velocity of a 12-inch Gun.

A point has now been reached when an actual example may be quoted, viz., the Government 12-inch Mark VIII. gun.

Weight of shot, 850 lbs.
Charge, 162 lbs. of 50 gauge Cordite.
Capacity of the chamber, 13,403 cubic inches.
Capacity of bore, 54,551 cubic inches.
Sectional area of bore, 114·9 square inches.

To find the expansions in the chamber as already described, the following calculation is made:—

$$\frac{13403}{162 \times 27{\cdot}73} = 2{\cdot}983$$

The total expansions in the bore are likewise found as follows:—

$$\frac{54551}{162 \times 27{\cdot}73} = 12{\cdot}1$$

These calculations involve the determination of the number of expansions at maximum pressure. In all investigations connected with the theoretical working out of velocities, it is necessary to see what would be the maximum pressure produced under the conditions of the problem. No separate calculation is required for this, since the third column of the table gives the maximum pressures corresponding with the wide range of expansions to be found in column No. 1.

The number of expansions at the point of maximum pressure is determined as follows:—

$$\frac{\text{Chamber in cubic in.}}{\text{Charge (in lbs.)} \times 27{\cdot}73} \times \left[1 + \frac{\text{Constant} \times \text{sectional area of bore (in square inches)}}{\sqrt{\text{Chamber (in cubic in.)} \times \text{shot (in lbs.)}}}\right]$$

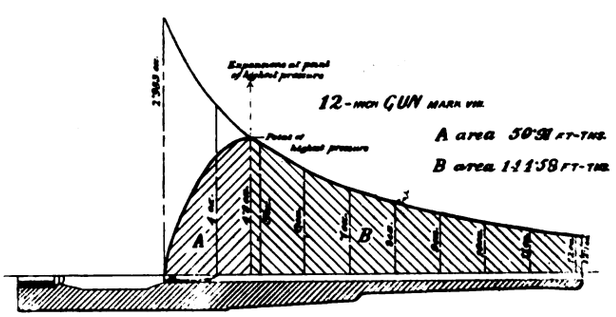
The constant used in this formula varies with different sizes of Cordite. For size 10 it comes to 3·9, size 15=6·6 size 20=10·5, size 30=16, size 50=18. These constants are calculated from powder fired which has a temperature of 80 deg. F. According to the Government text book, the pressure rises ·1 of a ton for each degree F. Hence the number of expansions at the point of maximum pressure is :—

No. of Expansions.	Energy in Foot-tons.	Corresponding Pressures in Tons per square inch.	Constants.	No. of Expansions.	Energy in Foot-tons.
3·85	33·72	20·32	36·52	11·7	212·10
3·9	36·02	20·01	35·96	11·8	213·32
3·95	38·29	19·70	35·41	11·9	214·53
4	40·53	19·41	34·88	12	215·73
4·05	42·73	19·12	34·37	12·1	216·91
4·1	44·90	18·84	33·86	12·2	218·08
4·15	47·04	18·57	33·38	12·3	219·24
4·2	49·15	18·30	32·90	12·4	220·39
4·25	51·23	18·05	32·44	12·5	221·53
4·3	53·28	17·79	31·98		
4·35	55·30	17·55	31·54	* *	* *
4·4	57·29	17·31	31·11		
4·45	59·26	17·08	30·69	16	255·58
4·5	61·20	16·85	30·28	16·1	256·42
4·55	63·12	16·63	29·88	16·2	257·25
4·6	65·01	16·41	29·49	16·3	258·08
4·65	66·87	16·20	29·11	16·4	258·90
4·7	68·71	15·99	28·74	16·5	259·72
4·75	70·53	15·79	28·38	16·6	260·53
4·8	72·33	15·59	28·02	16·7	261·33
4·85	74·10	15·40	27·68	16·8	262·13
4·9	75·85	15·21	27·34	16·9	262·92
4·95	77·58	15·03	27·01	17	263·70
5	79·28	14·85	26·68	17·1	264·48
5·05	80·97	14·67	26·36	17·2	265·25
5·1	82·64	14·50	26·06	17·3	266·02
5·15	84·29	14·33	25·75	17·4	266·79
5·2	85·92	14·17	25·46	17·5	267·55
5·25	87·54	14	25·17	17·6	268·30
5·3	89·13	13·85	24·88	17·7	269·05
5·35	90·70	13·69	24·60	17·8	269·79
5·4	92·26	13·54	24·33	17·9	270·53
5·45	93·80	13·39	24·06	18	271·26
5·5	95·32	13·24	23·89	18·1	271·99
5·55	96·83	13·10	23·53	18·2	272·71
				18·3	273·43
* *	* *			18·4	274·14
				18·5	274·85
9·7	184·73			18·6	275·56
9·8	186·25			18·7	276·26
9·9	187·76			18·8	276·95
10	189·25			18·9	277·64
10·1	190·72			19	278·33
10·2	192·17			19·1	279·01
10·3	193·61			19·2	279·69
10·4	195·03			19·3	280·36
10·5	196·43			19·4	281·03
10·6	197·82			19·5	281·70
10·7	199·19			19·6	282·36
10·8	200·55			19·7	283·02
10·9	201·89			19·8	283·67
11	203·21			19·9	284·31
11·1	204·51			20	284·97
11·2	205·81			20·5	288·14
11·3	207·09			21	291·22
11·4	208·36			21·5	294·21
11·5	209·62			22	297·12
11·6	210·87			22·5	299·95

$$\frac{13403}{162 \times 27{\cdot}73} \times \left[1 + \frac{18 \times 114.9}{\sqrt{13{,}403 \times 850}}\right] = 4{\cdot}8$$

In other words we have 4·8 expansions at the point of maximum pressure. According to the table, one pound of Cordite expanding from 4·8 volumes to 12·1 volumes (viz., the total expansions in bore) transmits an energy to the shot equal to 216·91—72·33=144·58 foot-tons

The diagram here reproduced shows graphically what this value of 144·58 foot-tons represents. The curve indicates pressure along the barrel, the vertical height representing pressures, the horizontal distances showing expansions based upon the measurements of the bore of the gun which is shown at the bottom of the diagram. The calculations so far made show that from the point of maximum pressure up to the muzzle, an amount of work equal to 144·58 foot-tons has been performed by each pound of powder. The area enclosed by the pressure curve represents the total amount of work done from the first movement of the shot up to the time the shot



has reached the muzzle. This total area is divided into two sections, viz., A and B, the amount of work done beyond the point of maximum pressure, viz., 144·58 foot-tons, being the B section of the area enclosed by the curve. To Longridge belongs the credit for the separation of the pressure curve into these two sections.

The next operation is to find the work performed from the first movement of the shot up to the point of maximum pressure, viz., the A section of the area enclosed by the curve. This is effected by subtracting the expansions in the chamber from the expansions at maximum pressure (4·8—2·983=1·817), and multiplying the result by the constant in column No. 4, which applies to 4·8 volumes. This constant is 28·02, and hence we have the energy in foot-tons of the A portion of the diagram (1·817 × 28·02=50·91 foot tons).

The total energy imparted to the shot by every pound of Cordite is, therefore, the sum of the A and B sections of the curve, viz., 50·91 + 144·58=195·49 foot-tons. Since this is the energy transmitted by each pound of the charge of Cordite acting upon the whole weight of the shot, we must multiply 195·49 foot-tons by the weight of the charge (162 lbs.) to find the total energy transmitted to the shot, and divide by the weight of the shot (850 lbs.) in order to find the energy stored up in each pound of the shot on leaving the muzzle, viz. :—

$$\frac{195{\cdot}49 \times 162}{850} = 37{\cdot}258 \text{ foot-tons,}$$

Having now arrived at the knowledge that each pound by weight of the shot leaves the muzzle with a stored up energy of 37·258 foot-tons, we may obtain the velocity corresponding to this energy from an ordinary energy table. The result is 2,318 foot-seconds. The reason for dividing above by the weight of the shot is now apparent, since by reducing the total energy to that stored up by each one pound by weight of the shot, we are enabled to use an energy table based upon the unit of one pound, in place of making a special calculation for determining the velocity from the energy.

Comparing the theoretical results of the calculations and Table with actual firing experience, we obtain the following:—

Calculated velocity	...	2,318 foot-seconds.
Observed velocity	...	2,327 ,, ,,
Divergence	...	9 ,, ,,

In the same way we may compare calculated with observed pressures. The expansions at maximum pressure were 4·8, which the Table shows to correspond with a pressure of 15·59 tons per square inch. The comparison with actual results is as follows:—

Calculated pressure	...	15·59 tons per sq. inch.
Observed pressure	...	15·50 ,, ,,
Divergence	...	·09 ,, ,,

Calculation Algebraically Expressed.

Before going further, the information and instructions already given may be summarised in the manner customary for such calculations. Therefore let

x = Muzzle Energy of Each Pound of the Shot (in foot-tons).
W = Weight of Shot in pounds.
w = Weight of Charge of Cordite in pounds.
K_1 = Constant Varying with Size of Cordite.
c = Capacity of Chamber in Cubic Inches.
C = Capacity of Bore in Cubic inches.
A = Sectional Area of Bore in Square Inches.
e_1 = Number of Expansions in Chamber.
e_2 = Number of Expansions in Bore.
e_3 = Number of Expansions at Maximum Pressure.
E_2 = Energy in Foot-tons corresponding with e_2 (see Table).
E_3 = Energy in Foot-tons corresponding with e_3 (see Table).
K_2 = Constant for e_3 (see Table).

$$e_1 = \frac{c}{W \times 27{\cdot}73}$$

$$e_2 = \frac{C}{W \times 27{\cdot}73}$$

$$e_3 = \frac{c}{W \times 27{\cdot}73} \times \left[1 + \frac{K_1 \times A}{\sqrt{c \times W}}\right]$$

Find value of e_2 in column No. 1 of Table, and the adjoining number in column No. 2 is the numerical value of E_2. Find E_3 from e_3 in the same manner.

Find value of e_3 in column No. 1 of Table, and the number in column No. 4 on the same line is the numerical value of K_2.

$$x = E_2 - E_3 + [(e_3 - e_1) \times K_2].$$

Convert x into velocity with Energy Table.

Various Examples.

Various results with other guns are tabulated below In some cases it will be seen that the calculated and observed velocities are but a few feet apart. Such coincidences are, of course, accidental, since velocities could never be calculated with such perfection.

In some cases it will be seen that corrections of 5 *per cent.* and 2 *per cent.* have been made on the velocities obtained from the calculations. A deduction of 5 *per cent.* serves to bring the calculated velocities to a level with those published in the Government text books. These latter are taken under Service conditions, when the guns have been worn, and the velocities thus obtained are about 5 *per cent.* lower than those from proof firing with new guns to which the values of the Table apply. The 2 *per cent.* may be used as a correcting factor between Cordite and Chilworth Cordite, which latter is really the "Ballistite" composition. Chilworth Cordite, other things being equal, gives about 2 *per cent.* higher velocities than true Cordite of official specification. The Table gives Chilworth Cordite results, and velocities

	Hotchkiss 3 Pr. 40 cal.	3-inch Q.F. 40 cal.	4·7-inch Q.F. 40 cal.	6-inch Q.F. 40 cal.	12-inch Mark VIII.
Value of W ..	3·3	12·5	45	100	850
,, w	·4325	1·9375	5·4375	13·25	195
,, K_1	1·75	6·6	10·5	16	18
,, c	42·3	125	278	715	13,403
,, C	208·4	873	3,367	6,964	54,551
,, A	2·735	7·2	17·8	28·7	114·9
,, e_1	3·486	2·326	1·843	1·946	2·478
,, e_2	17·2	16·2	16·2	18·95	10·1
,, e_3	4·9	5·15	4·95	5·25	4
,, E_2	265·25	257·25	299·95	278	190·72
,, E_3	75·85	84·29	77·58	87·54	40·53
,, K_2	27·34	25·75	27·01	25·17	34·88
Calculated Velocity	2,088	2,344	2,310	2,286	2,593
Do. less 5 per cent.		2,227	2,195	2,172	
Do. less 2 per cent.	2,046				
Observed velocity	2,047	2,235 ± 25	2,185 ± 25	2,200 ± 25	2,588
Calculated Pressure	15·2	14·33	14·33	14·0	19·41
Observed Pressure	15·1	15·0 (less than)	15·5 (less than)	16·0 (less than)	19·35

must be reduced 2 *per cent.* to read in Cordite velocities. The pressures obtained by the use of the Table are substantially correct for either explosive.

It will be seen that no correction has been made in the case of the 12-inch gun quoted at length in the article, nor in the same gun with a bigger charge shown in the tabulated results. This is because the observed velocity quoted is that of the proof rounds. No doubt when the gun is described in the official text books, the figures quoted will be about 5 per cent. less.

THE LATE MR. W. E. METFORD.

AN APPRECIATION.

WILLIAM ELLIS METFORD, born October 4, 1824, died October 14, 1899. Grandson of Dr. Ellis Bulton Metford, o Flook House, Taunton, and Post Green House, Poole, Dorset, a widely known physician, with a large practice. His father was also a physician, but gave up practice on his marriage in 1824 with Miss Anderdon.

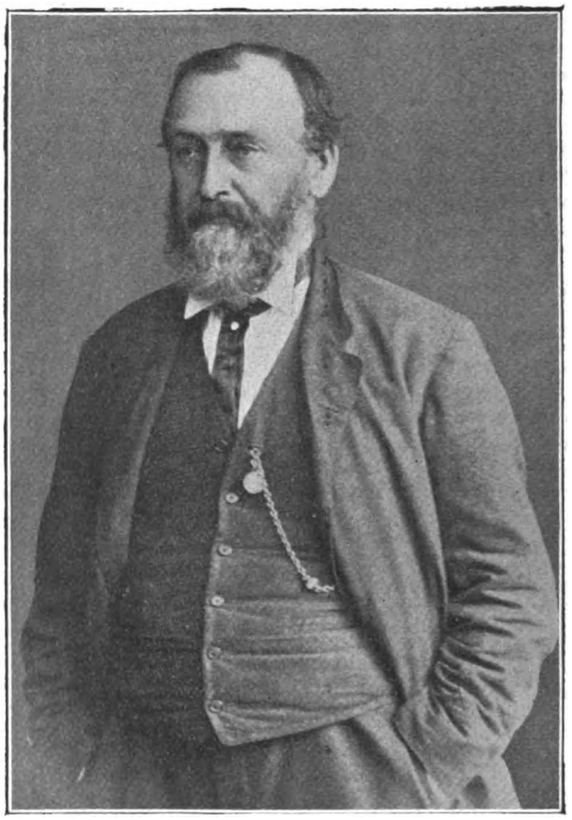
Such is the extraction of the late Mr. W. E. Metford, who was educated under Mr. Peniston, a civil engineer, and was afterwards employed under Brunel in railway work on the Great Western Railway. He was an intimate friend of Mr. William Froude and other men prominent in his profession.

Rifle shooting had been a hobby of his father's, who was also a very good archer. Consequently he took an interest in it from a boy, in the days when rifles were scarce and their use almost confined to sportsmen; for it was the Crimean War which first showed the necessity of superseding the army musket by a more accurate weapon. The making of fireworks was also one of the subjects which engaged his attention when young.

In 1851 he showed at the Great Exhibition a case of gems cut by a process of his own invention, which gave results much better than had up to that time been attained. In 1852 the Pritchett bullet was adopted by the Small Arms Committee of that day—a military bullet of improved shape, with a hollow base. This bullet was really invented by Mr. Metford, who had shown it to Pritchett, as the latter afterwards acknowledged. Before 1854 he was experimenting with a hardened expanding cylindrical bullet, and in that year proposed to the Select Committee an expanding bullet with a flat base, which, however, was not adopted. In 1853, being then familiar with the American telescopic rifle sights made by James, of Udica, he seems to have first made an improved telescopic sight of his own design. This he used for many years, and afterwards improved upon it. It was while fitting this firs telescope that he was struck by the fact that the telescope, when fixed so as to sight parallel to the axis of the rifle barrel, did not at all correspond with the line in which the barrel was projected. This divergence, due to the disturbance of the rifle by the explosion of the charge, had been hitherto ignored or quite misunderstood. With the help of his ever-ready friend, Mr. W. Froude, Metford soon arrived at the true explanation.

The year 1857 saw Mr. Metford in India, having taken up an appointment on the East Indian Railway under Mr. (now Sir Alexander) Rendel. Here he was at once brought into contact with the Mutiny, and, at the cost of his health, rendered great services. In this critical time he showed himself to possess powers of leadership over men not suspected by many of his most intimate friends. In a short time the young railway engineer became the resourceful chief to whom all applied for guidance in the protection of the town, and it was by his exertions that a properly organised system of defence was maintained, and many lives saved. (*Times*, October 25th, 1899, p. 3).

Returning to England, his ill-health made it necessary for him to abandon his profession. But his was one of those minds which cannot but be active, and he soon renewed his active interest



THE LATE MR. W. E. METFORD.

in rifle work. The volunteer movement of 1859-60 brought the subject prominently to the front, and in 1862 Mr. Metford fell in with Sir Henry Halford at the Wimbledon rifle meeting, and a friendship and constant companionship between them sprang up, which lasted more than 30 years and was terminated only by death. Mr. Metford had long found an interest in devising a satisfactory means of producing an explosive rifle bullet, and when there was a demand for one to be used in the Enfield rifle he produced one which proved easily superior to all its competitors. It had even the advantage of making rather more accurate shooting than the service bullet, and was very safe in use and simple to manufacture. It was adopted in November, 1863, but it never came into actual use, for the Convention of St. Petersburgh in 1868 declared against explosive missiles of less than 14 oz. weight, and in March, 1869, it was declared obsolete.

The signs of improved shooting obtained with the explosive bullet with a deep hollow at the nose led to an investigation of the best position for the centre of gravity of the bullet, and it was soon found that Mr. Metford, using his own ammunition (as was then allowed), had an advantage in competitions over those using other ammunition. He did not shoot a great deal, and considered his performances to be much handicapped by his health; yet in 1862, entering for the first time in a match for a prize of £100, he won it, and three weeks later repeated the performance. In 1863, he again won a first prize of like amount. At the Rifle Conference in January, 1864, he read a paper on the handicapping of men and of weapons, and alluded to the advantage which he considered to be given him by his method of loading. Almost immediately after the close of the Conference he wrote a letter to the secretary of it, describing the modified bullet on which his success depended; and a full description of it, with diagrams, was published in a pamphlet on "Rifling and Rifle Sights," edited by Lord Bury, for the National Rifle Association in the same year.

Mr. Metford felt that, having won enough prizes to recoup himself for the cost of his experiments, the best course was to give the secret to the public, and in 1865 we find that in the *Volunteer Service Gazette* competition for long Enfield rifles at 800 yards, "any ammunition" was allowed expressly in order to permit the use of Metford bullets, and that the first prize was won by a competitor using them. Advantage was taken by Mr. Metford of the form of this bullet, with its considerable hollow in front, to enable the position of the hit on an iron target to be indicated. He filled the hollow with vegetable charcoal, which, as the bullet broke up, made a momentary cloud easily visible from the firing point. Mr. Metford also pointed out how a similar bullet made of hardened lead (1 of tin to 15 of lead) would make good shooting at long ranges if fired from a rifle of ·577 calibre with a spiral of 1 turn in 3 to 4 feet and 3 shallow grooves of ·01 inch deep.

In 1864-5 the National Rifle Association gave prizes for a special competition at 2,000 yards with muzzle-loading rifles weighing not more than 15 lbs. Mr. Metford specially made for this competition a rifle of about ·5 inch bore with telescopic sight, which gave fair results. It was the only rifle entered in 1865, and in the competition of 1866 the only other competing rifle failed to find the target.

The production of a Metford small-bore rifle was a step now soon taken. A calibre of about ·45 was the obvious one, and had been already used by Sir J. Whitworth. The question of pitch of spiral was treated originally by Mr. Metford. From time immemorial variations had been made in the pitch; increasing and even decreasing spirals had been used. But they had depended on no rule—merely on the fancy of the maker. Mr. Metford was the first to see that a properly proportioned increase of pitch in the spiral should be such as would give the bullet equal increments of rotation in equal times during its passage up the barrel, and that this would reduce the tendency to "strip" to a minimum. The curve of the increasing pitch of the spiral corresponded, in fact, with that of the effective work of the powder. This invention formed the subject of a patent, and for nearly 30 years it was applied to the Metford rifle generally. It does not, however, seem to have been a principal element in its success, though it had the incidental advantage of infallibly shearing the paper patch surrounding the bullet, and so preventing a cause of false shots not unknown in rifles with an even spiral. Mr. Metford felt it important to patent his increasing spiral, both to record that it was he who put the principle upon a proper scientific basis, and also guard himself from unworthy imitations.

A more important principle embodied in the rifle was one which has already been indicated, and which did no less than revolutionize the manufacture of rifles. The name of Metford will always be associated with an important departure marked by the use of a hardened bullet, which the powder pressure expanded so as to fill the shallow grooves of the rifling, which latter are part and parcel of the system. The only previous move anywhere in this direction had been a mechanically fitted hardened bullet. The first "small bore" rifle made on these principles by Mr. Metford was fired by Sir Henry Halford, who at once made a sensation by winning with it the Cambridge Cup at the annual meeting of the Cambridge University Long Range Club in 1865, the competition consisting of 15 shots at 900, 1,000, and 1,100 yards, on each of two consecutive days. This rifle had five shallow grooves, with square edges cut concentric with the bore, a form of grooving, which, if allowance is made for the difference in size, is the very counter-part of that of the present service arm the "Lee-Enfield." From that time the Metford rifles, as was natural enough, grew in popularity and success, and the advantages of the new system were soon recognised by other manufacturers, who quickly followed suit. ("In 1867, says Mr. Walsh, in 'The Modern Sportsman's Gun and Rifle,' Mr. Rigby introduced his model long range rifle, for which in its essential features he had adopted the lines that had guided Mr. Metford.")

The next problem to which Mr. Metford turned his attention was that of the production of a military breech-loading rifle. This entailed much labour and experiment, and the chief points which he embodied in it were the use of a solid drawn brass cartridge case, the abandonment, as unmilitary, of lubrication (except such as a waxed felt wadding, suffering no appreciable loss of weight in its passage through the barrel, might be supposed to give), the bridging-over by the best form of "lead" or entry of the space between the end of the cartridge case and the beginning of the rifling, and the adoption of a grooving which should give as little opportunity as possible for fouling to interfere with the shot. The segmental form of groove was found the most suitable for complying with these requirements. The first Metford military breech-loader was produced in 1871, when Sir Henry Halford succeeded in winning the Duke of Cambridge's prize at 1,000 yards at Wimbledon with it. Experience was soon gained in the use of this rifle, and in a very few years it had gained something approaching a monopoly of the prizes for military breech-loaders, while the Martini-Henry, adopted about this time, gradually became conspicuous by its absence from the prize lists. The Metford rifle took the first prize in the Duke of Cambridge's competition nine years out of the ten following its introduction.

In 1877 the American match rifles, which were capable of extremely fine shooting if wiped out after every shot, began to be conspicous as giving better results than muzzle loaders, and this led to gradual improvement of English made breech-loading match rifles towards the same unpractical end. The

great results obtained with the military breech-loading rifles at long ranges during the course of preparation for the military matches with the Americans in 1882-3 led to the prohibition of cleaning out with the match rifle, and under this more practical condition the Metford rifle again asserted its superiority. Mr. Metford also introduced an improvement in the shape of the bullet which, with a rather flattened nose and a shoulder sloping back very gradually, was found to offer less resistance to the air than the round-nosed form in general use.

At the time when the Martini-Henry was adopted as our military arm, Mr. Metford had shrunk from the labour and worry entailed in bringing his rifling forward in competition with others with a view to its adoption. But the Committee on Small Arms in 1883 adopted provisionally a ·4 rifle with the Metford rifling. This, however, was almost at once succeeded by a reduced calibre. The Committee asked Mr. Metford to design them a barrel and bullet on the lines of the Rubin rifle, which he very quickly did, for his experience enabled him to lay down the shape of entry, pitch of rifling, depth of grooving, etc., within 24 hours, so perfectly that the Committee's most careful experiments failed to show any advantage in modifying them. The rifle was made to be shot in the first place with black powder, and some time elapsed before Cordite was adopted and brought into use. Soon after this it was found, as already mentioned, from experiments at Enfield, that the life of the barrel was prolonged by the adoption of five grooves of a less delicate shape instead of the former seven. Indeed, with the absence of a deposit of fouling, such as could be swept out of the bore by each shot, much of the *raison d'être* of the segmental groove ceased to exist.

Mr. Metford's experiments were as careful as a scientific mind and scrupulous accuracy could make them. His ballistic pendulum, a really trustworthy instrument, was a great improvement on its predecessors. No detail connected with rifles was neglected. The form of sights, the method of dividing them, the form of trajectories, the effect of wind, temperature, etc., on the shooting, all these matters and many more received much attention. He loved no occupation better, on a summer holiday, than to choose a really calm day and to shoot at some rock in the sea off Plymouth Harbour, or near Freshwater, in the Isle of Wight, at a distance of 2,500 to 3,000 yards, at which the splash of the bullet into the water could just be discerned after a long interval through a good glass. An excellent workman himself, he was, indeed, fortunate in having such a man as Sir Henry Halford to assist him in his experiments, while much credit is due to Gibbs, of Bristol, and to the firm of Westley Richards for the accurac of manufacture, so important a factor in the success of his rifles.

The name of Metford is known wherever English rifles are used. But the character of the man will be even better remembered than his ability by his friends. His was a personality which could not fail to make an impression—a mind observant of details, yet great in its breadth of grasp and width of sympathy, of unswerving integrity, conspicuous in unselfishness, in loyalty to friendship, in patriotism. Crippled as he was in health for the last 40 years of his life, yet he created during that time a reputation such as few men ever attain. The great master of the subject he made his own has departed, and we look in vain for a worthy successor.

APPLICATIONS FOR PATENTS.

SEPTEMBER 16th—OCTOBER 21st, 1899.

18,956. Mechanism Applicable to Small-arms, Machine Guns, and Ordnance. H. W. Gabbett-Fairfax.
18,986.* Torpedoes. T. McKenna. (Agent for *Elia, Italy*).
19,017.* Carriers for Small-arm Ammunition. (Agent for *T. C Orndorff, U.S.A.*).
19,093.* Carburizing Armour Plates. W. B. Johnson. (Agent for *J. S Unger, U.S.A.*).
19,111. Projectiles. J. Hosbein.
19,167. Single-trigger Mechanism. E. C. Hodges.
19,276. Cartridge Belts for Machine Guns. J. Formby.
19,333. Light Gun Mountings. A. Vickers, G. T. Buckham, and C. A. Larsson.
19,444.* Ejectors. T. M. Eynon.
19,448.* Automatic Small-arms. L. Hellfritzsch.
19,544. Detonators for Signalling. V. von Neuman.
19,695. Time Fuzes. Sir W. G. Armstrong, Whitworth & Co., Ltd., and G. Stuart.
19,777. Ammunition Priming Devices. C. von Görtz, and the firm of E. Skoda.
19,778. Primary Devices for Guns. C. von Görtz, and the firm of E. Skoda.
19,848.* Fire-arms. A. W. Savage.
19,859. Explosive Projectiles or Aërial Torpedoes. E. Wall.
19,906.* Cartridges. J L. Brewer.
19,940. Range Finders. R. R Bruce.
20,072. Single-trigger Mechanism. W. L. Powell and A. Dean.
20,111. Telescopic Rifle Sights. A. A. Common.
20,155.* Machine Guns. F. M. Garland.
20,156.* Cartridge Boxes or Magazines. F. M. Garland.
20,179. Steering Gear for Torpedoes. H. W. Webb.
20,191. Range Recorder. J. Macallum.
20.258. Miniature Ammunition Adaptors. J. Ramsey and T. E. Riddle.
20,535. Double-barrel Drop-down Guns. W. H. Brighton.
20,630. Drying of Cellulose Products. M. Fremery and J. Urban.
20,714. Ammunition. J. L Brewer.
20,828. Sling swivels for rifles. C. Moulder.
20,856. Breech mechanism for automatic guns. W. A. Burns.

* These applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

SEPTEMBER 23RD—OCTOBER 21ST, 1899.

18,965 (September 6, 1898). C. A. D. George, Bournemouth. A method of mounting targets together with protected mantlets without the use of a pit. The targets are mounted on a rail and run horizontally, being so arranged that when the dummy target is exposed the proper target is concealed behind the mantlet. The target proper when exposed may be observed by the operator through a thick plate glass window in the mantlets. Accepted September 6, 1899.

19,606 (September 19, 1898). E. Hollings, Chorlton-cum-Hardy. A means of moulding guncotton so that all the air is expelled from the pores of the cotton, the separate fibres being laid together by pressure, thus forming a mass free from air space. This is accomplished in a perforated mould into which the guncotton is placed, and is formed with water into a thick pulp. It is then pressed by a revolving layer, which consists of a bar provided at its end with screw blades. As the bar revolves the guncotton is compressed, the water being expelled through the perforations in the side of the mould. The moulded mass is then pressed by hydraulic power into blocks or discs of any required shape. Accepted September 19, 1899.

21,070 (October 6, 1898). M. Demancier, and A. Dalzon, Paris. Breech closing mechanism for ordnance. The mechanism has an operating shaft which is caused to turn the breech block by gearing distinct from that which operates the opening of the breech. The axis of the turning mechanism is carried by the gun whilst the opening gearing is mounted on the hinge-bolt. A safety slide also acts in conjunction with the operating shaft for preventing premature firing or swinging back of the breech block. Accepted September 16, 1899.

21,116 (October 7, 1898). R. Parry, Holyhead. Projectiles for smooth bore guns. The projectile is similar in shape to a torpedo, but attached to its tail are fins which set up a resistance to the movement of the projectile through the air, and by so doing create a rotary movement Expansion rings are provided at its centre to prevent any escape of the gases of combustion. Accepted September 23, 1899.

21,378 (October 11, 1898). W. C. E. Serjeant, London. A compound bullet the nickel jacket of which is unbroken at the nose. The core is, however, formed with a conical or wedge shaped air chamber at its forward part. The bullet is formed in this way so that it shall combine the advantages of a solid projectile with those of an expanding bullet. Accepted September 9, 1899.

24,062 (November 7, 1898). Dr. W. Wolff, Berlin. The Wolff chronograph. An instrument for measuring the velocities of projectiles. These instruments are worked in pairs, and their mechanisms are operated by the air wave which is set up by the nose of the bullet. A chronograph is connected with the indicators, and the bullet's travel over a given distance is timed. A full description of the indicator was given in our last May issue. Accepted September 23, 1899.

24,468 (Date of application in France, May 24, 1898. Date of application in United Kingdom, November 19, 1898). E. A. G. Street, Paris. In a former patent the patentee described a method of manufacturing chlorate powders from solutions of azo- or nitro-derivatives mixed with chlorate of potash at a temperature at which these solutions are liquid. The present specification describes another means of applying the same process to other chlorate powders by substituting pitch for the whole or part of the azo- or nitro-derivatives. Accepted September 23, 1899.

25,493* (December 15, 1898). C. O. Ellis, E. W. Wilkinson (trading as Charles Osborne & Co.), and W. Jerman, Birmingham. The Osborne Single-trigger Mechanism.

3,657 (February 18, 1899). W. P. Thompson. (Agent for *W. S. Isham, U.S.A.*). A shell which is designed so that it shall carry any required charge of high explosive without risk of premature explosion, and shall at the same time be capable of piercing armour plates. The patentee has discovered a law governing the pressure of the gases of the propelling charge upon the high explosive contained in the shell. From this law he is enabled to ascertain the height of each separate portion of the bursting charge which is contained in a number of cells into which the shell is divided. The bursting charge is regulated in this manner, the height of each separate charge being greater or less in proportion to the amount of propelling powder used. Accepted Sept. 30, 1899.

6,523*. (March 5, 1899). C. H. Curtis, C. L. W. Smith, L. J. Metcalfe, A. C. Pearcy, London, and A. F. Hargreaves, Midlothian. Gunpowder and Blasting Cartridges.

9,165 (May 2, 1899). J. Hermann, St. Petersburg. A range finder for finding the distance of objects, which consists of a telescope supported on a cup joint. The telescope is sighted upon the desired object, and from a scale attached to the instrument the angle formed on a horizontal base line may be read, and the distance ascertained. Accepted Sept. 16, 1899.

9,315 (May 3, 1899). J. T. Armstrong and A. Orling, London. A method of steering or operating torpedoes from a distance by means of a transmitting apparatus which projects a beam of light in any desired direction. A receiving apparatus, consisting of a closed circuit, contains an arrangement which is provided with a number of selenium cells whose electrical resistance is varied when under the influence of the rays. When the torpedoes course is to be altered, the rays are moved to the right or left as required, and by means of its influence on the receiving apparatus, the steering gear is altered accordingly. Accepted September 9, 1899.

11,051 (May 26, 1899). H. P. Hurst, U.S.A. A fuse or detonator for exploding shells on impact which is fixed at the base of the projectile. The object of the special mechanism in this fuse is to insure that even should the detonating charge explode prematurely, the main charge could not be ignited. This is prevented by a partition which is placed between the fuse and the main charge. It is axially supported, and is held in the closed position by some special means. Another mechanical device which may be operated by hand, or by the action of the gases of combustion, stores up sufficient power to rotate the partition during the flight of the projectile. Accepted September 2, 1899.

11,789 (June 6, 1899). E. F. G. Pein, Hamburg. A method of indicating at the firing point which section of the target is struck by the bullet. The target is divided up into quadrants or sections, and the impact of the bullet upon one of these sections closes an electric circuit, and establishes a current, the strength of which is arranged by resistance coils to vary according to the section of the target struck by the bullet. A galvanometer serves to indicate the strength of the current and hence the part of the target struck. In this way it will be seen that only one connecting wire between the target and the firing point is required. Accepted September 23, 1899.

12,392 (June 14, 1899). F. J. W. Lindeman, Utrecht. A method of decreasing the sensitiveness of nitroglycerin in explosives, and at the same time not decreasing the explosive force of the finished compound by causing the nitroglycerin to be absorbed by a substance which is itself possessed of explosive properties. The substance used in this instance is chlorate of potassium in the small crystalline state, which is caused to absorb a mixture of nitroglycerin, nitro-benzol, or dinitro-benzol, with or without the addition of benzol. The paste obtained by this means is then shaped and treated in the manner usual in dynamite manufactories. Accepted September 23, 1899.

13,232 (June 26, 1899). H. P. Hurst, U.S.A. High explosive projectiles and impact detonating fuses. The fuse is, in the normal state of the shell, entirely isolated from the main charge, so that should the fuse detonate prematurely the main charge is safe from explosion. The impact of the shell upon striking, releases the device which isolates the fuse from the main charge, and the fuse flies forward down a fuseway the shock detonating the primer, and so exploding the main charge. Accepted September 23, 1899.

13,784 (July 4, 1899). H. P. Merriam, U.S.A. An impact fuse which is attached to the base of explosive shells. The fuse is provided in its inner chamber with a hammer which is secured to a bolt, the head of which is exposed to the gases of combustion. The hammer and the bolt are secured to each other by a pin which is made weak enough to break upon any traverse bending strain being placed upon it. Upon the firing of the gun the fuse bolt is forced sideways by the gases and this breaks the pin and releases the hammer. Upon impact the hammer flies forward and detonates the charge. Accepted September 2, 1899.

13,785 (July 4, 1899). H. P. Merriam, U.S.A. An impact fuse for high explosive projectiles which is fixed into the head of the shell. The fuse charge is detonated, as in the preceding patent by the same patentee, by a spherical hammer, but in this case it is held in its normal position by a stop which is removed during the flight of the shell. The impact of the shell upon striking causes the hammer to detonate the charge. Accepted September 2, 1899.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

A NEW SAFETY GUNPOWDER.

6,523. (March 25, 1899). C. H. Curtis, C. L. W. Smith, D. J. Metcalfe, and A. C. Pearcy, London; and A. Fuller, Midlothian. This patent relates to gunpowder and blasting cartridges for use in dangerous mines. The object of the invention is to provide a modified form of ordinary gunpowder which may be used in dangerous mines without any fear of the explosion igniting marsh gas or coal-dust. To attain this end what is known as a "cooler" is provided. Various substances have been tried to act in this capacity, and these have formed the subject of previous patents, Nos. 232, 6,756, and 12,404, all of 1898. In place of either of the substances then named, it has been found that potassium nitrate commonly known as saltpetre, may be used, but the potassium nitrate added in excess of that already used in gunpowder is not explosive, and does not appreciably add to the strength of the gunpowder. This new cooling charge may be incorporated with the gunpowder in course of manufacture, by merely altering the proportion of its constituents. The potassium nitrate must not be in less proportion than 83 per cent. of the completed powder. This increase in the proportion of potassium nitrate necessitates a reduc-

tion in the proportion of the sulphur and charcoal. It has been found better to reduce the sulphur rather than the charcoal, and the former may be reduced to 1 per cent, or even omitted in some forms of the new powder with advantage. The difference, therefore, between this new powder and the ordinary is that it contains an excess of potassium nitrate. The excess of this material serves not only to reduce the temperature of the gases produced by the explosion, but also to promote the oxidation of the products of combustion. It serves to prevent the liberation of inflammable gases, such as heated carbon non-oxide, and also to avoid the formation of the inflammable form of potassium sulphide. The patentees claim the use of a cartridge constructed in the same manner as that dealt with in Patent No. 232 of 1898, which was fully described and illustrated in our last January issue, but with potassium nitrate substituted as a cooling agent for oxalate of ammonia. Accepted September 30, 1899.

THE OSBORNE SINGLE-TRIGGER MECHANISM.

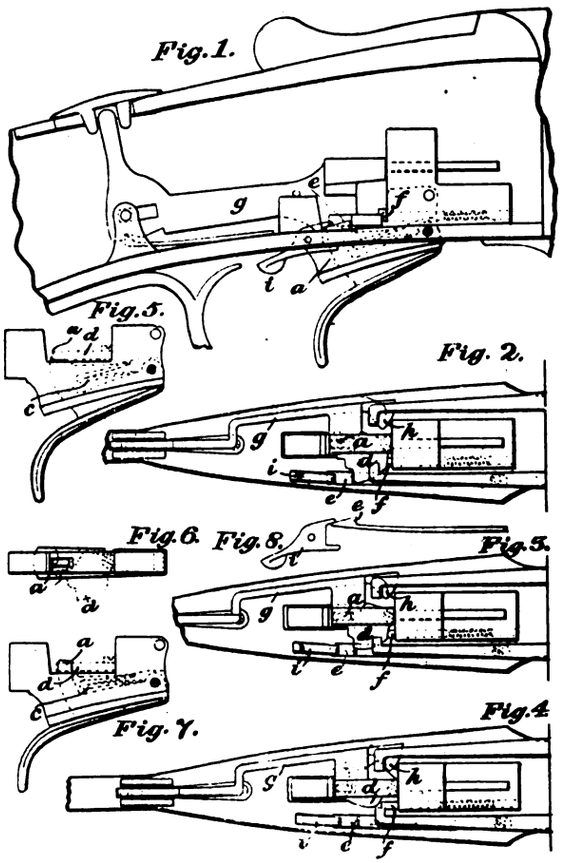
26,493. (December 15, 1898). C. O. Ellis, E. W. Wilkinson (trading as Charles Osborne & Co.), and W. Jerman, Birmingham. This single-trigger mechanism is of the type in which the essential feature is a switching arm attached to the top of the trigger blade, which travels laterally from beneath one sear to the other. The intermediary or involuntary pull is not a necessary operation after the first discharge for setting the parts to the position for discharging the second barrel.

In the illustrations Fig. 1 represents a side view of the mechanism, and Figs. 2, 3 and 4 are plans showing the parts in the various stages of their movements. Figs. 5, 6, and 7 show the trigger, which is made in two separate portions, in its different positions, and Fig. 8 is a view of a lever which is provided for the purpose of turning the mechanism over so that the left barrel may be discharged first.

Referring to the various parts it will be seen that the trigger, shown in detail in Figs. 5, 6, and 7, is composed of two portions pivoted at the point 20. The part containing the trigger fits into the interior of the trigger blade proper. The top of the trigger is provided with a projection or peg *a*, which protrudes through an opening *b*, Fig. 6, in the top of the trigger blade when the trigger is pressed upwards against the action of the spring *c*. The switching arm *d* is also attached to the top of the trigger blade, and it will be seen that after the trigger has been raised a certain distance the whole trigger blade, together with the switching arm, is also raised. As these are the only parts of the mechanism which need a special description, we will go on to their movements during the operation of firing the two barrels.

In Figs. 1 and 2 the mechanism is shown in a position ready for firing the right-hand barrel, the switching arm *d* being beneath the right-hand sear. From Fig. 2 it will be seen that the switching arm is secured in this position by the spring catch *e*, which is shown in detail in Fig. 8. When the trigger is raised the switching arm, together with the sear, is also raised and the right-hand barrel is discharged. The raising of the switching arm lifts it above the spring catch *e*, and under the influence of the spring push *f* it tends to fly over towards the left. Now, provided the trigger were immediately dropped to its full extent after the first pull, the peg *a*, which protrudes into the path of the switching arm when the trigger is raised, would be removed, and the switching arm would be free to travel completely over to the left. The involuntary pull immediately following from the first discharge would, in this case, cause practically a simultaneous firing of both barrels. The patentees, however, explain that the involuntary pull follows so swiftly after the first pull that the trigger has not time to fall to its full extent, being again involuntary pressed before the peg *a* has disappeared beneath the level of the top of the trigger blade. It will be seen, therefore, that the switching arm is retained in a position midway between the two locks by the peg *a* until the voluntary release of the trigger after the involuntary pull has occurred. The voluntary release of the trigger removes the peg *a* from the path of the switching arm, and still under the influence of the spring push *f*, it takes up a position beneath the left-hand sear as shown in Fig 4. Upon the trigger being pulled a third time the left-hand barrel is discharged.

The switching arm is turned back to its position beneath the right-hand sear when the gun is opened to extract the empty cases by an arrangement fixed to the safety mechanism. The safety is of the ordinary automatic type, and attached to its lower part *g* is



a sort of hook *h*, which is pulled back by the safety slide in its automatic movement to the "safe" position. As may be seen in Fig. 4, the switching arm, when in the left-hand position, is situated in the path of this hook's travel, and is, therefore, pushed out of the way by the backward travel of the safety mechanism. This push rotates the switching arm on its pivot, and turns it completely over to the right-hand position, where it is again secured by the spring *e*.

Fig. 8 is a detailed view of a lever, by means of which the mechanism may be so arranged that the left-hand barrel shall be fired first. The lever *i*, Fig. 1, is pressed upwards, and its forward end comes into engagement with the spring catch *e*, which holds the switching arm in the right-hand position. The spring is thus pressed downwards and out of the path of the switching arm, which is then free to fly over to the left. Of course, to fire the right barrel after the left has been first discharged, the safety would have to be pressed back by hand to rotate the switching arm over to the right-hand sear. Accepted September 30, 1899.

Arms & Explosives

A TECHNICAL AND TRADE JOURNAL.

EDITED BY MAX BAKER

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CONTENTS.

NOTICE TO OUR READERS.

With reference to the article which appeared in our last issue dealing with a new system of calculating the maximum pressure and velocity of shots fired from ordnance under various conditions, and our promised republication of the article, together with an enlarged and complete table of equivalents and constants, we regret to have to announce that the arrangements in question have been cancelled. The copyright of this material is ours by right of absolute purchase, and these rights we still possess unchallenged. But it has been pointed out to us that a portion of the material upon which the calculations were based was private property to the extent that it is not generally accessible. Consequently the many months of able research which have produced results of considerable value must be lost to the world in general and artillerists in particular, in so far that we shall not publish them now. We cannot say that we altogether agree with the reasons advanced for their withdrawal, but we have, nevertheless, acceded to the request of the author, and, therefore, beg to tender our regrets to those who have already ordered copies of the work or otherwise shown their interest therein.

CURRENT TOPICS.

Regina *v.* **Fraudulent Gun Markers.**—A lump rose in the throats of those who were present at the hearing of the case against Messrs. Goff for the fraudulent marking of guns. The idea of an old gentleman of 80 odd years of age being taken to prison for fraudulent trade practices was more than most of us would care to see realized. Usually, cases under the Merchandise Marks' Act are punished by sentence of imprisonment with the option of a fine, but in this case the humiliating alternative of imprisonment was not put forward by the magistrate, possibly as the result of the defending solicitor's plea for consideration of his client's age and infirmity. Nevertheless, the magistrate commented severely upon the gravity of the offence, and remarked that it almost amounted to forgery. Even with the qualifying word "almost" this was a strong statement for a magistrate to make when the charge of forgery had not been argued before him. Considering that the defendants had acknowledged the marking of names upon guns which their plea of guilty admitted to be false, it is clear that the magistrate had every justification for his remark. A more gross set of frauds than those which Messrs. Goff appear systematically to have carried on it would be difficult to realize, and the report of the case, which appears in another part of our issue, shows that when brought to book the evidence against them was so black that they had nothing to do but plead guilty and throw themselves upon the mercy of the Court. It would be an injustice to suggest that anything quite so bad as what has already been exposed is going on systematically in other directions without the clearest proof that such a statement was true. But, on the other hand, it is no secret that many doubtful practices in connection with the marking of guns are carried on with a degree of openness which suggests a dangerous contempt of the law. There is a demand for second-hand guns far in excess of the ordinary supply, and we believe we should be well within the mark in stating that eight out of every ten guns which are supposed by their purchasers to be second-hand are absolutely new. A firm doing a large trade in so-called second-hand

guns would not be able to sell them if they were all marked with the true maker's name. It is found necessary, therefore, to have a selection of "genuine names," which, on the payment of a small fee to the owners of such names, may be applied to the guns. Such an arrangement constitutes a conspiracy to defraud the purchasers, and one never knows when this offence may be brought home to its perpetrators with the same striking force as that which overwhelmed Messrs. Goff.

Home Office Testimonials for Explosives.—The new Order under the Coal Mines Act, which we publish elsewhere in this issue, will come as a rude shock to many who congratulated themselves upon having steered their explosives among the rocks and rapids of the statutory test. Now that they have settled down somewhat, the New Order serves to waken them to further activities; for it imposes another barrier between them and the calm waters due to official recognition of the safety of their explosive. A still more severe series of tests, tentatively optional, but ultimately to be made compulsory, is a very questionable innovation, unless H.M. Inspectors are absolutely certain that their tests are sound in theory and practice. We do not consider that the existing tests have been long enough in force to justify a further step towards the limitation of explosives for use in coal mines, and secondly, we should have preferred to wait until the conclusiveness of the present tests was more generally recognised among experts than at present. Striving towards a hazy ideal is not a good policy in business, and we regret that the working of an important industry has again been agitated before those concerned have had a chance of settling down under the new order of things, already of a drastic nature. It rests with the trade to submit or not to submit their explosives for the new test; and we cannot help thinking that some such protest might be adopted as to ignore the new test entirely. If there were any definite reason to suppose that any of the explosives at present "permitted" are not safe, then the tests are defective. Safety in explosives is certainly a matter of degree only, but even so the dividing line has been established for the time being, and there, in our opinion, it should stay. We don't believe in Government-recommended explosives, and we think the Home Office is going too far in recommending particular wares, and this is what the new Order amounts to. Another point to which we wish to draw attention is the large fee of £30 which, with certain exemptions, is charged for the new test. Since the same number of shots may be fired under other conditions for a fee of £4, it looks as though the new tests are somewhat in the nature of a commercial speculation. The Coal Mines Act is for the interests of the miners, and consequently the cost of its administration should be met from public funds. It seems hardly fair that besides the worries of the tests explosives makers should have to find the money for the carrying on of the testing station.

A New Proof Act.—The formal notice that a new Proof Act will be applied for next session will not surprise those who have realised how much the hands of the Birmingham Proof House have been tied on account of the limited powers conferred by the existing Act. No matter what powers are granted to the Birmingham Proof House, there is every assurance that they will not be misused in practice, since the Birmingham Proof House is managed by representatives of the trade. Consequently, the use they will make of their extended powers will be for the general benefit. The only clauses that will need careful watching are those dealing with the qualification for registration as members of the trade. Such modifications as may be made must not be of a character to concentrate an undue amount of voting power in the hands of a few large companies. We especially name this factor, as it is rumoured that the representation of limited liability concerns will be enlarged. The situation as regards the London Proof House is, however, on quite a different footing. The Gunmakers' Company is out of touch with the trade, and has shown the most obstinate ill-will towards proposals emanating from the trade. The Gunmakers' Company received a charter which presumed that it would be managed by the trade. If it were managed exclusively by outsiders, all the trade would be in an equal position. But as things stand, it is left to two or three members of the trade to run the show as they think fit, and to dictate many of the conditions of proof to the rest of the trade without fear of correction. That the system of proofs needs intelligent supervision by competent persons may be appreciated when the *Field*, the leading paper circulating among sportsmen, announces that certain proof stresses are less than service stresses. The legislature of a country with a limited monarchy, and an elective system for the ruling body, is to be asked to enlarge the powers of an organisation which so utterly fails to emulate the modern principle of representative government. The Gunmakers' Company has not used the powers it already possesses in a way encouraging those outside the charmed circle to do otherwise than offer the most strenuous opposition to any extension of its powers. We must await the draft Bill before going into detail.

We regret to place on record the death of General C. W. Younghusband, formerly superintendent of the Royal Gun Factory and of the Royal Gunpowder Factory.

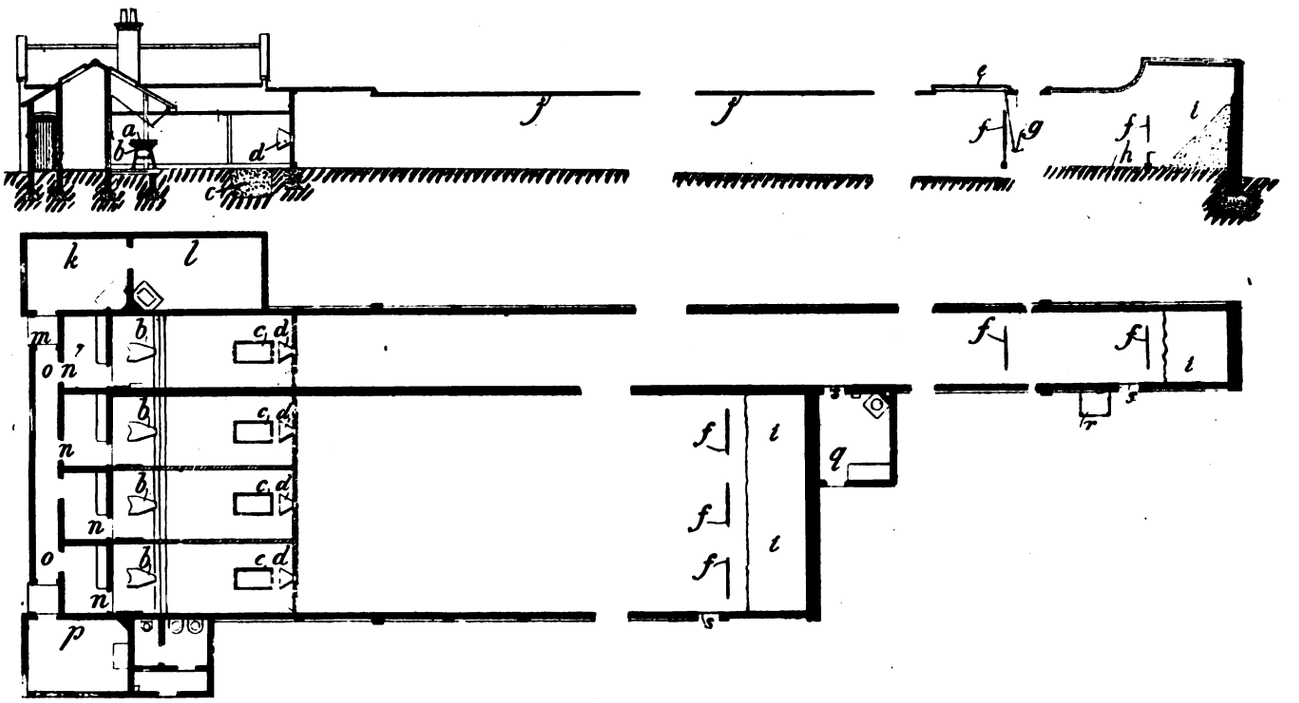
A practical work on metal engraving, chiefly appealing to amateurs, has been published by Messrs. Hampton & Co., Cursitor Street, E.C. It includes a chapter on gun engraving.

Capt. H. P. De La Bere, district inspector of musketry for the Western District, recently delivered a lecture to volunteers on the history of fire-arms. The conclusion of the lecture brought him to the Lee-Enfield, and future ones will deal with modern arms of other countries, a subject upon which the author should speak with some authority.

Messrs. John Rigby & Co. have introduced a new double rifle of ·350 bore firing a hard-jacketted bullet of 310 grains weight. To this firm belongs the credit for initiating the move towards rifles combining the velocity of the military type of arms with the weight of the bullet of the express, their ·450 bore double rifle firing 480 and 350 grain bullets being the first introduced. The Jeffery ·400 bore is another rifle of similar class so far as regards velocity and weight of bullet.

We have received a sample lot of Kynoid cartridges for trial. We know the trade think well of them. To secure for them a practical trial we have forwarded them to a friend, who has promised to give them a trial on the rainiest day of the Christmas vacation. The point to which, as a practical sportsman, he will pay the greatest attention is to the behaviour of the turnover in a wet pocket. Anyone can make waterproof cartridges, but it does not follow that the turnover will stand rough wear, as the waterproofing mixture is apt in some cases to prevent the turnover from sitting firmly.

DESCRIPTION OF THE NEW BIRMINGHAM RANGES.



a Position of gun.
b Fining tables.
c Blow-off pits.
d Iron hopper for diverting wads.
e Sliding iron shutter.
f Targets.
g Gearing for operating shutter at 150 and 200 yards targets.
h Sand floor.
i Butt of casting sand.
j Roof of asphalte and concrete.
k Office.
l Instrument Room.
m Porch.
n Workshops.
o Corridor.
p Smithy.
q Target room and Telephone.
r Mantlet with Telephone.
s Iron doors.

WE reproduce herewith an illustration showing the arrangement of the new ranges erected by the Birmingham Proof House. It will be remembered that in our last issue we recorded the opening ceremony connected with these ranges.

Our illustration shows the main building and offices, together with the long rifle ranges, in elevation, and a ground plan of the whole of the ranges and subsidiary buildings. The first requirement of these ranges was that they should be perfectly safe, and should not allow the escape of badly aimed or glancing bullets, and this has entailed the entire roofing over of the ranges with a flat concrete and girder structure, waterproofed with a layer of asphalte.

The perfect lighting of the firing points has been arranged by the simple expedient of interrupting the roof at those parts. The lighting is, however, subject to regulation by a movable screen. The targets are also open to the sky, and are thus effectively lighted from above. The longest range may be fitted with targets at either of the two distances. In order to provide for the use of the more distant target a sliding roof is arranged to cover the space which is left open when the nearer target is in use. The shorter ranges are worked on a similar plan, and in every case the lighting arrangements are perfect,

Each of the ranges is isolated, so that gunmakers using them are free from interruption. The entrance to the range is through a workshop provided with a bench and vice. This workshop adjoins the firing station, which is provided with a proper gunmakers' rest. The firing is done through a port-hole provided with an automatic shutter. This shutter is automatically closed, so as to make the shooting impossible when either of the doors leading to the range is open. At the far end of the range there is a door for the use of the range attendant, while there is an additional one leading from the firing station. As a further safeguard against accident, an electric bell is constantly ringing when either of the doors is open.

Each firing station is in telephonic communication with the target room, and also with the mantlet or bullet-proof box for the range attendant, so that there is every facility for securing prompt attention to the requirements of the gunmaker. The buildings also include a smithy, intended for the use of those requiring to adjust the barrels of double rifles.

The general effect of the new ranges is excellent from the firing point of view. The target is perfectly clear to the eye, and the sights are well illuminated. There is none of the effect of shooting down a hole, since there is a clear space of

ten feet from roof to floor. The suggestion that the ranges should be used for rifle practice is very unlikely to be adopted, since the whole of the arrangements have been specially designed for shooting from a gunmaker's rest. Besides the ordinary rifle ranges there is a series of shot gun targets in the open for ranges extending up to 80 yards.

The various reference letters attached to the diagram give a clear idea of the various conveniences which have been provided in these ranges. We are indebted to Mr. W. Hawley Lloyd for the loan of the plans illustrating this article. Mr. Lloyd has had a responsible task to perform in his capacity of architect to the Birmingham Proof House. There were no precedents to guide him in the erection of closed ranges of such extent, and it was left to him to express in architectural form the severe requirements laid down for his guidance. Numerous experiments were necessary in order to exhaust from the designs of the ranges every possibility of danger, and further, it was necessary that the very peculiar conditions upon which the accurate alignment of rifle sights depend should be studied and met. With the expert co-operation of the members of the Ranges Committee, these conditions were defined, and that Mr. Hawley Lloyd has succeeded in his part of the work is proved by the testimony of experts who have agreed that, not only is the range as easy to use as one in the open air, but that it provides even better definition of the sights than can be obtained out of doors. Considering that the object of gunmakers' work at the ranges is to get the best out of the rifle that it is capable of doing, it is clear how important is the success which has been achieved.

NOTES.

THE COLT GUN AND CARRIAGE CO., LTD.—The prospectus of this Company was issued to the public about the end of last month. The Company has been formed to take over and work various patents covering the new features of automatic gun construction contained in the Colt automatic gun, and also of a gun carriage suitable for automatic guns which has been introduced by Lord Dundonald. Frequent references have appeared in past issues of this paper to the Colt Automatic Gun. It was brought out by Colt's Patent Fire-arms Manufacturing Company of the United States, and it was accorded a favourable reception by the U.S. Government. Since its introduction, it appears to have performed useful service in actual war. The Dundonald carriage appears to be somewhat in the experimental stage, so far as can be judged from experiments that have been made with it, and from the appearance of such engravings of it as have been published. Its main advantages appear to be such lightness of construction that it may be drawn by one horse at a gallop, and that it possesses sufficient accommodation for ammunition to render it self-contained, and, therefore, independent of an ammunition supply for short periods of action. The new Company does not appear to have any definite connection with the Colt Company in America, beyond the use of the name which goes with the patents and what is described in the prospectus as beneficial arrangements, including rights to improvements. The financial arrangements of the Company, as displayed in the prospectus, show an authorized capital of £500,000, of which £350,000 has been issued. The whole of the issued capital is in ordinary shares. The purchase price of the patents has been fixed at the sum of £300,000, leaving £50,000 for working capital. The arrangements for purchase include the payment of £50,000 in cash and £100,000 in shares issued as fully paid, the balance of £150,000 to be payable in cash or shares at the option of the directors. The position of affairs may be best understood by considering its bearing towards subscribers, who hold among them £100,000 worth of shares. In return for this payment they become entitled to two-sevenths of the available profits of the Company. £50,000 is paid out for part purchase of the patents, and the remaining £50,000 provides the funds for working the business and making the profits. This point of view is in no way altered by what happens to the remaining capital of the Company. Whether or not the public have subscribed so as to enable the directors to pay much or little of the balance of £150,000 in cash does not affect the situation. The present intention of the Company appears to be to confine its engineering operations to a fitting and finishing shop, and to get the guns manufactured by outside contractors. The trading operations of the Company are confined in so far as that the whole of North and South America (excepting Canada) are forbidden markets, as also are the following places or countries:—China, Cuba, Porto Rico, and the Phillipine and Sandwich Islands. The directors of the Company are the Earl of Westmorland, Gen. Sir Seymour Blane, Bart., C.B., Admiral L. Keppel, Mr. W. W. Rutherford, Prince Duleep Singh and Capt. P. J. Zigomala. Besides the above, the Company has secured the services as expert advisers of Col. W. F. Nuthall, late Inspector of the Army Ordnance Dept., and of Mr. John Rigby, late superintendent of the Royal Small Arms Factory, Enfield.

NORTH OF ENGLAND SHOOTING SCHOOL.—This is the title given to the grounds just opened at Holborn Banks, Ryton-on-Tyne. The ground is only four minutes' walk from Ryton Station, and a good service of trains places it in easy communication with the surrounding neighbourhood. It is also but five miles' drive from Newcastle. The natural formation of the ground suits it excellently for the purposes of a shooting school. There is plenty of rough ground and cover to screen the traps used for practice in covert shooting. Overhead birds are thrown from the top of a hill some fifty feet high, so that the expense of erecting a tower has been avoided. Large targets have been fitted up for use in gun fitting, and they are provided with the usual moving objects. The ground is some forty acres in extent, and there is some good game shooting close at hand. A sort of season-ticket arrangement has been started by which the subscriber of one guinea per annum may use the ground for practice at all times. That this scheme is appreciated may be seen from the fact that no less than 300 members have already been enrolled. Mr. J. A. Riddell is the enterprising manager of this well-developed scheme, and every praise is due to him for the excellent arrangements of the school. Success seems already to be fully assured, and sportsmen in the northern counties are bound to appreciate the unique conveniences afforded by this shooting school.

INCIDENTAL JOTTINGS.

WHAT IS LYDDITE?

THIS is the question which is on everyone's lips just now—all are thirsting for this information in order to attain the satisfaction of instructing their friends. Even the garrulous barber—having grown meditative—presently asks in a despairing tone, "I suppose, sir, you can't say what this Lyddite is? They say it knocks Cordite into fits, and gunpowder's nowhere in it." The man in the train says, "Lyddite? Oh yes, that's Melinite; same thing, quite new!" which we are bound to admit is both explanatory and descriptive! However, picric acid, from which Lyddite is made, is hardly a new thing; for we learn that it was discovered in the old world at the same time that America was fighting for her independence 128 years ago. Picric acid is made from a distillation of coal tar (crystallised carbolic acid), which is first sulphated, then nitrated; the product consisting of crystals of a bright yellow colour, the taste of which is exceedingly bitter. Here I may parenthetically observe that this is a fact upon which both the manufacturers and our enemies entirely agree.

WHAT, ONLY PICRIC ACID?

FROM picric acid to Lyddite is only a step. These harmless crystals are turned into a most devastating explosive by being melted and poured in a molten condition into the steel shells, which, by the way, are first carefully coated with a shellac varnish, so that the Lyddite shall not come into contact with the metal. The picric acid melts at about 255° F., its igniting point being about 720° F., or about the heat of iron which shows red in the dark. But, ask the majority of people, is there not something else mixed with it—some other secret component, which, like an American bride, will bring something the other must of necessity lack? Well—now that is mentioned—it does happen that Lyddite lacks sufficient oxygen for its own combustion. Eugene Turpin, who first patented the use of picric acid as a high explosive in a molten or compressed form, employed collodion cotton in his early Melinite; but there is none in Lyddite, though the transformation from the bright yellow crystals of picric acid to the dirty granite-like look of the molten product would lead one to believes so. But why conjecture? Maybe the primer with its ammonic picrate will yield the necessary oxygen, and whatever the prescription is, it is a good one, and, as such, it should serve to stimulate erring humanity over the seas. A dose of steel tonic so administered need not be labelled "To be shaken before taken."

LYDDITE'S FASCINATING CHARMS.

LYDDITE has several peculiar charms which endear it to the artillerist. It is absolutely safe to handle. This may be judged from the fact that for 90 years picric acid was used in the manufacture of aniline dyes and of the national beverage when hops were bad or scarce. Yet no one discovered it to be an explosive. When in the shell it will stand rough handling without fear of danger, and with the present design of percussion fuses it is practically impossible to get a "premature" in the gun from any normal cause; but when detonated upon impact at its destination, it fulfils its functions with a maximum of explosive effect truly appalling. There is plenty of evidence to point the moral, but very little Lyddite shell—the fired fuse, with a pound or two of steel hanging on, is the sole relic for identification, no other fragment being bigger than a small walnut. Just a word to my barber friend—Lyddite is not taking the place of Cordite, whose high propulsive powers are due to a characteristic the direct opposite of Lyddite, that of slow burning, in the same way that a hacksaw is an excellent cutting tool, yet hardly suited to the needs of my friend the barber.

WHO HAS THE GUNS?

FOUR hundred and fifty of them, price £10,000 each. Such a prospect is enough to drive our British workmen out on strike, for fear prosperity should come to their masters for reasons beyond their own control. But when we read on, we see that half of them have been delivered! This is too much. Who is the lucky firm that raises 12-inch guns in a night on a mushroom bed, or who keeps genii on the staff who emulate the deeds of our heroes in the fairy books? Such news is not dear at one halfpenny. Alas for our shattered hopes! the four hundred is wrong; the fifty is nearly right—spread over the combined resources of Woolwich, Sheffield, and Elswick. We have not a word to say against the descriptions of its powers, as they are fairly correct. The 12-inch Mark IX. is the most formidable gun in the world, and once again it is the "contractor" who has designed it. Five of these weapons have up to now been made at Sheffield, and one, we believe, has been made at Woolwich. They are of the usual wire-wound pattern, 120 miles of wire being used in their manufacture. We are a little curious to hear how they stand proof. The angle of the cone seating for the obturator pad does not commend itself to us, though it is perhaps unavoidable in order to provide the necessary clearance for the breech block in opening or closing.

4·7 GUNS AT LADYSMITH.

IN the last issue we predicted that with the howitzers the Boers would get their first taste of Lyddite, knowing that as yet Lyddite shells are not made of less calibre than 4 inches; but we reckoned without the Navy, who are always fertile in expedients, and when Jack got his 4·7 guns to the front it must have been a pleasant surprise for all. A gun with a range of from six to seven miles, and sighted to four and a half miles, is not to be despised; it is in every sense a "quick firer," and one of the most accurate in the service, and if we except the 6-inch Mark VII., it is for its weight and proportionate size unapproached by any other gun, no matter of what make. It is 16 ft. 2 in. long, and its projectile weighs 45 lbs. The total weight of gun and mounting, shield, &c., is about 7¼ tons. This should present no difficulty in transit by rail; but we are perplexed to know how they have been mounted in position. There are two descriptions, each from "eye witnesses." One declares that timber baulks are fitted under the mounting, so as to give it a very large area of base, whereas the other correspondent says they are mounted upon iron railway trucks (rivetted is the term employed), and they simply dig a cutting at the position required, lay rails, and run the truck into it, then shovel back the earth and bury the railway truck, and in that way the gun has a firm foundation,

WAR FEVER.

Now that the War Office has bought its hay, straw, biscuits, and grub, its thoughts lightly turn to war munitions, and, as a result, within the last week or two the calm, imperturbable ordnance factories have roused up to do great wonders. It is a noble sight to see the huge factories working on war strength. But be well advised, and don't go to visit them. You will not be welcome; they are too busy to be obstructed by visitors—every bullet, every fuse, every shell wants undivided attention; each may save or lose one life or many. It's not, we trust, a question of piece work now, it's a thought for "Tommy" at the front, and in no sense are "absent-minded beggars" wanted in the ordnance factories, so don't go to distract them. Wait till General Buller gets his stores out to polish off Oom Paul, then enjoy your own factories, paid for (partly) out of your own pocket. You can't assume the proprietary airs due to your proud position of a British taxpayer when you feel your presence is not altogether welcome.

WOOLWICH MECHANICAL ENGINEERING DEPARTMENT.

WE have referred on previous occasions to the "building works" and other kindred non-producing departments, whose precarious existence is only due to what they purloin from the large and well-staffed manufacturing departments. In the history of ordnance factories there has from time to time been a sort of raid on the producers with a view to increasing their efficiency by the enlistment of mechanical engineers. The military and civil element have, with the swing of the pendulum, each had their turn. We are now confronted with another department of engineering, to which we wish every success. At present it consists of a chief mechanical engineer and two exceedingly able and respected assistants. But these will want a staff and a workshop for experiments, which will all cost money. Will the War Office provide these on such a scale as to make it a success? Again, being once established, will their suggestions be thwarted by want of funds preventing them from carrying out what their research and labour indicated as worthy of adoption. It is financial starvation which may mar the success of this new department, which in every other way has a brilliant future before it.

THE OLD MACHINERY DEPARTMENT.

THERE still exists an embodied tradition which has the legend "Machinery Department" on its door. This is where that very able engineer, Sir John Anderson, of "strength of materials" fame, ruled under the title of "Superintendent of Machinery" many years ago; but time has changed all this. Until recent years the water works, gas works, hydraulic cranes, locos., testing and other machinery, beside outside work of heating barracks, hospitals, etc., equipping, steam laundries and clothing factories, all these and sundry other matters came under its control; and of their early inheritances their main care is now centred upon store-ships, barges, and steam launches which transport stores round the coast to the various military and naval stations. Nearly all the other work has gone away, most of it to the building works department. Here, however, is an existing department of mechanical engineers capable of extension, with young blood, to retrieve its old position if called upon.

THE BUILDING WORKS DEPARTMENT.

THIS, owing to the character and strength of its chief, has acquired for itself a position which will be very difficult to assail, nor is it a task which could be entered upon lightly; for the influence of its director is surprisingly great. Yet, much as we admire him, we cannot agree that all the work is best left in the hands of that department. All buildings under the War Office are under its charge; not a brick may be removed, nor a joist cut, without its permission. Nearly all the engines (some of the departments have stuck to their own engine affairs), the boilers, cranes, electric light, railway locos. and stock, and numerous other plant, come under this rapacious department. Now there is no real "Building Works" about it, since all work is put out to contract; but even were it granted that such a department is a necessity, it could be worked as a "Maintenance of Buildings" department; for all the rest is mechanical engineering pure and simple. Boilers and engines, (such engines, too,) pumping engines, cranes, etc., should, by all that is right, be handed over to the new mechanical engineers' department.

ELECTRIC DRIVING OF MACHINERY.

BUT most important of all that the Building Works Department be made to disgorge the electric light and power stations. Electricity is to play a very important part in mechanical engineering, particularly in installing explosive factories, where the utmost safety can be relied upon at economic cost, and in the factories for driving large and heavy tools. The development of this will fall upon the new mechanical engineering department, and they should be in a position to run the various plants without let or hindrance. It is only by such means that they can get, at a minimum cost, the power essential to the success of their schemes. By these means the new department would control various plants and works drawing a maintenance income, so receiving some sort of financial position to command the respect of the manufacturing departments, who fear that directly or indirectly they will have to pay for this new luxury.

THE DYING DEPARTMENTS.

WHAT has already been explained shows very briefly how we now have three departments of mechanical engineers in the ordnance factories; and though we have attempted to formulate the specialities of each, they overlap to such an extent that it would require the argumentative powers of St. Athanasius to unravel them. It is easy to suggest; but time alone will show if this trinity will work in harmony, or if it be war to the knife. Frankly, none of the three look like dying off; certainly not the new department; but, then, no one can tell without some positive sign. In the autumn, when the leaves put on their lovely coloured foliage, we should think it a magnificent development did we not know this peculiar beauty and brightness to be the expiring effort of those leaves, and that suddenly they would fall away. So, in the bright autumn of the existence of these departments, we may any morning see in our newspapers:—"Reforms in the Ordnance Factories," "Re-organisation of the Mechanical Engineering Departments."

CYCLOPS.

EXPLOSIVES IN COAL MINES.

ADDITIONAL TESTS.

THE following important paper has been issued by the Home Office, and bears date October 18, 1899:—

The Secretary of State finds from the reports made to him by Her Majesty's Inspectors of Mines that there is a desire on the part of mine owners for further assistance in the selection of explosives for use in dangerous mines than is given by the present "Permitted List." That list contains merely the names of all the permitted explosives, *i.e.*, the explosives which have passed the Woolwich test. It is left to mine owners to select the best explosive from the list which does not distinguish in any way between those which have barely passed the test and those which can be fired safely under much more severe conditions.

The ultimate responsibility of selecting from the list the safest explosives and the best suited to their requirements must always remain with the mine owners; but, in order to assist them in this matter, the Secretary of State has decided to establish a new test, the conditions of which will be more stringent than those of the present test, particularly in the following points:—

The charges of the explosive to be fired will be larger.

They will be fired in a more sensitive gaseous mixture.

The required number of shots must be fired without any ignition of the gas.

If an explosive fails to pass, no second trial will be allowed without the special sanction of the Secretary of State: except that in case of failure to pass by reason of incomplete detonation, a second trial will be allowed with such alteration in the method of firing or otherwise as the manufacturer may propose, if the alteration is not such as in the opinion of the Secretary of State constitutes a new explosive.

The explosives which pass this special test, the exact conditions of which are set out in Appendix A, will be placed in a separate list to be called the "Special List," and a certificate to the effect that the explosive has so passed will be given to the manufacturer by the Secretary of State.

The list will specify in the case of each explosive by what manufacturer and at what factory or factories it is to be made; but alterations in the name of the manufacturer and in the factory or factories will be allowed on good cause being shown.

It is probable that, if the new test proves satisfactory and a sufficient number of explosives succeed in passing it, the standard for the "Permitted List" will ultimately be raised, and that only those explosives which pass the special test will be permitted in the mines to which the Explosives Orders apply. The Secretary of State, however, does not propose to make this change until after the expiration of at least one year after the establishment of the new test.

Applications for an explosive to be submitted to the new test must be made on a form, which can be obtained from the Explosives Department of the Home Office.

No explosive will be submitted to the new test unless it is already on the list of authorised explosives issued under the Explosives Act, 1875, and unless the Secretary of State is satisfied that both the explosive and the cartridge or combination in which it is proposed to issue it are of such a character as not to be liable to deteriorate or to be misused or to be less safe under the conditions of storage or practical use.

The Secretary of State may at any time cause any explosive on the Special List to be formally retested. Notice of any formal retest will be furnished to the manufacturer of the explosive.

If any explosive fails on formal retest, the Secretary of State will, if he thinks fit, remove it from the "Special List." He reserves his right, after such inquiry as he may think fit, to remove from the "Permitted List" any explosive which in practical use is found to cause ignitions or to be otherwise dangerous, or which on examination proves to be of defective composition or bad manufacture, or fails in any way to comply with the conditions on which its use is permitted.

Applications from manufacturers and importers, mine owners, miners, and others interested, for the informal retesting of any explosive on the list, will be entertained on payment of the fees specified below.

Facilities will also be given to manufacturers for samples to be tried for experimental purposes in connection with the working out of new explosives for use in coal mines on payment of fees to be determined in each case.

FEES.

Fees for the Testing of an Explosive in accordance with the Special Test:—

For an explosive named in the Schedule to the Explosives in Coal Mines Order of 24th July, 1899, £5.

For any other explosive, £30.

Fees for Second Trial (when allowed):—

For an explosive named in the above-mentioned Schedule, £5.

For any other explosive: £15 if an alteration in the chemical composition is made; £10 if there is no such alteration.

Fee for Testing Altered Explosive:—

If the manufacturer desires to make an alteration in an explosive which has been placed on the "Special List," and if such alteration does not, in the opinion of the Secretary of State, constitute a new explosive, the fee for the test of the altered explosive will be £15 if the alteration is one of chemical composition; and £10 in case of any other alteration.

Fee for Retesting:—

For the informal retesting of any explosive on the "Special List," the fee will be £2 for a minimum of 10 shots; additional shots pro rata. (For a formal retest ordered by the Secretary of State, no fee is payable).

Fee for Experimental Shots:—

For experimental firing in connection with working out of new explosives the fee to be determined in each case, not being less than at the rate of £2 for ten shots.

THE TEST (*APPENDIX A*).

1. The test will be carried out by H.M. Inspectors of Explosives with the testing apparatus at the Home Office Testing Station in Woolwich Arsenal.

2. The charges of explosives to be fired will be determined as follows*:—

(*a*) In the case of explosives intended to be fired by a detonator, and commonly called "High Explosives," the charge will be taken as the equivalent of a given charge of dynamite No. 1 (containing 75 per cent. of nitro-glycerine), as determined by the enlargement obtained on firing the same in a lead cylinder tamped with loose sand.†

* If, in any case that may arise, it is shown to the satisfaction of the Secretary of State that neither of these methods is applicable to the explosive, the method of determining the equivalent charge will be specially considered.

† In cases where an explosive differs much in power from dynamite, the charge fired in the lead cylinder will be varied, so as to give an enlargement approximating to that given by dynamite.

(*b*) In the case of gunpowder, or any explosive not intended to be fired by a detonator, the charge will be taken as the equivalent of a given charge of R.F.G.[2] gunpowder, as determined by the enlargement obtained on firing the same in a lead cylinder tamped with loose sand and heavily weighted above with a mass of metal.

3. Each explosive to be subject to the following test :—

10 shots with charge equivalent to 3 ozs. of dynamite, or 9 ozs. R.F.G.[2] gunpowder, and 9 inches of stemming.

10 shots with charge equivalent to 4 ozs. of dynamite, or 12 ozs. R.F.G.[2] gunpowder, and 12 inches of stemming.

4. Every shot will be fired electrically, and in the case of high explosives the size of the detonator recommended by the manufacturer or the person submitting the explosive will be used.†

5. All charges will be stemmed with dry clay well rammed.

6. Each shot will be fired in the case or wrapper in which it is proposed to be employed in actual use.‡

7. Each shot will be fired into a mixture consisting of or equivalent to 85 per cent. of air and 15 per cent. of the coal gas now supplied from the Royal Arsenal Gas Works.

8. An explosive will be considered to have passed the test, if in the series of 20 shots mentioned above no single shot has ignited the gaseous mixture, or left an appreciable amount of the charge unexploded.

9. A shot may be repeated at the discretion of the officer in charge of the testing, if in his opinion there is reasonable ground to believe that a failure was due to any cause unconnected with the explosive.

‡ In the event of an explosive passing the test it will be permitted for use only with a detonator or detonators, and in a case or wrapper similar to those with or in which it has been tested. No alteration in the detonator or case may be made without the special sanction of the Secretary of State.

GUN BARREL PROOF ACT 1868.*

AMENDMENT, IN PARLIAMENT, SESSION 1900.

(Amendment, Alteration, or Repeal of the Gun Barrel Proof Act, 1868; Re-enactment of the said Act with Alterations or Amendments; New Powers to the Master, Wardens, and Society of the Mystery of Gunmakers of the City of London, and the Guardians of the Birmingham Proof House; Alteration or Amendmentof the Constitution of the said Guardians and Provisions with respect to the Qualification and election of the Members thereof, and of the Birmingham Gun Trade and the Registry Board constituted by the said Act, and with regard to the date of the Meetings of those respective bodies; Abolition of office of Warden; Provisions with regard to the Appointment, Powers, and Duties of a Proofmaster and Deputy Proofmaster, and their Qualifications and Remuneration; Extending Power to hold Lands; Bye-laws; Accounts; Reserve Funds, and other matters).

NOTICE is hereby Given, that application is intended to be made to Parliament in the ensuing Session for leave to bring in a Bill for all or some of the following among other purposes, that is to say ;—

1. To alter or amend the Gun Barrel Proof Act, 1868 (hereinafter called "the said Act"), and to confer additional powers upon the Master, Wardens, and Society of the Mystery of Gunmakers of the City of London (hereinafter called "the Gunmakers' Company"), and the Guardians of the Birmingham Proof House (hereinafter called "the Guardians"), or to repeal and re-enact the provisions of the said Act with such alterations and amendments as may be contained in the Bill.

*Official announcement issued on behalf of the Birmingham Proof House.

2. To define what shall be deemed to be small arms for the purposes of the said Act, and the marks, numbers, or devices which shall be used in connection with such small arms, or to amend the existing definitions thereof in the said Act.

3. To enable the Guardians to carry out experiments with any small arm or explosive, and provide the necessary instruments and apparatus for the purpose; to make pecuniary assistance to a master or apprentice so as to encourage the teaching of the art of gunmaking; to establish a school, either independently or in conjunction with any educational or other establishment, for the purpose of teaching the art of gunmaking in all or any of its branches: to acquire, print, and circulate amongst the Birmingham gun trade, and any other person or persons, any book, article, consular report, or paper of interest to the trade, and to provide lecturers to deliver lectures and addresses to the trade on matters affecting the gun trade; to inquire into the operations of foreign proof houses, and to obtain particulars of the gun trade in foreign markets; to take such steps as may be necessary to obtain information as to any infringements abroad of English proof marks, and to stop and prevent the recurrence of any such infringement; to oppose any Bill promoted in Parliament which, in the opinion of the Guardians, would be detrimental to the gun trade or the users of small arms.

4. To alter or amend the constitution of the Guardians, and to make new provisions as to the persons to be nominated and elected Guardians, and with regard to the qualification of such persons, and the nomination or election of such members by ballot or otherwise, and with regard to the date of the ordinary and annual meetings of the Guardians, and the appointment of Chairmen.

5. To abolish the office of Warden, provided by the said Act, and to alter the remuneration payable to elected Guardians, and to make new provisions with respect to the appointment, powers, and duties of a Proofmaster and Deputy-Proofmaster, and their qualifications and remuneration, and, if thought fit, to disqualify any person holding any such office from being, or continuing, a Guardian.

6. To alter the qualification of members of the Birmingham Gun Trade, and of the Joint Stock Companies, who may be represented on the register of the Birmingham Gun Trade, and to amend the existing or make new provisions with respect to the admission of claimants thereto, and the making-up of the said register, and the publication of the list of members of the said trade.

7. To provide for the temporary filling up of vacancies in the Registry Board constituted by the said Act, and to make new provisions with regard to the election of members of that Board by ballot or otherwise; the meetings of the Board, and their powers and duties, and with regard to the election of an auditor.

8. To extend or alter, and to define the various particulars which shall be given in the accounts of the Guardians, and the duties of the auditors, accountants, and clerks of the Guardians, and to provide for the form in which such accounts shall be kept.

9. To enable the Guardians to provide and maintain additional branch proof houses in or near Birmingham, to maintain any existing rifle shooting ground, and to extend or enlarge the same, and from time to time to discontinue any branch proof house or shooting ground.

10. To extend the powers now possessed by the Gunmakers' Company and the Guardians (hereinafter together referred to as "the two Companies") respectively, with respect to the purchase and holding of lands, and to enable them respectively to sell and grant leases and easements over all or any portion of their property as they may from time to time respectively think fit.

11. To enable the two Companies respectively to provide such apparatus at their branch proof houses as they may think fit, including tools and other instruments for the efficient proof, gauging, testing, and shooting of small arms, and to alter or extend the

power of the two Companies, to limit or restrict the use of any proof house or shooting ground.

12. To make new provisions with respect to the reserve fund of the Guardians, and to extend the purposes to which the same may be applied, or to constitute a new or separate reserve fund towards meeting any damage or contingency which may arise in carrying out the provisions of the said Act, or for such other purposes as the Bill may provide.

13. To make new provisions with respect to the application of moneys received by the Guardians under the provisions of the said Act, and to extend their powers with regard thereto: to enable the Guardians to provide for an insurance fund against accidents, or for compensation to servants and others for injuries sustained during their employment, and to enable them to contribute towards any benefit or superannuation fund for the benefit of their officers, workmen, or servants, or towards any similar fund established by the Birmingham Gun Trade or other body, or to contribute towards the support of any needy member of the Birmingham Gun Trade, and generally towards any charitable or benevolent objects in connection with the City of Birmingham.

14. To enable the Guardians to make, alter, rescind, and vary bye-laws regulating the granting and continuance of any superannuation allowance or gratuity to their officers, workmen, and servants, and the qualifications and conditions upon which any such superannuation allowance or gratuity may be granted.

15. To make new provisions in regard to acts or matters now required to be done on Bank Holidays, and to authorise the closing of the proof house and other premises of the two Companies, or either of them, on such days; to extend the power of the Guardians in making bye-laws for the regulation of or in relation to proof houses and rifle shooting grounds to other shooting grounds and premises of the Guardians.

16. To confer further powers on the Guardians with respect to the proving of small arms, and to alter and amend the fees chargeable in respect thereof.

17. To confer on the Guardians, or any of them, or the Proofmaster or other officers of the Guardians, any powers or duties now exercisable by the Wardens, and to enable the Guardians to call in or appoint engineers, chemists, or any other person in connection with their business, or for any of the purposes of the Bill.

18. To extend the operations of Sections 122, 126, 127, and 129, of the said Act, and to apply the same to Great Britain and Ireland, or to Scotland or Ireland, as the Bill may prescribe, with such modifications or alterations thereof as may be expedient in the circumstances.

19. To make new or further provisions as to the registration of foreign proof marks, and to provide that the notices to be given by advertisement of the registration of any foreign proof mark under the provisions of section 129 of the said Act by the Proofmaster of the two Companies respectively, shall be at the expense of the person applying for such registration.

20. To amend the said Act in regard to penalties, and to make such minor alterations and amendments on the said Act as may be deemed expedient, or as may be contained in the Bill.

21. To alter, vary, or extinguish all rights and privileges which would interfere with the carrying out of the intended objects of the Bill, and to confer, vary, or extinguish other rights and privileges.

Printed copies of the Bill will be deposited in the Private Bill Office of the House of Commons on or before the 21st day of December next.

Dated this 16th day of November, 1899.

ROWLANDS and Co., 41, Temple Row, Birmingham,
Solicitors for the Bill.

GRAHAMES, CURRY, and SPENS, 30, Great George Street,
Westminster, Parliamentary Agents.

ROUND THE TRADE.

We are credibly informed, viz., by the editor of the *Kynoch Journal*, that the second issue of that paper will be a "knock out."

Mr. J. T. Musgrave has been elected a director of the Wilkinson Sword Co., Ld.

We have an inquiry from a correspondent as to the existence of a firm in a position to supply efficient machinery for the manufacture of paper cartridges. Can any of our readers assist us with information? We believe business is meant.

The Northern Explosives Co., Ltd., is the name of a company, with registered office at 45, Renfield Street, Glasgow, which has been formed with a capital of £10,000 to acquire the patent rights of the new explosives "Erupturite" and "Nordite."

Mr. W. R. Pape, of Newcastle-on-Tyne, has introduced a new clay pigeon made of white porcelain, which breaks very well up to 40 yards, and should be appreciated for the practice ground or shooting school. They do not smash on reaching the ground, and consequently travel well.

The George Y. Cooper Small Arms and Cycle Co., Ltd., is the somewhat redundant name of a company which has been formed to trade with a capital of £1,000 in such items as guns, rifles, and motor cars. The registered address is Heneage Street, Birmingham.

Messrs. G. Pettinger & Co., of Manchester, supplied the electrical firing apparatus for the explosion of six tons of gunpowder at a big blast in Bonawe Quarries. The blast was in every way successful, and Messrs. Pettinger are to be congratulated upon the result.

It is stated that the Birmingham Proof House Guardians were to meet on the 30th ult. for the election of the new proofmaster. We have no information at the moment of going to press as to what is likely to happen, though rumours in the trade have favoured the view that the appointment would be postponed.

The event of the year for the London Proof House came off on Tuesday the 16th inst., when the Gunmakers' Company held their annual dinner at the Gunmakers' Hall Council Room. Mr. Athol S. Purdey, Master of the Company, presided, and was supported by Mr. D. Cecil Gibbs as Upper Warden, Mr. H. Stanley Barnett as Renter Warden, and Mr. F. T. Aston as Law Clerk.

Mr. Frank Izzard recently gave evidence as an expert witness at an inquest held upon the death of a performer at the Savage South Africa Show at Earl's Court. Mr. Izzard convincingly proved that with a blank cartridge in the chamber and an empty case in the barrel, conditions are established whereby, upon the fall of the hammer, an explosive effect within the first cartridge is followed by the violent departure from the muzzle of the second cartridge. Verdict accordingly.

Mr. Joseph Wilkes, of the firm of Wilkes and Son, gunmakers, Leeds, is about to retire from this business, which he has conducted for the last 35 years. It will be carried on in the future under the title of Wilkes Bros. by his two sons, Charles and Albert, who have been responsible for the practical management of the business for some years, Mr. Wilkes, being 75 years of age, having slacked off somewhat of late.

That commercial caucus, the Article Club, is represented in the trade of sporting cartridges by Messrs, Joyce, and in guns by Mr. Chas. Lancaster. Nobel's Explosives Co., Ld., have recently been elected, up to now in the persons of Mr. T. Johnson and Mr. W. Wortherspoon, as representing the high explosives industry. The object of the club is to select one leading firm in each industry, and to combine forces for mutual help.

Mr. J. F. Smythe, who has been in business some 15 years at Darlington and Stockton, and has the honour of the patronage of the Prince of Wales and other "Royals," has now opened another branch at 16, Albert Road, Middlesboro, for the sale of guns, fishing-tackle, etc. Mr. Smythe is fortunate in having two sons who have both a practical knowledge of the London and Birmingham trade, and they will take charge of the branch establishments, while Mr. Smythe superintends the whole from headquarters at Darlington.

Mr. Wanless, gunmaker, is now settled down in his new premises at 20, Norfolk Street, Sunderland, where he has the advantage of more room and better workshops than in the old place in St. Thomas Street. He has a fine stock of fire-arms and fishing-tackle. Mr. Wanless will remember one of his early customers in the new shop. A young Russian sailor wanted to buy a shot gun, and expressed curiosity as to the cartridges for the same. Taking advantage of Mr. Wanless, junior's, back being turned, he loaded the gun and blew a hole through his foot, the shot passing into the basement. It seems the sailor wanted to qualify for the local infirmary, which he accomplished minus one toe. Moral: Don't hand a suspicious customer loaded cartridges.

LECTURES TO YOUNG GUN-MAKERS.

II.

THE CONVERSION OF PRESSURE INTO VELOCITY.

WHEN an explosive is detonated unconfined upon the ground it makes a big hole in the air, and a somewhat smaller one in the ground. The hole in the air is soon filled up; that in the ground remains as a symbol of undirected, and therefore wasted energy. In the case of a fire-arm the barrel provides a means of restricting the power of the explosive, and directing its expansion so that the bulk of the available energy is usefully applied in the propulsion of the shot. When the expansion of the gases is checked by confinement in a closed space we have a gradual building up of pressure as the gases are liberated by the progressive combustion of the charge, and also a gradual expansion of these gases within the ever-enlarging chamber formed by the sides and breech face of the barrel and the base of the shot.

A charge of smokeless powder occupies a certain volume. On combustion it is converted into gas, which under ordinary atmospheric pressure would occupy a volume many times exceeding the volume of the space containing the powder charge. The powder gases are, however, produced within a closed chamber, and the result of combustion is, therefore, that the gases are liberated within this confined space, and gases being elastic they attain a very high pressure. Now the law of compression and expansion of gases is very simple. Their pressure is proportionate to the extent that the volume of the chamber containing them is reduced. If we sealed up a vessel with a capacity of one quart, and then battered in its sides until the capacity was reduced to one pint, the air within would have doubled its former pressure. The pressure of our atmosphere is ordinarily stated at 14·2 lbs. on every square inch. Therefore if we compressed a certain volume of air into one-half its former bulk, it would have a pressure of 28·4 lbs. per square inch, or 14·2 lbs. above ordinary atmospheric pressure. The same result as the above could be secured by pumping additional air into the reservoir. We should still double the pressure when we had doubled the amount of air contained in the closed chamber. The explosion of a charge of powder within a gun may be regarded from the same point of view as that of pumping air into a chamber. The combustion of the powder produces gas, and the greater the amount of gas liberated the greater the amount of pressure within the chamber. If we take the case of a shot gun in which the firing of the powder charge produces a pressure at the rate of 2·9 tons on every square inch, we have the same result as if we had pumped air into the chamber until that pressure had been attained. The pressure of 2·9 tons per square inch may equally well be expressed by its equivalent of 6.496 lbs. per square inch—or even as 457·4 atmospheres, the latter being obtained by dividing 6.496 by 14·2, the number of pounds of atmospheric pressure upon every square inch of surface. By expressing pressure in atmospheres we realize that to produce a pressure of 2·9 tons per square inch within a chamber we must compress into that chamber 457·4 times the amount of air it ordinarily contains.

It will be well to divert somewhat to point out the absolute necessity of gaining a clear and definite idea as to the meaning of scientific terms in ordinary use, and the expression "lbs. per square inch," will serve to point the moral. Now lbs. per square inch is a convenient means of expressing the elastic pressure of gases upon themselves, and upon the sizes of the chamber confining them. The pressure of a given weight of gas depends upon the capacity of the chamber in which it is confined. The chamber may be a hollow sphere having a capacity of one cubic inch, it may be a cube having six sides, each one square inch in area, or it may be a chamber 12 inches square and ·0069444 of an inch deep—all these chambers having a cubic inch of capacity. In the second case we have six inches of interior surface receiving a pressure, say, of 30 lbs. on each of the six surfaces, and in the last-mentioned case we have an interior surface of upwards of 288 sq. ins., each receiving its 30 lbs. of pressure. We therefore have, with the same amount of compressed gas and the same capacity or cubical contents of chamber, in one case an aggregate pressure of 180 lbs. against the walls of the chamber, and in the other upwards of 1728 lbs. This appears to provide a solution of the problem of perpetual motion, since there is such a multiplication of force with the same amount of gas at the same pressure. Pressure, or force, is not, however, the same thing as work; and it involves a fallacy to suppose that the above comparisons are otherwise than an absolute scientific truth. Tons per square inch, or lbs. per square inch, express the elastic tension of gases; and however the dimensions of a chamber may be varied, the capacity remaining the same, every square inch of the chamber's surface receives a pressure proportionate to the tension of the confined gases. This need for properly understanding scientific expressions should be grasped at the start, for it sometimes happens that even when experts write for the information of other experts, egregious fallacies are propounded on account of the careless handling of scientific expressions.

The gases formed within the chamber of a gun present many difficulties not to be found in analagous calculations, such, for instance, as those connected with steam engines, where somewhat similar conditions exist. In the case of a steam engine we have a reservoir of compressed gas, viz., steam, of known pressure, which is admitted into the cylinder

and which fills the available space at the pressure of the steam within the boiler. At a given point in the travel of the piston the supply of steam is cut off, and that within the cylinder thereupon expands with the movement of the piston until, at the end of the stroke, it is exhausted and passes away. All these conditions are subject to fairly simple calculation, but in the case of the gun many of the factors are unknown, and others can only be ascertained indirectly.

In the case of fire-arms gas commences to be liberated as soon as the cap has been detonated. The powder then commences to burn and gas is given off, the pressure gradually rising within the closed chamber to the rear of the shot until sufficient force is exerted upon the base of the shot to start its movement. As soon as the shot commences to move we have a gradual enlargement of the closed chamber, which tends to reduce the pressure, and a continued evolution of gases which tends to increase the pressure. These two factors have an opposite effect upon the pressure within the confined space, and it is impossible to arrive at an exact idea of either one of them. We know, however, that in the early stages of the movement of the shot the gases are liberated faster in proportion than the available space is enlarged by the movement of the shot. Consequently we have a gradual increase of pressure due to the rapid production of gas, and this increase of pressure continues until such time as any portion of the powder charge remains unburnt, or, to be still more accurate, until the evolution of gas is balanced by the enlargement of the chamber due to the movement of the shot. This stage in the operations is known as the *moment* of maximum pressure, or the *position* of highest pressure, if we regard it from the point of view of the position of the base of the shot at the time when the highest pressure has been attained.

After the maximum pressure has been attained the gases expand by their own elasticity, and continue the propulsion of the shot until it is expelled from the muzzle of the gun. If we could ascertain exactly the position of the shot at the moment of maximum pressure we could measure the cubical contents of the closed chamber to the rear of the shot. Then we should know that when the shot had moved far enough beyond that point to double the capacity of the closed chamber, the pressure would be one-half of what it was at the moment of highest pressure. Unfortunately the position of maximum pressure is not so readily ascertainable, and secondly there are other things than the mere enlargement of the space containing the gases to cause a reduction of their pressure. The gases evolved upon the explosion of powder have a very high temperature, and as they cool a portion of their pressure disappears. For instance, a portion of the gases evolved consists of vapourised water or steam, and the pressure is lowered as condensation takes place. The comparatively cool metal of the barrel provides an efficient condenser for the gases, and the warming up of a barrel as the result of firing is evidence that such cooling occurs. We are therefore not in a position to judge the reduction of pressure after the point of maximum pressure has been attained by mere calculations of chamber enlargement. In fact there are many other reasons which render it difficult to calculate the amount of effective pressure exerted upon the bullet. On the other hand much may be done by working as it were from the other end of the stick. The behaviour of the shot may be noted, and from the results of such observations much that happens to the shot may be deduced.

When an engine starts a train, the train gets up speed gradually. Behind this most ordinary of every-day truths lies the means of ascertaining what goes on within the gun during the infinitesimal period that the various operations of firing take place. It is an old saying in the trade that the little man who could get inside a gun and see what was going on is now dead. Fortunately there are other means of gaining the knowledge required without risking the lives of mannikins small enough to step inside the barrel of a 12-bore.

The velocity of a shot is produced by the application of a given force, or series of forces, over a given time or distance. When the velocity is known, and also the weight of the shot, we can ascertain the amount of work which has been imparted to the shot during its passage along the barrel, and up to the time when it reaches the muzzle. Now this work is expressed in foot-pounds, which is the energy stored up in a mass of one pound in weight which has fallen one foot. The object of our calculations is, therefore, to ascertain from what height a body would require to be dropped in order to attain a velocity equal to that of the shot emerging from the gun. This provides us with the number of feet. If the shots weighed one pound we should have the effect of one pound falling say 22,450 feet, in other words 22,450 foot-pounds. If the projectile weighed one ounce, then the number of foot-pounds would be 22,450, divided by 16 equals 1,403 foot-pounds.

In order to arrive at the method of expressing the velocity of a shot of given weight in foot-pounds, it is necessary to enquire somewhat closely into the laws of gravitational attraction. Most boys know that in vacuum a weight falling under the impulse of gravity will travel 16·1 feet during the first second, 48·3 the next, and so on; but not one in a thousand knows all that depends upon this simple truth. At the end of the first second the weight is travelling at a velocity of 32·2 feet per second; and here we have the connection between foot-pounds of energy and feet per second of velocity. If we take the weight as one pound we have it that one pound which has fallen 16·1 feet is travelling at a velocity of 32·2 feet per second. In other words we find that an energy of 16·1 foot-pounds is represented by the movement of a weight of one pound at a velocity of 32·2 feet per second.

The various values of movement under gravitational attraction for four seconds are given in the following table:—

Time in seconds.	Velocity at end of each second.	Average velocity since first movement.	Spaces fallen in each successive second.	Total spaces fallen.
1 ..	32·2	16·1	16·1	16·1
2 ..	64·4 (32·2 × 2)	32·2	48·3	64·4
3 ..	96·6 (32·2 × 3)	48·3	80·5	144·9
4 ..	128·8 (32·2 × 4)	64·4	112·7	257·6

The letter *g* is used to denote the "acceleration due to gravity." In other words, *g* denotes a force capable of adding 32·2 feet per second to the velocity of the body upon which it acts *during every second that it operates*. Column No. 2 above shows that for every second that gravity acts upon a body an addition of 32·2 feet per second is added to the velocity. In four seconds the velocity is 32·2 + 32·2 + 32·2 + 32·2 = 128·8 foot seconds, or calculated more simply 32·2 × 4 = 128·8.

The result 128·8 foot seconds is obtained by multiplying 32·2 feet per second (*g*) by four seconds, and the number of

seconds of time during which the force acts is denoted by the letter t. We have now evolved the rule that the velocity v due to gravitational attraction is found by multiplying the 32·2 by the time in seconds during which it acts, the result appearing in feet per second. This rule is expressed mathematically as follows:—

$$v = g \times t.$$

While column No. 2 in the table shows the velocity at the end of each second, column No. 3 shows the average velocity from the state of rest until that velocity had been attained. Since the body starts with no movement, and gradually builds up velocity in uniform quantities, it is clear that the average velocity up to any point is always half the velocity at that point. This will explain why the values of column No. 3 are in every case half those of column No. 2. The average velocity for a given movement being half the velocity attained at the end of the period during which the force has been acting, the value of the average velocity may be expressed as

$$\text{average velocity} = \frac{v}{2}$$

or since $v = g \times t$ it also may also be expressed as

$$\text{average velocity} = \frac{g \times t}{2}$$

Having now ascertained the means of discovering the average velocity of a falling body when the period occupied by its fall is known, it is a simple matter to ascertain the distance it has fallen by taking into further account the time it has been falling. A train moving at an average velocity of 40 miles an hour covers 120 miles in three hours. To turn average velocity into distance travelled, we therefore multiply the above expression for average velocity by the time in seconds. Thus:—

$$h = \frac{(g \times t) \times t}{2} = \frac{g \times t^2}{2} \text{ or } h = \frac{g \times t^2}{2}$$

The letter h indicates distance moved, or in the case of a falling body the height from which it has fallen. Now, it is clear from the above formula that we can find the height from which a body has fallen under the influence of gravity, provided we know the time during which it has been falling, the sign g having the same value for all calculations. But what we really want is to derive the value of h from the *velocity* attained by the falling body. Now, the final velocity v (not the average velocity) has already been shown to be equal to $g \times t$, so that we require to remove the letter t in the formula and replace it with the letter v signifying velocity. If we multiply both sides of the equation by g thus:—

$$g \times h = \frac{g \times g \times t^2}{2} = \frac{g^2 \times t^2}{2}$$

it will be seen that we can replace the $g^2 \times t^2$ for the square of the velocity, viz., v^2, since $g^2 \times t^2 = v^2$. We then get

$$g \times h = \frac{v^2}{2}$$

which means that g, viz., 32·2 multiplied by the height of fall is equal to half the square of the velocity. To find the value of h, the velocity being known, we may alter our formula by carrying the g over to the opposite side of the equation, thus:—

$$h = \frac{v^2}{2 \times g}$$

Having now the means of ascertaining the height of the fall when the velocity is known, we need only to multiply our result by the number of pounds, or fractions of a pound, to express the result in terms of foot-pounds, instead of height of fall. If W is the weight of the shot in pounds, our formula then becomes

$$\text{Energy} = \frac{v^2 \times W}{2 \times g}$$

We will take for an example a 12-bore shot gun firing 1⅛ oz. of shot at a velocity of 1,150 feet per second. The weight of shot expressed in fractions of a pound is $\frac{9}{8 \times 16}$ The formula is applied thus:—

$$\text{Energy} = \frac{1150 \times 1150 \times 9}{2 \times 32{\cdot}2 \times 8 \times 16} = 1{,}322 \text{ foot-pounds}$$

We thus determine that the shot leaves the muzzle of the gun with a stored-up energy of 1,322 foot-pounds. Supposing the barrel to be of ordinary length, we may take it that 1,322 foot-pounds of energy have been imparted to the charge of shot during a travel of 28 inches. If we divide the number of foot-pounds by 28 inches expressed as the fraction of a foot, viz., $\frac{28}{12}$, we obtain the amount of force which would require to be exerted continuously upon 1⅛ oz. of shot to impart to it an energy of 1,322 foot-pounds during a travel of 28 inches. Thus:—

$$\text{Mean force of powder} = \frac{1322 \times 12}{28} = 566{\cdot}6 \text{ lbs.} = {\cdot}253 \text{ of a ton.}$$

The above calculation may be expressed algebraically as follows:—

$$\text{Mean force of powder} = \frac{E}{L}$$

when E represents the muzzle energy in foot-pounds, and L the length of barrel in feet over which the impulse of the powder gases have operated. Knowing the propelling force of the powder gases to be ·253 of a ton, it is easy to ascertain the gas pressure which would be required to exert this force upon the wad of a 12-bore gun. The diameter of the barrel of a 12-bore gun is ·729 of an inch, and its sectional area may be found as follows:—

$$·729 \times ·729 \times ·7854 = ·417 \text{ of a square inch.}$$

We require to ascertain what pressure in tons per square inch would require to be exerted upon an area of ·417 of a square inch to produce a force of ·253 of a ton. It should be clear that this may be ascertained by dividing the force in tons by the area in inches. Thus:—

$$\text{Gas pressure} = \frac{·253}{·417} = ·607 \text{ of a ton per square inch.}$$

Algebraically expressed:

$$\text{Gas pressure} = \frac{M}{A}$$

when M stands for the mean force in tons and A for the sectional area of the bore in inches.

Summarizing the results so far attained, we see that a gas pressure of ·607 of a ton requires to be exerted over a length of 28 inches to impart to a charge of shot weighing 1⅛ oz. a muzzle velocity 1,150 feet per second.

The calculation of the gas pressure from the ascertained velocity of the shot has been carried out in stages in order to facilitate the explanation of the processes involved. For ordinary work, the calculations may be effected in a single process. The formula is at first sight somewhat complicated, but it is merely a repetition of the various processes already explained in detail. It may be explained thus:—Let

A=Sectional area of bore of gun.
W=Weight of charge in lbs.
v^2=Velocity × velocity in foot-seconds; and
L=Given length of barrel in feet.
2240=Pounds in one ton.
2g=2 × 32·2 for all calculations.

$$\text{Mean pressure} = \frac{W_w \times v^2}{2g \times L \times 2240 \times A} \text{ tons per square inch.}$$

We know that no powder gives an even pressure all along the barrel, and consequently in some parts of the barrel the pressure must be higher than ·607 of a ton per square inch, and in other parts lower. No account has yet been taken of the effects of friction and other agencies which necessitate additional pressure to overcome them; but for our present purpose it will be sufficient to confine our attention to the amount of pressure required to overcome the inertia, or, roughly speaking, the dead weight of the projectile.

Since L stands for any length of barrel over which a given velocity is produced, it follows that the above formula may equally well be applied for the discovery of the mean gas pressure, which would be required to produce a given velocity over a portion of a barrel's length. For instance, if we knew that over a given part of the barrel, six inches in length, the velocity of the shot was increased by 160 feet per second, we could ascertain what mean gas pressure acting over this distance would be necessary to produce such an increase of velocity. This, however, is a matter requiring careful consideration in a future lecture.

FRAUDULENT MARKS ON GUNS.

REGINA *V.* S. GOFF & COMPANY.

THIS is a prosecution by the Gunmakers' Association, of Effingham House, Arundel Street, Strand, London, W.C., against Messrs. S. Goff & Co., of 136 and 446, Strand, and 17 and 18, King Street, Covent Garden, for various offences specified in six summonses under the Merchandise Marks' Act in respect of a gun marked "J. Mortimer & Sons," which was purchased by Mr. H. A. A. Thorn from one of Messrs. Goff's premises, and a further summons in respect of other guns falsely marked.

Mr. Frank Safford, instructed by Messrs. Wakeford, May and Woulfe, appeared on behalf of the Gunmakers' Association, and Mr. Wilson appeared on behalf of the defendants.

The history of the case is as follows:—It had become known among various gunmakers that Messrs. S. Goff & Co. were exposing for sale guns which bore evident signs of fraudulent marking. On the 16th of October Mr. Thorn, trading as Charles Lancaster, one of the members of the Executive of the Gunmakers' Association, passed Messrs. Goff's premises at 136, Strand, in company with Mr. Reginald Woulfe, the Solicitor to the Association. They saw the guns in the window and decided to purchase one of them with a view to bringing the matter before the Association for the purposes of a prosecution. £6 15s. was asked for a gun bearing the name of J. Mortimer & Sons, and after some time the shopman offered to accept £6 10s. When it was pointed out that there was very little difference between the "Mortimer" gun and a gun marked "Thomas Jackson, Wigmore Street, W.," for which £5 5s. was asked, the shopman explained that he could not sell the "Mortimer" for the price he was asking for a "Jackson," as Mortimer was a much better maker. He said that it was a perfect gun, and mentioned that the barrels were Damascus, though they were in reality what the trade knows as "scelp." £3 deposit was paid, and the shopman was asked to add the word "Mortimer" to the receipt to identify the gun, which he did after some demur. Mr. Thorn also asked for the ticket attached to the gun which described it as provided with a Greener cross bolt. The shopman explained that they sold a lot of Mortimers, and that the ticket originally belonged to another "Mortimer" gun. The ticket was handed over to Mr Thorn.

The above facts were laid before the Executive of the Gunmakers' Association on October 19th, and Mr. Reginald Woulfe was instructed to take proceedings on behalf the Association.

Messrs. Mortimer & Son, of Edinburgh, had been previously communicated with, and they stated that such guns bearing their name could not be of their manufacture, and further that they had registered their name as a trade mark. Messrs. Mortimer thereupon instructed their solicitors to write to Messrs. Goff, calling their attention to the sale of a gun bearing their name and a London address which had been sold for £6 10s., and Messrs. Goff wrote in reply that the gun was a second hand one, and was sold just as it was bought as a second hand article, and that they were not responsible for the gun bearing that name.

Upon receiving the instructions of the Gunmakers' Association, Mr. Woulfe wrote to Messrs. S. Goff & Co, on the 25th of October to give them an opportunity required by the provisions of the Merchandise Marks' Act to show that they had acted innocently in the matter. Section 2, Sub-Section (2), which is the portion of the Act refered to is as follows:—

(2). "Every person who sells, or exposes for, or has in his "possession for, sale, or any purpose of trade or manufacture, any "goods or things to which any forged trade mark or false trade "description is applied, or to which any trade mark or mark so "nearly resembling a trade mark as to be calculated to deceive is "falsely applied, as the case may be, shall, unless he proves—

(*a*) "That having taken all reasonable precautions against "committing an offence against this Act, he had at the time "of the commission of the alleged offence no reason to suspect "the genuineness of the trade mark, mark, or trade description; "and

(*b*) That on demand made by or on behalf of the prosecutor, "he gave all the information in his power with respect to the "persons from whom he obtained such goods or things; or

(*c*) That otherwise he had acted innocently; be guilty of an "offence against this Act."

In answer to Mr. Woulfe's letter, Mr. Gotobed, Manager of Messrs. Goff's, called upon Mr. Woulfe, Mr. Thorn being present at the time. Mr. Gotobed was informed that the Association was desirous of getting at the fountain head of these frauds, and they were prepared to receive the name of the person from whom Messrs. Goff had obtained the goods. Mr. Gotobed expressed himself unable to trace the source from which the guns had come. Mr. Gotobed further admitted that the "Mortimer" gun purchased was not a "Mortimer" gun, and that it only cost about 35s., and should not have been sold for more than about £2 10s. Mr. Gotobed stated that all guns had been removed to the head office at King Street, Covent Garden, and he invited Mr. Thorn and Mr. Woulfe to go and inspect them there. This they did, and were shown a number of guns obviously genuine, and none of the falsely marked kind which they had seen on the 16th of October in the firm's Strand premises. Mr. Thorn picked up a piece of plain cardboard lying in one of the shop cases, and found that it was a shop-window ticket lying face downwards. It referred to a gun by "J. Mortimer & Son, Pall Mall, London." Mr. Thorn kept the label, and Mr. Gotobed repeated his denial that he had any such guns in his possession, and declined to allow them to look through their ticket

box. Even under the threat of proceedings Mr. Gotobed would not disclose any of the books, and, in fact, denied that there were any to produce except the salesmen's counter books.

Mr. Gotobed subsequently called upon Mr. Woulfe, and stated that he could not disclose the name of the maker of the "Mortimer" gun. He offered various undertakings for the purpose of stopping the proceedings, but these proposals were not entertained. It was suggested to Mr. Gotobed that the reason why he would not disclose the name of the maker of the gun was probably because investigations would show that the names had been put on by Messrs. Goff's orders, and that they were thus afraid of being prosecuted for forging the trade marks.

On October 28th Mr. Reginald Woulfe applied for six summonses for various offences under the Merchandise Marks' Act. Each of these summonses dealt with a particular offence under the Merchandise Marks' Act.

Mr. Reginald Woulfe subsequently applied on November 4 for a further summons in respect of various other guns, which he had reasonable cause to suspect were in the possession of Messrs. Goff, and he applied at the same time for a warrant to search the premises of Messrs. Goff for fraudulently marked guns and other documents and papers relating thereto. Both applications were granted, and Mr. Woulfe, accompanied by Mr. Thorn and the police authorities, visited Messrs. Goff's premises at 136, Strand, but did not find any guns therein. They, however, seized a stock book showing that certain guns had been transferred on the 26th of October to the King Street premises of the firm. They also seized 11 gun tickets referring to guns, some of which were stated to be by Mortimer, Jackson, and Blissett. They then proceeded to the firm's premises at 446, Strand, where they seized a stock book containing an entry showing that one gun had been transferred to King Street. They then proceeded to 17 and 18, King Street, Covent Garden, and the assistant showed great unwillingness about giving information or in any way facilitating the search. They found one gun on the ground floor bearing no name, and the assistant denied all knowledge of any guns having been transferred from the other premises. After about half-an-hour Mr. Gotobed arrived and found that a detailed search of the premises was being carried out. He explained that there were various guns in a store room on the top floor, and on proceeding there, five guns were found, one the exact counterpart of the unmarked one on the ground floor, except that it bore the name of "J. Mortimer & Sons, New Bond Street, W." Another similarly marked was also found. Further, there was a gun marked "Parker, Field & Son, High Holborn," and finally two bearing the name "Thomas Jackson, Wigmore Street, W." These five guns were seized, and the unmarked gun was also taken away, A set of invoices were also seized showing the purchase of various guns at 35s. and other similar prices, and in addition of two guns at £12 each.

The same afternoon, viz., the 4th of November, the series of summonses came up for hearing at Bow Street, before Mr. Marsham. Mr. Wilson, who appeared for Messrs. Goff & Co., offered a plea of guilty for the offence of selling a gun falsely marked, but this was declined by the prosecution, and Mr. Wilson therefore withdrew it. In the course of Mr. Stafford's speech he dealt with various of the facts already noted. He drew very special attention to the two guns of similar style and make, one marked "Mortimer" and the other unmarked, and pointed out that it had been admitted to the police that the guns are received unmarked and are afterwards marked by Messrs. Goff. He proceeded to point out that he doubted whether he had gone far enough in the charges against Messrs. Goff.

Mr. Wilson intervened at this moment, and offered to tender a plea of guilty to all the summonses, and give an undertaking that the offence should not be repeated in the future. Mr. Safford thereupon claimed that the seized guns must be forfeited, but before this could be done it was necessary to prove the fact of their seizure, and to bring forward evidence showing his worship that just cause existed for ordering the seizure. Sub-Divisional Inspector Pardo thereupon entered the witness box, and gave evidence relating to the goods and documents seized, and to the circumstances relating to their seizure.

Mr. T. A. C. Mortimer, trading as Mortimer & Son, at 86, George Street, Edinburgh, also gave evidence. He stated that the guns he had examined were not second hand, and that they were new ones of the cheapest kind he had ever seen, and, in fact, perfect rubbish. He also stated that the two guns, one marked "Mortimer" and the the other plain, appeared to be in all respects similar and of the same origin. He finally stated that none of the guns marked "Mortimer" were of his manufacture.

Mr. Thorn's name was mentioned as the next witness, but he was not called upon to give evidence in view of the plea of guilty already lodged by the defendants.

Mr. Wilson stated that Mr. Goff had carried on business as Goff & Co. for something like 50 years, and until now has never had a complaint against him. He is now 80 years of age, and quite unable to attend to his business. He has to leave it in the hands of his manager, and a general business is carried on and very few guns are sold. It is admitted that he had the guns marked, but he did not know he was infringing the law. The names used were names of people who have long ceased to exist.

The magistrate observed that the guns were sold for three or four times what they cost. Mr. Wilson suggested that the prosecution wanted to pay a high price, but the magistrate pointed out that the price appeared to be on the guns before the purchaser went in, and further it was mentioned by Mr. Safford that the price had been reduced 5s. in the course of the negotiations for the sale.

Mr. Marsham, in giving judgment, stated that it was a very grave offence, and that the guns are inferior in quality and yet they bear the names of well-known makers. He stated that it almost amounted to forgery. On the series of summonses relating to the gun purchased by Mr. Thorn the defendant would be fined £20 in respect of one of the summonses, and 2s. on each of the others. In respect of the summons issued for other guns he fined the defendants another £20. He awarded the prosecution £21 in costs. This makes up £61 10s. in all. He further ordered the confiscation to the Crown of the seized guns bearing fraudulent marks.

BIRMINGHAM AND PROVINCIAL GUNMAKERS' UNION.—The third annual meeting of this Union was held on Wednesday, November 15th, at the Proof House Hall, Birmingham. The annual report of the executive committee, and the statement of accounts were presented to the meeting, and Mr. Hughes, in the course of his speech, touched generally upon the work which the Union had in hand. We hope, in our next issue, to give a full account of the proceedings, and also of the work and development of the Union.

APPLICATIONS FOR PATENTS.

OCTOBER 23—NOVEMBER 18, 1899.

21,107. Ejecting Mechanism for Small-arms. W. Baker.
21,126. Machine Gun with Carriage. W. H. FitzGerald.
21,249. Breech-loading Small-arms. J. L. Copping and G. D. Treece.
21,263. Armour Plates. J. Vavasseur.
21,389. Range Finders. A. A. Common.

21,395. Factory for Manufacturing Explosives. G. Beneke.
21,554. Detonators for Signalling. F. E. Applegate.
21,714. Apparatus for detecting Explosive Gas in the Atmosphere. C. E. G. Simons.
21,765. Projectile for Rifled Small Bores. J. J. P. Leman.
21,860. Explosives. S. P. Thompson.
22,001. Sighting Guns. D. Dragoumis.
22,083.* Magazine for Artillery Ammunition. E. Muller.
22,245. Chronographs. A. Baume and C. Victor.
22,270. Quick-firing Guns. The Hotchkiss Ordnance Company. (Agent for *L. V. Bénet* and *H. A. Mercié, France*).
22,321. Cartridge Carriers. W. Lindsey. (Agent for *T. C. Orndorff, U.S.A.*)
22,422.* Safety Vessel for containing Explosive Liquids. G. Ulrich.
22,468. Armour Plates. T. G. Challis and W. J. Hunter.
22,479.* Automatic Revolvers. C. G. Dymond. (Agent for *Halvard Folkestadhandstad, Norway*).
22,599. Mountings for Disappearing Guns. A. Riechwald (Agent for *Fried. Krupp, Germany*).
22,712. Explosives. C. E. Bichel.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

OCTOBER 11—NOVEMBER 18, 1899.

21,840 (October 17, 1898). O. Imray. (Agent for *J. Hyland, Melbourne*). Modified mechanism for magazine rifles of the bolt type. The magazine is of special construction, and the ordinary magazine spring is dispensed with, the cartridges being pushed up by a lever. This lever works on a pivot, and is actuated by one arm of a duplex spring, the second arm of which operates the hammer. There are also several other minor alterations in connection with the ordinary bolt mechanism which tend to make the whole simpler. Accepted October 14, 1899.

23,477 (Nov. 8, 1898). C. B. Englis and W. Field, Birmingham. Martini rifle mechanism, which may be secured to the body of the rifle by one pin only. Upon the removal of this pin the whole of the lock mechanism, each separate part secured as a whole, may be removed bodily. By another similar arrangement the breech block with the striker may also be removed. It is claimed that this modification does not in any way interfere with the strength of the action or the arrangement of the moving parts. Accepted October 7, 1899.

24,554 (November 21, 1898). S. Pitt. (Agent for *F. F. Fletcher, U.S.A.*). A breech block for ordnance applicable to the interrupted screw type of mechanism. The breech block in this case is such that a cross section represents a curve of gradually decreasing radius. This produces a shoulder, the face of which lies in the line of the longest and shortest radii. The interior of the breech block is similarly shaped, so that after the breech block has been swung into its box, the turning of the former causes it to wedge tightly up against the box. Accepted October 14, 1899.

25,515* (December 3, 1898). L. B. Taylor, Selly Oak. A Method of attaching Sights to Small-arms.

26,685 (December 13, 1898). A. J. Boult. (Agent for *The Cleveland Target Company, U.S.A.*). Various modifications to the mechanism of automatic clay-bird traps, particularly relating to the rotation of the throwing arm and the releasing apparatus. A method is also described for delivering birds to the arm from the magazine, and also for regulating the speed of the arm. Accepted October 28, 1899.

26,893 (December, 20, 1898). W. F. Reid. Addlestone, and E. J. V. Earle, London. A water-proof safety fuse for blasting, in which the usual gutta-percha waterproof coating is dispensed with. The gutta-percha is liable to become brittle if stored for any time, and it also has the disadvantage of softening when warmed. In both cases the fuse ceases to be waterproof. In order to do away with these disadvantages, the patentees employ another method of waterproofing, consisting of coating the yarn covering of the fuse with a mixture of nitro-cellulose and nitro-ricinolein. Accepted October 21, 1899.

27,316 (December 27, 1898). L. Davies, Kyles of Bute. A nitrate of ammonium explosive, which is claimed to be practically flameless, and, therefore, valuable for use in dangerous mines. It is also, however, adapted for use in small arms. It is composed of about 80 or 90 per cent. of nitrate of ammonia, incorporated with about 10 to 20 per cent. of natural carbon, such as lignite, with or without the addition of one per cent. of paraffin wax. Accepted October 21, 1899.

27,612 (December 31, 1898). F. R. von Mannlicher, Austria. Improvements in automatic fire-arms of that type in which the barrel is fixed, the breech-bolt only being thrown backwards by the recoil. A considerable pressure has to be exerted mechanically in this class of arm to withstand the sharp recoil. The present patent deals with a method of providing the hammer with a very strong spring to help support the breech-bolt. Several other alterations are also described, which are provided for the purpose of making the pistol as neat and compact as possible. Accepted October 28, 1899.

852* (January 13, 1899). W. H. Brighton, Wylde Green. Single-trigger Mechanism.

6,456* (March 25, 1899). W. H. Brighton, Wylde Green. Single-trigger Mechanism.

8,680 (April 25, 1899). T. H. Kelly, W. Bell, and R. N. Kirk, Sydney. An explosive for blasting purposes, the principle constituent of which is the leaves of trees or plants—preferably those obtained from two particular Australian trees, named in the specifications. These leaves are nitrated by soaking them in a mixture of sulphuric and nitric acids. The resulting mass is then washed and dried, and is afterwards passed through a sieve to convert it into a powder. Accepted October 21, 1899.

9,505 (May 5, 1899). P. M. Justice. (Agent for *The Driggs-Seabury Gun and Ammunition Company, U.S.A.*). A modified form of mechanism for operating the breech-block and extractor in semi-automatic rapid-fire guns. In this type of gun the breech mechanism is opened and closed by energy stored up in a spring, or during the recoil of the gun. The present patent describes mechanism which is provided for independently operating the breech-block and extraction by hand if so desired. This modification embodies the alteration of a number of the various parts contained in the breech. Accepted October 7, 1899.

10,601 (May 19, 1899). G. Roth and K. Krnka, Austria. Automatic small-arm mechanism, which may be applied to pistols, rifles, or guns. This mechanism is operated by the recoil, which drives the barrel and breech-block locked together a certain distance backwards. The unlocking of the two does not occur until the barrel has started on its return movement, the breech bolt then being rotated slightly upon its axis. This movement unlocks it from the barrel, and an interceptor is brought into play to retain the breech-bolt until the spent cartridge has been ejected from the breech through an opening only sufficiently wide to allow it to pass. The construction, it is claimed, prevents the gases of combustion from escaping at the rear when the breech is thrown back. Accepted October 7, 1899.

11,075 (May 27, 1899). L. H. Sibthorpe, Northam, York. A hook which may be attached to the belt for carrying a rifle or a gun. The weapon is rested on the hook in front of the trigger guard, so that the hook sits in the angle formed by the guard and the stock. The stock rests under the arm, leaving both hands free, the rifle being carried quite comfortably. Accepted October 21, 1899.

14,814 (July 18, 1899). A. S. Williamson, Canada. A cap for blasting fuses, the main feature of which is a waterproof joint. The end of the cap is formed in the shape of a thimble, and into this thimble is fitted an india-rubber collar. The collar fits round the end of the fuse, and a special pair of crimpers are described for crimping the thimble so that the cap is secured firmly to the fuse. Accepted October 7, 1899.

15,231 (July 25, 1899). T. Bergman, Germany. Modified mechanism for automatic recoil-operated pistols, relating principally to a method of retaining the breech-bolt in its backward position after the magazine has been emptied. A stop is provided for this purpose, one end of which projects into a recess in the breech-bolt sleeve, and thus intercepts the breech-bolt in its forward movement. When the magazine is filled, the cartridges press against the other end of the stop and press it out of the path of the breech-bolt. Accepted October 14, 1899.

* These Specifications will be more fully described under "Selected Patents" in our next issue, as the pressure upon the space in this number is too great to permit their publication.

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