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CONTENTS.

CURRENT TOPICS.

Sir Andrew Noble on Cordite.—It is with no idea of making capital out of the matter that our columns have been opened to a careful analysis and criticism of Sir Andrew Noble's recently published work on the temperature of explosion for cordite and other propellants. Artillerists are necessarily very keenly interested in all experiments which tend to show the temperature which exists during the combustion of a smokeless powder charge. The erosion of the bore is considered to vary according to the temperature, and explosives of equal merit in other respects are frequently graded according to the figures of temperature which are supplied by such scientists as Sir Andrew Noble. His reputation for research of a high order is so firmly based on a lifetime's efforts to elucidate the hidden meaning of ballistic phenomena that it would be scarcely appropriate in the present connection to dwell upon those services. However great a reputation may be that reputation gains brightness by admitting errors which have inadvertently crept in through failure to investigate what may at first sight appear to be immaterial side issues. No one will think the worse of Sir Andrew if he takes an early opportunity to revise the fallacious conclusions which he has derived from numerous experiments for determining the closed chamber pressure of various explosives. But his reputation must suffer if he insists on adhering to the figures which are so destructively treated in Mr. Jones' temperately reasoned criticism. If there is an answer to the allegations, that answer should at once be forthcoming. The present paragraph would not be necessary did not evidence exist of a desire to ignore a mistake which must be apparent to every chemist. At first sight it might appear as though the errors alleged cancel out in the calculation, but Mr. Jones has made it quite clear that no such equalising process takes place. Consequently the figures which have been issued have not only earned the criticism which Sir Andrew anticipated they would receive, but a fair case has been established for wiping them out, and doing the arithmetic over again.

Juggling with Cartridges.—Now that it is the fashion for the novelist of the day to interest himself in the organisation and management of rifle clubs it is not surprising to find that he has rapidly acquired a good deal of practical knowledge concerning the weapons themselves and the conditions under which they are used. One may remember for instance a letter from Sir Arthur Conan Doyle in the *Times*, in which, with all the authority attaching to his name, he expressed the opinion that the long Morris tube cartridge was the best all-round ammunition for rifle clubs to use, whether regarded from the point of view of cost or efficiency. Possibly when he returns to the subject he may have a few words to say for the long ·22 cartridge, which some people at any rate regard as possessing merits, apart from its greater cheapness. However small may be the price of a hundred rounds of ammunition, the cost to the individual is considerable if his enthusiasm is as great as his means are small. Mr. Rider Haggard, to judge from his recent romance "Benita," has evidently solved the problem of making a little go a long way. All now wanted is to know how it is done. To take the bare facts, as disclosed in his highly interesting story, a couple of traders, apparently in contravention of the rule against supplying savages with anything better than African guns, purchased for the sum of £600 fifty Martini rifles, fifty Westley Richards falling-block rifles and 10,000 rounds of cartridges therefor. For up-country charges these seem fairly reasonable; and it is not surprising to find that that the savage tribe for which they were intended granted in exchange a concession which in due course proved of great value. However, to stick to the 10,000 rounds of ammunition, the rifles were in due course served out to the blacks, who took very kindly to practising with them. Although time is not measured in the modern romance with the historic exactitude of a Robinson Crusoe story one gains the impres-

sion that these dark-skinned warriors practised day by day, week following week, until they became fairly proficient marksmen. Trouble then arose with the Matabele, who wished to crush this small but well-organised unit. Several lively actions were fought, and a sustained siege was endured, the rifles popping unceasingly, and everyone having a thoroughly good time. In a future edition the author should certainly disclose the secret for making an allowance of one hundred cartridges per rifle go such a long way.

The New N.R.A. Target.—It is very interesting to know that next season's rifle shooting will be conducted at a size of target bearing a commonsense relation to the standard of marksmanship which exists amongst Bisley competitors. One can well understand that a 7in. circular bull at 200 yards represented unduly easy conditions, having due regard to the class of shooter who fires through the great meeting held in July. Moreover when the competitors run into hundreds and thousands, and the prizes are graduated on the assumption that everyone cannot be first, it is clear that the difficulty of the target must be proportioned to the severity of the weeding out process which must take place before the competitors can be arranged in numerical order. The old 7in. bull had an area proportional to 49. Last year's 5in. bull at 25 gave practically half the area, this being obviously too big a drop. The new size is 6ins., which squared out gives 36 for the proportional area. When the size of bull approaches in size the space representing the natural dispersion of the shots, comparisons are only fair when based on area, instead of on diameter. The decision to adopt a diameter midway between 5ins. and 7ins. certainly fits in with the practical shooting experiences of last season. The 12in. area of black remains, probably because the same target can so be used for class firing as well as for competitions carried out under Bisley conditions. The inner ring is no longer limited to the boundary of the black disc which one instinctively desires to continue calling the bull. Its diameter is 15ins., thus giving a white circle 1½in. beyond the black circumference. Another change concerns the targets which have hitherto been khaki-coloured. In future they will be a grey-blue. A running deer of this colour will be somewhat of a novelty; but the change is certainly justified in the disappearing and other targets which have hitherto been so hard to distinguish in a bad light. The above information is conveyed in a circular issued by the National Rifle Association. A similar official document announces that the invitation to send a team of riflemen to Australia has been accepted, subject to raising the necessary funds. The present idea is for the team to arrive in Australia early in October, a time of year which suggests pleasant visions to those who remain at home with an English winter in prospect.

The Birmingham Gunmakers' Association.—Mr. W. H. Hughes presided at a harmonious gathering of the Birmingham and Provincial Gunmakers' Association. In reviewing the past year's work he called attention to the very satisfactory revenue account, which shows a further addition to the already substantial fund which had been accumulated. He was unable to report a satisfactory issue to the attempts which have been made to secure a revision of those clauses in the Pistols Act which have proved hurtful to trade interests without, it is contended, materially enhancing public safety. In a similar fashion the efforts of the Association to secure a modification of the Indian Arms Act restrictions have not had a fruitful result. A few remarks on the Spurious Sports Bill, now before Parliament, sufficed to complete the tale of woe, the Chairman pointing out that the gun trade's worst enemy is mischievious legislation by the Government. By rather a curious coincidence Mr. Bonehill immediately jumped up and suggested that the Government ought to formulate a compulsory standardization of gunpowder, whereby manufacturers would be forced to bring out an article of properly regulated strength, in just the same way that the gun conversely must not go below a definite power of resistance. What is sauce for the goose is equally sauce for the gander, and on the principle that misfortunes are easier to bear when shared with others Mr. Bonehill's idea was that the powder maker ought to be restricted in some way or another. The only difficulty about belling the cat is to show means by which a standard strength of powder can be set up, with a reasonable probability that that strength will properly forecast the behaviour of the cartridge into which the powder is loaded. The most careful powder maker finds considerable difficulty in keeping his product within the limits which are defined by the conditions under which it may be used. Certainly as things stand at present, the small private loader is responsible for greater variations in the behaviour of the cartridge than can be accounted for in the action of the powder. When a reliable grade of loading has been assured it will be time enough to enquire whether the powder can be more closely standardised than at present. For the moment the powder maker must strike an average between the variations in guns and in loading which everyone must admit. When extremes meet, a degree of violence may result, which at first sight seems attributable to the powder alone. Careful experimentation frequently shows that the powder is a useful scapegoat which compulsory standardization would kill.

The Explosives Committee.—It is impossible to deny the gravity of the charges which underlie a letter which appeared in the *Times* of the 19th ult. The letter consists of the following questions, and the writer at any rate seems to have convinced the editor that his allegations can be sustained:—(1) Whether it is not the case that the person entrusted by the committee with the control of its expensive laboratory at Woolwich has been summarily dismissed? (2) Whether the case is not of a character justifying prosecution? (3) Whether any such prosecution has been undertaken, and, if not, why not? (4) Whether the person in question was at the time of his appointment either an acknowledged authority upon explosives, or had proved his capacity for original research in any serious sense of the word? (5) Whether the laboratory has furnished the Committee of National Defence with a single practical suggestion beyond the statement that it could not improve upon the cordite already in use? (6) Whether it has produced a single scientific paper of the smallest value? (7) Whether the laboratory, though full of expensive apparatus of miscellaneous kinds, is not wanting in fundamental appliances for the serious study of explosives? (8) What is the cost to the country of this sham Charlottenburg? (9) Whether the Treasury has not for some time protested against the misdirected and useless expenditure, but in vain?

BREAKING UP CARTRIDGES.

IT may be remembered that in commenting on the report of an accident which recently occurred during the illegal breaking up of cartridges, the present state of the law was emphatically condemned. Capt. Thomson, H.M. Chief Inspector of Explosives, wrote expressing regret that a journal, which had hitherto upheld the Department's efforts towards ensuring the safe treatment of explosives, should deliberately encourage a dangerous infraction of the law. Some months have now elapsed since these events transpired; and the subject is now taken up afresh, because the existing state of affairs is unsatisfactory on both sides. Cartridges are constantly broken up on registered premises as a regular trade operation; and the legal maxim quoted by Capt. Thomson *de minimis non curat lex* is a frail barrier to protect the gunmaker from a charge of manslaughter should a fatal accident ensue. The inspectors of explosives naturally hesitate to authorize a process which they regard as dangerous when carried out beyond the scope of factory regulations, and the object of the present article is to voice a feeling which the trade cannot itself express. To deal first of all with the question of danger. The accidents which have happened on registered premises consequent on the illegal breaking up of cartridges amount to five in number since the Explosives Act, 1875, came into force. Nine persons have been injured, but none killed. On April 14, 1886, an accident occurred at 88 Fleet Street, through the explosion of a pin-fire cartridge, and two persons were injured. On November 3, 1887, at Edinburgh, a man was injured during the illegal breaking up of cartridges. In September, 1890, at 143 Queen Victoria Street, another person was injured under similar circumstances. In February, 1900, one person was injured when opening a rim-fire cartridge. In March this year, at Dublin, four persons were injured in the accident which occurred whilst breaking up revolver cartridges under conditions which admittedly courted disaster. A summary of these cases does not confirm the view that breaking up cartridges is a dangerous operation when carried out under a suitable code of regulations.

To deal with the legal aspect of the position. Section 105 of the Act forbids the unmaking of an explosive away from a factory; but destroying it in a safe manner is not unmaking. Another section forbids making explosives except in licensed factories, but the loading of cartridges is specially exempted from the range of manufacturing operations. Various other exemptions show a desire to study practical convenience. One must, however, face the existing anomaly that to load a cartridge is not manufacture, but to unload it is. The anomaly arises from the circumstance that the whole cartridge had necessarily to be classified as an explosive, and be treated as such in transit and storage for considerations of public safety. There seems in consequence to be no reason why a beginning should not be made by relaxing the present restrictions in respect to sporting cartridges. These are loaded in large quantities up and down the country, and it should be recognised that a man who is competent to load must be competent to unload any worthless stock which has accumulated. The recovered components have a high intrinsic value, but one which would nevertheless disappear if the cartridges had to be sent to a licensed factory for treatment. The usual method of proceeding to break up cartridges under the protection of the legal principle already quoted, is to nick the paper tube with a knife (a bronze instrument would be worthless), tear away the side of the case, spill out the shot, release the wads and shake the powder into a bowl. Certain obvious precautions should be taken, and if danger still exists it is certainly no greater than is involved in crossing the street.

With rifle cartridges on the other hand very different conditions must be admitted to exist. The expert loader of sporting cartridges is not necessarily a safe man to trust with the breaking up of rifle or revolver ammunition. Never having loaded it, he may lack experience in knowing how to treat it. If a man of sense, he would limit the quantity of loose powder which accumulated in the immediate vicinity of the operation. But further than that he might easily fail to go. Each class of cartridge presents its own problems. Express or military ammunition with hard jacketted bullets can be removed by proceeding in a certain way with a vice and a piece of rag. The cap can only be withdrawn, without a special machine, by an interesting application of hydraulics. At the finish the component parts are of little value, and the chief gain is in the fact that the explosive ingredients have been removed and can be destroyed. Rifle or revolver cartridges with firmly crimped lead bullets are more difficult to deal with, and special circumstances apply in special cases. Rim-fire cartridges should under no circumstances be unmade, the only safe plan is to explode them in a special oven with or without the bullets according to whether or not they can easily be extracted.

The main question having now been discussed in a way which it is hoped will not cause offence to H.M. Inspectors of Explosives a few suggestions may be permitted. As a general principle it might be recognised that sporting cartridges can be unmade in trade quantities by persons authorized to load, and under conditions to be laid down by H.M. Inspectors. The present state of the law regarding rifle and revolver cartridges might be upheld, with the added force which would follow the removal of a restriction which is not observed. But in certain special circumstances as for instance in the case of rifle makers of high repute and carrying on business in distant places, breaking up might be allowed under conditions fully safeguarding the life and limb of the operator and entirely safe for all other persons. Whether or not the present law can be harmonised with the granting of such a privilege is for H.M. Inspectors alone to decide, but rules for the conduct of breaking up operations should certainly be framed and published. If then cartridges of a prohibited kind were broken up in an unauthorized place, the responsibility for infringing the law would be in no wise diminished. The breaker up might unsuccessfully plead the *de minimis* principle; but there would be no innocent victims of accidents where the safeguarding rules had been observed. In this connection a most valuable letter has been received from Messrs. Eley Brothers, who have had a very large experience in unmaking old stocks of cartridges, both for themselves and for customers. In it they make suggestions for safeguarding all kinds of breaking up operations, hints which will prove of value when the time comes for drafting a code of instructions.

THE DEPARTMENTAL COMMITTEE ON BOBBINITE.

COAL-GETTING EXPERIMENTS.

ON the 14th December the Bobbinite Committee completed the task which, in the course of its investigation it had deemed expedient to undertake, viz., to carry out a series of practical shot-firing experiments with a view to ascertaining, as nearly as possible, the comparative values of different classes of "permitted" explosives for coal-getting.

Since the introduction of safety explosives in coal mines the question of their inferiority to gunpowder as regards production of round coal has been raised and debated again and again, and the opinions expressed on the subject from time to time, frequently backed by numerical results of systematic trials, have varied like the wind. Some pronounced dead against the new supersedents, whilst others, on the contrary, came to the conclusion that there was very little to choose. This diversity of opinion was, perhaps, not to be wondered at, seeing that gunpowder was an old and trusted friend, cheap and easy to manipulate, whilst the newcomers required special handling and cost more money, the latter circumstance being, in itself, a moment of suspicion from the miner's point of view. But apart from the matters of mere prejudice, it would appear that local conditions of working and of the coal itself were not always taken duly into account when comparing results. At all events, many of the reports which appeared from time to time contained views which were either highly exaggerated or only superficially inferred.

Some seven or eight years ago a number of colliery managers in the Midlands made what appears to have been a thorough investigation of the matter and the majority of them found that the safety explosives then in use generally gave from 1 to 2 per cent. more dross than gunpowder, a result which it is interesting to recall for comparison with those given below. For, although Bobbinite must be acknowledged to be a decided and interesting improvement on the ordinary black powder with regard to safety, it is still a gunpowder variety, and retains some of the characteristics of its class. The advantage to the miners of being able to send their trucks to bank with a high proportion of large coal is obvious, and the claim that Bobbinite gave far better results in this respect than the rest of the permitted explosives had been so strongly brought to the notice of the Departmental Committee that the members ultimately decided to see for themselves. Hence these trials.

For comparison with Bobbinite, three other permitted explosives, viz., Carbonite, Ammonite and Saxonite, were selected as representative of their class, and it was arranged to conduct the trials at four different collieries, the names of which will be found in the tables below. About 50 tons of coal were got with each explosive at each colliery, the stalls being cleaned up before and after the use of each explosive. The trucks were sent up with a special mark, and their contents carefully screened and weighed, 1¼ in. to 1⅛ in. mesh being chosen as the dividing line between round and small coal. The local inspectors of mines were in charge of the experiments in each case, representatives of the different manufacturers being, however, invited to be present and to advise as to the quantity and method of firing the explosives used.

The arrangements underground were perfect, and the experiments were conducted with that thoroughness and impartiality which one is justified in expecting and accustomed to meet with in connection with governmental work of this kind.

Everything went without a hitch save, on one or two occasions, the late arrival of explosives sent by rail, and also, perhaps, in regard to the above named representatives' advice which, indeed, was not incapable of missing the mark under such exceptional circumstances and in face of such ever-changing local conditions as were frequently met with.

The following are the tabulated results of the trials:—

	Bobbinite.		*Carbonite.*		*Ammonite.*		*Saxonite.*	
	Large.	*Small.*	*Large.*	*Small.*	*Large.*	*Small.*	*Large.*	*Small.*
Don Pedro Pit, Whitwood Colliery ...	T. C. 41 19½ (77·7%)	T. C. 12 0½ (22·3%)	T. C. 40 6½ (77·7%)	T. C. 11 11 (22·3%)	T. C. 38 10½ (74·3%)	T. C. 13 6 (25·7%)	T. C. 40 9½ (74·1%)	T. C. 14 3½ (25·9%)
Victoria Colliery, Ebbw Vale ...	73 10 (65·0%)	39 11 (35·0%)	70 5 (64·9%)	37 19 (35·1%)	82 10 (64·0%)	46 8 (36·0%)	91 3 (62·4%)	54 17 (37·6%)
Moor Green Colliery (Eastwood) ...	38 7 (78·6%)	10 9½ (21·4%)	38 7½ (75·8%)	12 4½ (24·2%)	37 15½ (73·6%)	13 9½ (26·4%)	37 1 (73·7%)	13 8½ (26·3%)
Ystradgynlais (Swansea)... ...	41 8 (81·3%)	9 10 (18·7%)	26 9 (75·0%)	8 16 (25·0%)	— —	— —	29 9 (76·4%)	9 2 (23·6%)
Totals ...	195 4½ (73·2%)	71 10½ (26·8%)	175 8½ (71·3%)	70 10½ (28·7%)	3 Collieries 158 14 (68·4%)	73 3½ (31·6%)	198 2½ (68·5%)	91 5½ (31·5%)
	266 T. 15½ C.		245 T. 18½ C.		231 T. 17½ C.		289 T. 8½ C.	

Quantity of Explosives used per ton of Coal gotten.

(a) Calculated on large coal only. *(b)* Calculated on gross.

	Bobbinite.		*Carbonite.*		*Ammonite.*		*Saxonite.*	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*
Don Pedro	oz. 3·81 (Total 10 lbs.)	oz. 2·96	oz. 2·11 (Total 5 lbs. 6 oz.)	oz. 1·68	oz. 2·13 (Total 5 lbs. 2 oz.)	oz. 1·58	oz. 1·44 (Total 4 lbs. 2 ozs.)	oz. 1·07
Moor Green	2·14 (Total 5 lbs. 2 oz.)	1·68	1·90 (Total 3 lbs. 2 oz.)	0·99	1·23 (Total 2 lbs. 14½ oz.)	0·91	1·14 (Total 2 lbs. 10 oz.)	0·80
Victoria...	3·18 (Total 14 lbs. 6 oz)	2·04	1·98 (Total 8 lbs. 11 oz.)	1·28	1·15 (Total 5 lbs. 15 oz.)	0·74	1·18 (Total 6 lbs. 7 oz.)	0·7
Ystradgynlais... ...	3·06 (Total 7 lbs. 14½ oz.)	2·49	3·4 (Total 5 lbs. 10 ozs.)	2·55	——		2·61 (Total 4 lbs. 12½ oz.)	1·99
Average...	3·06 (Total 37 lbs. 6½ oz.)	2·62	2·02 (Total 22 lbs. 13 oz.)	1·48	(3 pits only) 1·41 (Total 13 lbs. 15½ oz.)	0·96	1·49 (Total 18 lbs. 7¾ oz.)	1·02

A copious commentary on these results and the conclusions to be drawn therefrom will be found in the Mine Inspectors' Reports when published. Meanwhile one significant suggestion, at least, seems inseparable from their import, that, namely, of "*classification*," and if this principle of gradation be extended to the whole question of safety, both as regards mines and explosives—and there is, indeed, good ground for believing that such will be case—then the Bobbinite Committee may be said to have succeeded in laying down an equitable basis for future research and control. It has thereby completed its labours in a spirit acceptable to all parties concerned—an achievement neither easy nor frequent.

THE SINGLE TRIGGER LITIGATION.

IN the Chancery Division of the High Court of Justice an action, Robertson *v.* Purdey, came on for hearing on December 15th. The case, which is of considerable interest to patentees of single-trigger gun mechanism and to the gun trade generally, was taken in King's Bench Court No. 1 before Mr. Justice Parker.

The plaintiff, Mr. John Robertson, trading as Boss & Co., sought an injunction to restrain the defendants, Messrs. James Purdey & Sons, from infringing letters patent granted in 1894 to the plaintiff for an invention relating to the trigger mechanism of double-barrelled guns. In this patent, No. 22,894 of 1894 (abridged and illustrated in these columns in December, 1895) various methods were described for producing single-trigger gun actions, in which a trigger release, and subsequent pull, both performed involuntarily by the finger of the shooter immediately after the discharge of the first barrel, were relied upon to actuate mechanism for the prevention of unintentional dual discharges. The invention could be carried into effect in various ways, and numerous modifications were described in the specification to which a very considerable number of drawings was appended. In all cases the mechanism required, or was intended to require, three distinct pulls for the discharge of the two barrels, and in this principle lay the essence of the invention. Defendants denied infringement, pleaded the priority of a patent No. 13,130 of 1894 granted to William Nobbs (abridged and illustrated in these columns February, 1898), and contended that plaintiff's patent was invalid by reason of anticipation.

Mr. T. Terrell, K.C., and Mr. Courtney Terrell appeared for the plaintiff, and Mr. A. J. Walter, K.C., and Mr. Gray for the defendants.

On December 15th Mr. T. Terrell, K.C., opened the case for the plaintiff, and dealt broadly with the issues raised. On Monday, December 17th, and Tuesday, December 18th, expert witnesses were examined on patent specifications and on the construction of mechanisms. On December 19th Mr. John Robertson's evidence concluded the case for the plaintiff. After the luncheon interval Mr. Walter opened for the defence, and expert evidence was given concerning the Robertson patent and the alleged anticipation of Nobbs. Mr. William Baker, of Birmingham, gave evidence concerning anticipation by certain guns alleged to have been fitted by himself with single-trigger mechanism in 1883. In these guns the principle of the three pulls was alleged to have been employed. On Thursday, December 20th Mr. Baker's examination was concluded, and Mr. W. P. Jones, of Birmingham, Mr. H. A. A. Thorn (Charles Lancaster) and Mr. Frank Murray (Webley & Scott, Ld.) gave corroborative evidence concerning guns fitted with Mr. Baker's mechanism of 1883. Mr. Athol Purdey and Mr. William Nobbs were examined concerning the alleged anticipation by the Nobbs patent of 1894 and by guns made as therein described. This concluded the case for the defence. Mr. Terrell desired to call further evidence regarding the alleged anticipation by the Baker guns, and the further hearing was adjourned, the case to be put into the list for January 17th, 1907.

In opening the case on December 15th Mr. T. Terrell dealt at some length with the history of the use of single triggers to actuate the two locks of sporting guns or other double-barrelled fire-arms. On December 17th Mr. C. Bauer, a member of the firm of Bauer & Imrie, patent agents, gave evidence at great length concerning the specification of Robertson of 1894 and the alleged anticipation of Nobbs of the same year, He explained very fully to his Lordship the action of the Robertson mechanism. He did not consider it possible that the mechanism indicated in Nobbs's provisional specification could have been of the three-pull type. In the final specification the voluntary pull was indicated, but not in the provisional. Cross-examined by Mr. Walter, witness said that single trigger mechanisms were old. The use of a swinging piece (switching blade) was also old. He did not consider that a device for arresting the movement was the only new feature disclosed in Robertson's specification. The arrest alone was not enough. On December 18th Mr. Bauer's cross-examination was concluded. Re-examined by Mr. Terrell, the witness said that in the provisional specification of Nobbs there was no indication of knowledge of the involuntary pull. In the complete, there was reference to a three-pull mechanism, but the figures were not consistent with the use of three-pulls to actuate the mechanism as drawn. He thought that between the filing of the provisional and the complete, the invention of Robertson had become known. Mr. Walter with some heat protested against the suggestion. On the previous day he had read a letter dated July, 1894, in which knowledge of the three-pulls was clearly shown, and the provisional patent of Robertson was not filed until November of that year.

Professor C. V. Boys gave evidence concerning chiefly the patent of Nobbs. He did not consider that the provisional specification was in any way consistent with a knowledge of, and an intention to make use of, the three-pulls. Mr. John Robertson, the plaintiff, examined by Mr. Terrell, said he was the patentee of the three-pull mechanism for which provisional protection was obtained in November, 1894. In December of that year he had an exhibition of the invention. He did not show the mechanism, but explained the system and showed the three-pulls on unloaded guns. Pressed, later on, as to whether he suggested that something was learnt from his exhibition in December, 1894, before the complete specification of Nobbs was filed, he said he did. This concluded the plaintiff's case, and Mr. Courtney Terrell addressed the court.

Mr. A. J. Walter, K.C., in opening the defence, said there were four issues put forward. First the prior manfacture and use of guns with Baker's mechanism of 1883; second the prior manufacture and use of guns with Nobbs mechanism of 1894; third that Nobbs, and not Robertson, was the first inventor; and fourth that letters patent had issued to Nobbs in priority of Robertson. As concerning the Baker guns, evidence would be given to show their existence and use. Manufacture and sale of guns made according to Nobb's specification would also be proved. Mr. James Swinburne, engineering expert, said he had read the specifications of Nobbs and of Robertson. The mechanisms described differed widely in detail, but the essential principle was in both cases the same. Nobbs anticipated Robertson. He had seen the model, working as a two-pull, which purported to represent one of the Nobbs mechanisms. The two-pull model was absurd and had useless mechanism introduced in it.

Mr. William Baker, of Birmingham, was next examined. He said that he was a gun lock maker. In 1882, he had, in conjunction with a Mr. David Bentley, provisionally patented a single-trigger mechanism. The patent was No. 4,766 of 1882. It had never been completed, because after a number of the mechanisms had been made, it was found that the guns went off both barrels together. He was told of this, and to overcome it he fitted an intercepting limb to prevent the slide, which was mounted on the trigger, reaching the left sear until the trigger had been pulled a second time. There were then three pulls needed to fire the two barrels, and the guns worked all right. He had made three of them in 1883, and two were still in existence. One of them had been submitted for consideration to Mr. Webley in 1883, but Mr. Webley had not purchased the invention. Re-examined by Mr. Walter: He had fitted two guns with the same three-pull mechanism for Mr. W. P. Jones, of Birmingham. Mr. W. P. Jones said that in May, 1883, he had had a gun fitted with the Baker single-trigger, and in June of that year he sold it to Carr Bros., of Huddersfield. Later in the year he had another, and he sent it to Mr. Reilly, of E. M. Reilly & Co., London, to try. The Carr gun had come back to him, and had then been sold to Mr. Charles Lancaster. It was in good order, but gummed up with oil. He sent it to Baker to be put right.

Mr. Henry A. A. Thorn (Charles Lancaster) said he had read a report in *Land and Water* in 1893 concerning a three-pull single trigger gun in the possession of Mr. W. P. Jones. Had borrowed the gun from Mr. Jones in 1896, and

had carefully examined the mechanism. The trigger carried a sliding bar and the sliding motion after the first pull was intercepted, and resumed only after the involuntary pull had taken place. He knew of the existence of the gun which had been sold to Mr. Carr. When it came again into Mr. Jones's possession he had bought it. He knew that an article describing Mr. Jones's gun had appeared in the *Shooting Times* of December 9th, 1893. (This article was also read.) Cross-examined—He had not permitted either the plaintiff or defendants to have possession of the Carr gun. He knew from experience of previous litigation the importance of an anticipating mechanism; he did not consider that any single-trigger mechanism at present in existence could be absolutely relied on never to fail in use. He had furniture filed by Mr. Baker and fitted to a hammerless ejector. It was precisely the same in principle as the single-trigger work in the Carr gun. He considered that in a hammer gun a three-pull single-trigger was dangerous. To let down the two hammers the trigger had to be pulled three times, and that might easily cause an accident. He would never recommend a three-pull hammer gun, but this objection did not apply to a hammerless. Mr. Frank T. Murray, managing director of Messrs. Webley & Scott, Ld., produced the letter book of the firm of P. Webley & Son containing a press copy of the letter from Mr. T. W. Webley to Mr. W. R. Leeson respecting the Baker mechanism. The date of it was February 7th, 1893. Mr. Webley was now dead. Witness did not know what finally became of the three-pull single trigger referred to in the letter. His attention personally had not been called to the three-pull gun of 1883, until early in April, 1903, when Mr. Baker recalled the circumstances to the mind of Mr. T. W. Webley, and the copy of the letter now produced was searched for and found. Mr. Newton, a member of the firm of Messrs. Newton & Sons, patent agents, said that a letter dated July 2nd, 1894, had been received by them from Messrs. Purdey & Sons, and had remained in their possession until it had been required for the purposes of this case. An explanation of the mechanism to be protected, a single trigger requiring three pulls to release in succession the two locks, was given. Cross-examined—The drawings in the specification were made from the mechanism contained in a complete gun.

Mr. Athol Purdey said that he was the writer of the letter dated July 2nd, 1894, which was sent to Messrs. Newton & Sons. The gun had been made previously and had been shot. It had a three-pull switching blade mechanism. Re-examined—His firm did not sell very many single trigger guns. They did not recommend them. Mr. W. Nobbs, the patentee of the mechanism of 1894, said that Messrs. Purdey & Sons had experimented with single triggers in 1883. The mechanism was not a success, and it had been thrown aside. In 1894 attention was again directed to single triggers, and he tried to find out why the old mechanism discharged both barrels together. He did not fire the guns. That was not his business. It was found that if the gun was fired when held in two hands and not at the shoulder it worked properly. He made experiments, and at last arrived at the mechanism described in his specification, the trigger requiring three pulls to discharge the two barrels. This witness was not cross-examined.

Mr. Terrell stated that he would have more witnesses to call. The further hearing was adjonrned to the next sittings.

THE EXPLOSION AT WITTEN (WESTPHALIA).

CONSIDERABLE difficulty has, according to the *Cologne Gazette*, been met with in tracing the cause of the great explosion at the Roburite Factory, owing to the deplorable fact that but few of those who witnessed its earlier stages and might have described what happened after the first outbreak of fire are amongst the survivors. The following statement is abbreviated from the report of an expert as a result of his inquiry into the circumstances of the disaster:—Flames were first seen issuing from the upper part of the building where the storing tanks containing unfinished Roburite, the production of several days, were situated. The fire-hose was at once connected to the hydrant, and efforts were made to extinguish the fire. Meanwhile the day-fireman and the coachman of the factory, both of whom lived close to the works, had also arrived on the scene. The first explosion, which doubtless took place in the mixing-house, soon afterwards occurred. Flying particles of burning matter were scattered all over the factory, and the conflagration soon spread to other buildings, involving considerable quantities of raw materials, such as Ammonium Nitrate, various hydrocarbons, etc., which, under the influence of intense heat, would doubtless be capable of exploding. Judging from the size of the crater left at the site of the demolished store-house, there is little doubt that it was there that the second, and by far the more formidable, explosion took place. As far as can be ascertained, the first explosion occurred about half-an-hour after the outbreak of the fire, the second explosion about an hour later. The fire then continued to burn, fed by occasional local explosions, until nothing was left of the factory but smouldering brick heaps. Of the Roburite stock in the packing-house close to the entrance to the works, where it was stored ready for dispatch the next day, the whole (some 45 cases) remained intact. The magazine stock likewise escaped damage, and was safely removed the next morning. It is very remarkable, and well-nigh impossible to explain how a quantity of *half finished* Roburite, which at no time is easy to ignite, could spontaneously have caught fire and subsequently even exploded, and an explanation would seem all the more desirable seeing that this mysterious occurrence is entirely at variance with the general impression, even among experts, viz., that Roburite is incapable of detonation except by means of a suitable detonator or through the explosion of some other explosive charge in contact. As regards the second explosion, it was no doubt caused by the action of intense heat. The large number of persons killed and injured is accounted for by the widespread disbelief by the sight-seeing spectators in the possibility of Roburite exploding. Even the superintendent of the factory and his chief chemist were amongst those who lost their lives through this delusion.

The familar phenomenon attending similar explosions, viz., that the window panes in some cases fell outwards through suction and in others inwards through pressure, was again observed on this occasion, the former action being particularly noticeable in the direction of Witten whilst the latter predominated towards Annen. Like in previous cases, the scene of the explosion was strewn with pieces of wearing apparel torn from the bodies of the injured.

ROUND THE TRADE.

Both Mr. William Cullen and Mr. R. B. Pollitt have returned to their respective spheres of activity in South Africa.

The Government of India are so severe in respect to the new restrictions that they have forbidden service rifles attached to the sub-target practice device from passing into use until the barrels have been bored out.

It was intimated to us on the 30th November last that the Executive Committee of the Gunmakers' Association, at a meeting held on the 25th October last, appointed Mr. F. B. Bosworth to the office of Secretary, which had been vacated by Mr. R. H. Angier.

According to the financial newspapers the profits of the Fried. Krupp Company for the year ended June 30th last amounted to £1,462,867 on a capital of eight millions sterling, which is to be raised to £9,000,000, by the issue to the founders' family of new shares to be paid for in two instalments.

Remembering the famine in Guide Books to the Explosives Act which followed the going out of print of the last of the old series, a nice stock was laid in of the new four-shilling edition. This unfortunate attempt to form, in the interests of our readers, a corner in this publication has been frustrated by the issue of a later edition very much better turned out than the old one, at the reduced price of two shillings and sixpence.

The De Beers report for the year ending June 30th last makes mention of the circumstance that the directors decided during the year to form the dynamite factory at West Somerset into a separate company, called the Cape Explosives Works, Ld., with a capital of £500,000 in fully paid shares of £1 each and £750,000 five per cent. debentures, principal and interest being guaranteed by De Beers Consolidated Mines. These shares and debentures the company proposes to hold for the time being, and they represent the purchase price of the factory.

A most successful meeting of miniature rifle shooters came to a close with the Astor competition on the 30th November last. As showing the great importance of the new rifle club movement from the trade point of view it is interesting to note that the total entries received during the meeting were 3,224, and the total shots fired 38,274, Several hundred competitors took part in the meeting in one way or another, and as Bisley winners were practically excluded most of these may be regarded as new customers for the gun trade. The rifles mostly in evidence in the competitions were the new War Office miniature model, and besides the ordinary service rifle, fitted with the Morris tube, there were a number of ·22 Lee-Enfields of B.S.A. and L.S.A. manufacture. Considering that open sights were the rule, and that the ammunition was practically confined to ·22's and ·297-·230's some surprisingly good scores were made.

A warning has been issued in the *Manchester Courier*, and possibly in other newspapers as well, to the following effect:—"It has been brought to the notice of the undersigned, being the Danish Company owning and working the above (Rexer Arms) Danish inventions, that statements have appeared in the British Press to the effect that the Rexer Arms Co., Ld., has the practical monopoly of the manufacture of the above guns. The undersigned think it therefore right to inform the public, both in Great Britain and elsewhere, that the only patents with which they have parted are the patents for the United Kingdom and Canada, together with certain rights in the British Colonies and Dependencies, including India, which they sold to Mr. Henry de Morgan Snell in 1904, subject to the annual payment to the undersigned of certain Royalties. In the above-mentioned countries alone, therefore, has Mr. Snell or the Rexer Arms Co., Ld., any special rights or privileges of manufacturing and supplying Rexer guns. The undersigned have retained and continue to hold all the other patents which they have taken out throughout the world, and will strictly enforce such patents whenever and wherever occasion arises." (Signed) Dansk Rekylriffel Syndikat.

Mr. S. Salisbury of 13 Mosley Street, Newcastle-on-Tyne has forwarded a little booklet of mining specialities which include the products of the Lancashire Explosives Co., Ld., and the "Composite Detonator," which is specially constructed with a view to ensuring complete immunity from miss-fires.

Messrs. Ludw. Loewe & Co., Ld., have once more favoured us with their Week-at-a-glance diary for the new year, this being a publication which is found on the desk of many busy men who have discarded other means of recording their appointments.

The published apology of Messrs. Phillips, which appears in our advertising columns, shows that Messrs. Kynoch intend to uphold price maintenance. This firm's humiliation has been completed by the issue of a show-card containing the same matter and fitted with a brass ring for its suspension picture fashion.

The London Small Arms Company, true to the principle of enterprise which has marked their entry into the private rifle trade, have issued a most useful pamphlet giving instructions as to the best means of starting rifle clubs. The very clear illustrations have made it possible to condense the verbal description to a brief compass.

A noteworthy aspect of recent financial journalism is the extraordinary amount of attention which is paid to the Rexer Arms Company. This concern constantly forms the subject of unqualified recommendations to the favourable attention of investors, not only as a present profit-making concern, but as a company with important future prospects.

Gunmakers and others will need to pay some attention during the current year to the new Act for dealing with bribery and corruption. It is quite impossible from merely reading the Act to decide whether its provisions will become operative. The trade associations should certainly take an early opportunity of deciding whether a joint policy should be recommended. The better class retail trade is to a certain extent a victim of the blackmailing proclivities of gentlemen's gentlemen.

The long expected publication of the Birmingham Gunmakers' Association has just made its pleasing appearance, and one cannot help feeling that the talented committee of that body have proved as successful in the making of books as in the making of guns. It is not exactly that they have written a book in the ordinary sense of the word, but, as business men, they have jointly compiled a reference treatise which contains under its several headings matters upon which the trade daily requires information. The digest of the history of the Birmingham Proof House since the laying of the foundation stone in 1813 contains many dates and references to procedure which are not readily available elsewhere. The recent pamphlet describing the proof marks, English and foreign, which are recognised in this country, has been reproduced; as also have the shot gun chamber sizes, which were originally prepared by this Association in conjunction with the Gunmakers' Association of London. A few tables of metric and other measurements next appear, and following that some shot tables and a reprint of the current year's loading instructions for smokeless powders, as issued by the *Sporting Goods Review*. The remainder of the book is mainly occupied with a most valuable compilation relating to the import duties on arms and ammunition throughout the world. Some of the particulars seem somewhat odd. For instance, springs for air-guns are subject to an import duty for India of nearly eleven shillings each, against a first cost of sixpence or a shilling, which suggests that special knowledge may be necessary for evading such an iniquitous charge. The United States tariff forms an interesting piece of reading to those who have not the particulars fresh in mind. The only free item is shot gun tubes forged and roughed-bored. The ordinary double-barrelled gun or rifle pays a duty of twenty five shillings and 35 per cent. *ad-val.* It seems almost superfluous to include such a country in the list of particulars which are given concerning the regulations in force in connection with British commercial travellers. The book is published at two shillings and sixpence, and an extra threepence will secure its dispatch post free from the Hon. Secretary at Proof House Hall, Birmingham.

THE TEMPERATURE OF COMBUSTION OF PROPELLANTS.

BY F. W. JONES.

THE methods in vogue for determining this important element of an explosive's behaviour have been described in this journal on several occasions, more particularly in the issues of September and October, 1904, the matter was discussed in detail, and later in January, 1906, Cordite was taken as an example in illustration of the methods. The subject has again been brought to the front by the publication of Sir Andrew Noble's Researches on Explosives, Part IV., which was reviewed in the last issue. Noble gives temperatures of combustion for several propellants, and also describes his method of calculating them. These temperatures are in some instances about double the figure obtained by the more usual methods. The reason is apparent on examining Noble's formulæ. It is, accordingly, only right in the interests of science, to point out where Noble's figures are questionable and to show reasons why this view is taken.

In the first instance it is necessary to enquire—what is temperature. The hotness of a body is determined by the physical action this same degree of hotness has on special substances. Water, boiling under normal conditions, and ice thawing under normal conditions, are taken as standards, the amount of hotness or temperature separating these two states of water is in the Centigrade scale of temperature, taken as equal to 100 degrees. Beyond these two limits the scale is extended by assuming the observed behaviour of the special substances per unit of temperature within the limits, is of the same degree beyond the limits, i.e., that the expansion of mercury between 0° C. and 100° C. per unit of temperature is the same at say 200° C. The so-called perfect gases fulfil the above conditions of constant behaviour, and it is by means of the gas thermometer that the scale of temperature has been, and is extended. It has frequently been estimated by direct experiment that such a gas enclosed in a vessel at atmospheric pressure and 0° C. has its pressure increased to $\left(1 + \frac{100}{272{\cdot}6}\right)$ atmos., when submitted to the temperature of boiling water, i.e., 100° C. If the same rate of increase of pressure coincident with rise of temperature is taken as correct beyond 100° C., then at 272·6° C. the pressure would become $\left(1 + \frac{272{\cdot}6}{272{\cdot}6}\right)$ = 2 atmos., in other words a rise in temperature of 273° C. in round figures, doubles the pressure of the enclosed gases. The scale of temperature is an arbitrary one, and just as the standard yard or metre is of national importance and stored with every care, so it is with the standard gas-thermometer. The scale, however, of this latter instrument depends on the relation of pressure and volume of a perfect gas, and with explosives, fortunately, the gases evolved take the place of the gas-thermometer.

According to the notation of the Kinetic Theory of gases the pressure is given by

$$p = \tfrac{1}{3} d v^2 \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where d is the weight of gas per unit volume and v is the mean velocity of the molecules. Now a perfect gas enclosed in a vessel at 0° C. will have its pressure doubled when raised to 273° C., obviously d remains constant, and therefore the square of the mean molecular velocity at 273° C. must be double that at 0° C., viz., the square of the mean molecular velocity increases in direct proportion to the rise in temperature, and is a measure of the same. Now, as the pressure is directly proportional to the square of the mean molecular velocity, this is also a measure of temperature. This, however, is not true at high gaseous densities, because it has been found that at these high densities the pressure increases more rapidly than the square of the mean molecular velocity, the explanation being as follows:—

Let the figure represent at a given instant a small unit of the enclosed vessel containing gases at high density, let the internal round figures represent the

o	o	o	o
o	o	o	o
o	o	o	o
o	o	o	o

volume of the molecules, the space between them being the free space between the molecules. Now, assuming any temperature, and therefore, mean molecular velocity, it is obvious that the larger the volumes of the molecules and the smaller the space between them, the more frequently will the molecules, in their movements and impacts, pass through the boundary and be replaced by others, or for the same reason strike the supporting walls of the vessel. The formula (1) depends upon the momentum lost and gained by each molecule as it strikes and rebounds from the vessel's walls and the number of times they strike in a second. This latter factor is clearly directly proportional to the mean molecular velocity and inversely proportional to the free space in which the molecules move about. Consequently for gases under high pressure and great density, a given increase in the mean molecular velocity will produce a greater effect on pressure than the same increase would produce in the same gases at a lower density. An enclosed perfect gas, at atmospheric pressure and 0° C. has 99·9 per cent. of its volume, free intermolecular space but the same gas pumped up to a pressure of 665 atmos. at 0° C. has only 60 per cent. of its volume free intermolecular space. This latter density exists for a volume of perfect gases equal to the gases evolved on firing Mark I. Cordite at a density of 0·5.

It has been pointed out that the true index of the present scales of temperature is the square of the mean molecular velocity, and if temperature is measured by pressure, obviously a correction must be made for the volume of the molecules. If v is the volume of our vessel and b the volume of the molecules then the real volume in which the gases move about is $(v - b)$. In these formulæ, b is known as the co-volume or the volume of the "molecular spheres of action." Theory is in reality an explanation of experience; it is not always true, because more than one explanation is possible, but when theory is used to rewrite the results of the experiments on which it was formed, it is in accordance with experience and may be taken as a condensation of all experiments. Sarrau gives for the value of the co-volume $\frac{1}{1000}$ the volume the gases would occupy at 0° C. and atmospheric pressure, assuming they

behaved as perfect gases. This value was taken from experiments on gases at different temperatures and up to pressures of over 300 atmos.

In the behaviour of gases experience demands another correction, and to bring this about physicists have suggested that when molecules strike one another, especially dead straight, they approach so near to one another that they cohere and affect for a short time the after movements which take place. This correction is called *cohesion*, and it has been found that its nature is such that at high temperatures and gaseous densities it may be ignored. There is therefore no need to consider *cohesion* when dealing with explosives, and it has been ignored in the following :—

Let v = the volume of the enclosed vessel,
p_1 = the pressure at o deg. C. due to the gases, assuming they behave as perfect gases,
p_2 = the pressure observed when the temperature is t,
p_0 = atmospheric pressure,
v_0 = the volume of the gases per gramme, at p_0 and o ° C., assuming they behave as perfect gases (this is known also as the *specific volume*),

we have by Van der Waal's and Clausius'.

$$p_1 (v - b) = R = p_0 v_0 \quad \ldots \quad \ldots \quad (2)$$

therefore $$p_1 = p_0 \frac{v_0}{v - b} \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

also $p_2 (v - b) = R\left(1 + \frac{t}{273}\right)$. Subtracting from this expression relation (2), and then dividing the result by (2) one obtains

$$\frac{(p_2 - p_1)(v - b)}{p_1 (v - b)} = \frac{R\frac{t}{273}}{R}$$

whence $$t = 273 \frac{p_2 - p_1}{p_1} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

When calculating temperature it is best to take p_1 and p_2 in atmos. The values of p_2 and v_0 are given by the experiment, and p_1 is obtained from (3), and lastly t from (4).

The value of t, the temperature of combustion, given by (4), is the maximum value of temperature. This is clear on enquiring into the assumption and possible errors in the observations when taking the pressure and the total volume of gases per gramme or the specific volume of explosives fired in closed chambers. The following errors may exist, viz.:— The crushers may give erroneous readings, *i.e.*, the relation of decrement to pressure may be erroneous by faulty table or crusher, or the pressure may be put on partly dynamically, the table used being a statical one. These errors in general give too high a pressure, but it must be admitted that the error may be the other way. Again, the general movement of the gases during the combustion of the explosive may take the form of a blow on the piston's head, and give a result in excess of the pressure which is due to temperature alone. Cooling during combustion conversely reduces the pressure. On the average Noble "faired" his pressures to lower values than those he obtained, possibly with the idea that the existing errors tended to increase the readings. In passing it may be noted that these latest closed chamber pressures for Mark I. cordite are considerably higher than Noble's previous results. The volume of the total gases per gramme, *i.e.*, the specific volume, may be greater at the moment of complete combustion than found at o° C., and this would materially reduce the calculated temperature—*e.g.*, if dissociation took place to such an extent that only the simplest gases existed at the maximum pressure, the specific volume for Cordite Mark I. at density 0·5 would be 1067 cc.'s, instead of 798·8 cc.'s by Noble's tables, and the calculated temperature would be only about half that obtained by Noble's specific volume. It is probable that dissociation to some extent does take place, and this is the main reason for regarding the calculated temperatures higher than the real. Another doubtful point is the value of the volume of the "molecular spheres of action," viz., the smallest space the molecules require under the given conditions. That obtained by experiment is larger than the molecules would occupy if at rest, and it may be that at the very high molecular velocity which obtains on the combustion of explosives the co-volume is greater than that found at moderate temperatures. This point may be better appreciated when note is taken of the fact that the mean molecular velocity of hydrogen at o° C. is about 6,000 f.-s., whilst at the temperature of combustion of cordite hydrogen has a mean velocity of about 20,000 f.-s.

With a proper appreciation of the points here made it should be clear that the temperatures of combustion of explosives calculated from the pressure and specific volume are the maximum possible temperatures, unless, of course, the work of physicists and chemists is absolutely ignored, and mere wild guesses are substituted. The fact that the high temperatures and pressures which obtain during the combustion of explosives are beyond the limits of the experiments on which gaseous laws are based is no justification in itself for disregarding them, and substituting others found to be inaccurate at moderate temperatures and pressures.

The application of expressions (3) and (4) to the details furnished by Noble's tables enables one to calculate the maximum temperature of combustion. This has been done for several propellants, and the values so calculated set out under the column W. & C. (Van der Waal's and Clausius') in the table below, along with those Noble obtains from the same details. It will be noticed that Noble's temperatures increase rapidly with the density, the increase amounting from about 60 % to over 100 % One would have thought that these great differences in temperature, due to density alone, would have made the most fearless scientist hesitate and call in question the method of calculation adopted. However, Noble explains these differences by the assumption that at low densities dissociation is very active, whilst at high densities it is practically absent. Later it will be shown that, contrary to this view, Noble's results support Berthelot's early experiments that dissociation is independent of pressure or gaseous density. A much simpler explanation of Noble's results is here suggested. Noble calculates temperature from (4), but obtains p_1 as follows:—

$$p_1 = p_0 \frac{v_0}{v}$$

that is to say, he ignores the co-volume (compare with (3)). This omission of the co-volume has not much effect on the low densities, but as the density increases and the volume of the "molecular spheres of action" takes up more and more of the bomb the error becomes greater and greater. There is only one explanation of this omission on the part of Noble, and that is inadvertence. No one could suggest that he would purposely ignore the important work of Regnault,

Amagat and others, or the scientific explanation of the same due to Van der Waal's and Clausius'. Doubtless if he had been cognizant of the violence his method does to the work of these scientists, reasons for adopting it would have found a place in his researches, instead of the statement that he was afraid the method he had employed would not escape criticism.

Beside the above method of calculating temperature there is another, which depends on the heat evolved during combustion and the specific heat of the products of combustion. The heat evolved is measured by noting the rise in temperature of the water in which the bomb is placed. This measurement gives the number of degrees of temperature a unit weight of explosive ~~which~~ would elevate a unit weight of water, *i.e.*, the units of heat per gramme. Obviously, as the specific heat of water is unity, a given number of units of heat would raise the products to a temperature obtained by dividing these units of heat by the mean specific heat of the products. The units of heat are measured near 15° C., and the water in the products is liquid; therefore to ascertain the heat evolved at maximum pressure the heat of volatilization of the water must be subtracted from the result to obtain the units of heat for water gaseous.

There are two important sources of error in estimating temperature from the heat evolved. In the first case the products found at 15° C. may be quite different to those existing at the temperature of combustion, *i.e.*, the water and carbon dioxide may be more or less dissociated respectively into hydrogen and oxygen and carbon monoxide and oxygen. This throws a great doubt on the value of the heat units and the calculated temperature, because very little dissociation would reduce the temperature considerably. One must, therefore, bear this in mind, remembering that the calculated temperature is for this reason greater than the real temperature. If dissociation takes place the simple gases unite after maximum temperature, and the curve of pressure on cooling should show this recombination. Such, however, is not the case, and the matter is still doubtful. The point about dissociation, for temperature calculated from the heat units, is the same as for those calculated from pressure: it places these values at the maximum possible. The second source of error arises from the values adopted for the specific heat of the products. Gases free to expand have a specific heat greater than the same gases in enclosed vessels or at constant volume. In the case of explosives, the latter is the rôle. Now the specific heat at constant volume cannot be measured, and has to be estimated from that found at constant pressure, by dividing the latter by the ratio of the specific heats. This ratio can be determined in several ways, the one in general use being from the velocity of sound in the particular gas. Neither the specific heats nor their ratios are constant with the temperature, and it is quite impossible to observe these values at high temperatures. Therefore for the temperatures of combustion of explosives we are entirely dependent on experiments made with explosive mixtures. Over twenty years ago MM. Mallard and Le Chatelier, and also MM. Berthelot and Vieille, investigated this matter independently by firing bombs filled with explosive gaseous mixtures and observing the pressures developed, the heat evolved and the volume and nature of the products. The effect of cooling, on the maximum pressure, was eliminated by experiments in bombs of various capacities, and therefore cooling superficies. The temperature was obtained from the pressure in the same manner as explained for propellants. The mean specific heat was then determined by dividing the heat evolved by this temperature. Varying the explosive gaseous mixture, it was possible to ascertain the specific heat of the usual products of combustion, between temperatures of under 2,000° C. and over 5,000° C. For the so-called perfect gases the method presented few difficulties, but when either water or carbon dioxide was present, then the results became doubtful on account of possible dissociation. Berthelot sought to eliminate these doubts, and gave figures for the maximum and minimum temperatures. There is no need to go into that here, the subject may be restricted to the consideration of the maximum limit only. In using these values for propellants one has to remember that the temperatures calculated are the maximum. It is not merely a working backwards to take the values of specific heats from the experiments with gaseous mixture, because the conditions are entirely different from those which obtain on firing propellants. The gaseous mixtures had a very low density, so much so that the consideration of the co-volume had no effect, and the pressure remained constantly under 0·2 tons. If, then, the specific heats obtained under these conditions give for propellants practically the same temperature as obtained from pressure, then may it not be affirmed that these values are fairly correct, and that dissociation is absent or equally present in both, thus proving, contrary to Noble's statement, that dissociation at constant volume is independent of pressure and a function of temperature only, a result Berthelot obtained from the experiments with gaseous explosive mixtures. The maximum temperatures given by pressure and heat are practically identical, and this establishes the validity of the usual methods for not only gaseous mixtures, but also explosives fired in closed chambers.

Mallard and Le Chatelier obtained linear equations from their own experiments relating specific heat with temperature, whilst Sarrau has developed similar, but different equations from Berthelot and Vieille's experiments. These two different sets of equations have been used to calculate temperatures from the details furnished by Noble in his No. 4 researches. These values, so calculated, are set out in the table below under M. and C. (Mallard and Le Chatelier) and S. B. and V. (Sarrau's, Berthelot and Vieille's papers.*)

Noble's calculated temperatures from the heat evolved are also given in the table. It will be noticed that the latter are much in excess of either of the former. This is due to Noble assuming that the specific heat of all the products but carbon dioxide are the same at near 5,000° C. as at 0° C. In the case of carbon dioxide, he took a value given by Holborn and Austin for 1,400° C., and assumed this was constant up to about 5,000° C. It may be noted that Sarrau's equation gives, within 6 per cent. the same value as Holborn and Austin for 1,400° C., but at 5,000° C. Sarrau's figure is nearly double as much. There is no need to press the anomaly of Noble's selection of specific heats. Probably these would never have been proposed if an error had not been made in the calculation of temperature from pressure.

* The M. & C. equations were given in *Arms and Explosives* of September, 1904. Sarrau's equations are as follow:—For the perfect gases $C = 4{\cdot}8 + 0{\cdot}0010\,t$ and for carbon dioxide and water $C = 6{\cdot}2 + 0{\cdot}0025\,t$, where t = temperature and C = the specific heat at constant volume.

TABLE OF TEMPERATURES.

Propellant.	Density of Loading.	Temperature by Pressure.		Temperature by Heat Evolved.		
		Noble.	W. & C.	S. B. & V.	M. & C.	Noble.
Mark I. Cordite	0·1	3100° C.	2757° C.	2850° C.	2823° C.	4665° C.
	·2	3760	3060	2894	2794	4608
	·3	4435	3251	2927	2785	4665
	·4	4960	3251	3003	2825	4800
	·5	5270	3060	3117	2906	5060
M.D. Cordite	0·1	2565° C.	2318° C.	2472° C.	2472° C.	3770° C.
	·2	3240	2602	2522	2492	3790
	·3	3961	2779	2616	2512	3962
	·4	4551	2924	2786	2621	4290
	·5	5051	2883	2978	2759	4630
Nitrocellulose Rottweil	0·1	2415° C.	2176° C.	2191° C.	2230° C.	3195° C.
	·2	2815	2214	2270	2222	3312
	·3	3335	2394	2394	2362	3520
	·4	3832	2542	2580	2384	3742
	·5	4212	2634	2664	2598	3977
Italian Ballistite	0·1	3060° C.	2771° C.	3010° C.	2850° C.	4889° C.
	·2	3686	3090	3019	2828	4873
	·3	4235	3167	3039	2987	4897
	·4	4655	3221	3071	2927	4955
	·5	4930	3123	3113	2901	5025

Turning to the table, we may ignore Noble's pressure temperatures altogether, and compare the temperatures from the heat evolved with those calculated on Van der Waal's and Clausius' relations. Sarrau's results are very close to the latter; the average difference is less than 4 per cent., and only in six instances is the difference greater than 5 per cent. The Mallard and Le Chatelier results are not so close; the average difference is under 7 per cent., and in two instances the difference goes over 15 per cent. On the other hand, Noble's results all differ by over 42 per cent., and average over 53 per cent. It may be taken as proved that the temperature calculated by the usual methods give a maximum value, and as propellants burn in guns near a density of 0·20 we may say that when fired in guns the temperature of combustion of

Mark I. Cordite	is	less than	3060° C.
M. D.	,,	,,	2600° C.
Rottweil	,,	,,	2215° C.
Ballistite	,,	,,	3100° C.

It may be interesting to note that the writer calculated the temperature of combustion, from the chemical composition of Mark I. Cordite at 2824° C. and M.D. Cordite at 2509° C., when using Mallard and Le Chatelier's specific heats.

·22 CALIBRE CARTRIDGES.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—It was with great interest that I read Mr. C. H. Mann's letter on ·22 cartridges in your December issue, but for the further guidance of your readers I feel that several of Mr. Mann's statements should not be allowed to pass without comment.

In the first instance it is impossible to speak intelligently of rim fire cartridges from a critical point of view without specifying to what make of cartridge the criticism refers. For this reason paragraph 3 of Mr. Mann's letter means nothing, and his attempt to express priming composition in terms of black powder is no more comprehensible.

I might cite a few details of primings to show how considerably they vary in four different makes (a, b, c and d) of ·22 long rifle ammunition.

(a) contained 0·10 grains of priming, (b) 0·12 grains, (c) 0·26 grains, and (d) 0·54 grains. (a) and (b) were loaded with black powder, and (c) and (d) with smokeless powder.

The weight of priming, however, cannot be taken as any criterion of strength, since the details of the composition must first be known, and nothing varies more in ·22 cartridges than the composition of the priming. (a) contained 70 per cent. of fulminate, (b) only 31 per cent., and (d) 73 per cent., and whilst (b) contained 46 per cent. of ground glass (d) contained none.

These few figures will suffice to show how impossible it is to speak in general terms of the power of the priming in rim fire cartridges.

So far as increased velocity due to the priming is concerned, this again is a matter which must be considered individually for each different make of cartridge.

In a cartridge such as (b), probably the best known and most used black powder ·22 long rifle cartridge on the market, the force exerted by the priming is far too small to have any direct influence on the velocity, but indirectly, of course, it plays its part, since regular and certain ignition of the powder charge is imperative to successful shooting. From the very nature of the majority of priming compositions, they are in no way direct velocity producers. Their sole duty in the cartridge is to ignite the powder used well and regularly. As soon as this end is obtained, further increase of priming or strength of priming, instead of adding to the velocity, will do the reverse, aud the powder charge, instead of burning progressively and so exerting its force to the best advantage as a propellant, will become ignited too rapidly, the result being increased pressure with diminished velocity.

A match may light a fire, but it is not of much interest to know how many matches a fire is equal to. In a ·22 or any other cartridge the priming is the match, and so long as it ignites the powder well and regularly, nothing more is expected of it.

If Mr. Mann had asked himself the following question before going to print, I do not think that he would have fallen so easily into his misjudgment of the relation of the power of the priming to that of the charge. If the priming in ·22 calibre rim fire cartridges is equal to 2 grains of black powder, why do most black powder long rifle ·22 cartridges contain a charge of about 4·5 grains instead of twice the amount of priming and only 2·5 grains of gunpowder? If Mr. Mann's suppositions were correct, manufacturers would willingly jump at the idea, and we should be enjoying ·22 cartridges at little more than the cost of percussion caps.

The question of lubrication raised by Mr. Mann in his letter is a point of extreme interest in connection with ·22 ammunition, and a recent article in the *Field* for December 15th on the new K.N. ·22 cartridge seems to point to the fact that a ·22 cartridge has been produced which is capable of maintaining a very high degree of accuracy, although not lubricated in the ordinary sense of the word. I say in the ordinary sense of the word, because powders can be produced

which on combustion yield a certain amount of lubricant, but whether this is the case with the powder in the new K.N. ·22 cartridge I cannot say. To attempt lubrication through the medium of the powder has not up to the present yielded brilliant results, and the maintained accuracy of a ·22 cartridge such as the new K.N. in absence of apparent lubrication might be explained on other lines. It is probably more than a coincidence that with the introduction of the new K.N. ·22 cartridge one reads in your December issue of a solvent principally designed for removing lead or alloys rich in lead from the barrel of a rifle, this solvent being a patent belonging to the makers of the K.N. ·22 Cartridge. I am not a Sherlock Holmes, but I fancy that by putting two and two together I can see here a possible explanation of the maintained accuracy of the K.N. ·22 cartridges, in spite of the apparent absence of lubrication. To suggest that a cartridge with a lead bullet and a priming comprised largely of mercury fulminate may contain all the elements necessary for its lubrication may require some explanation, but an elementary knowledge of chemistry will show it to be at least a possibility.

In the firing of a ·22 cartridge the passage of the bullet down the barrel smears the interior of the barrel with a film of metal, chiefly lead. The bullet is followed up by the products of combustion from the charge and priming, which contain some mercury vapour from the explosion of the mercury fulminate in the priming. Is it not possible that some of this mercury vapour may combine with the film of lead in the barrel and so produce a pasty lead-mercury amalgam which may act as an excellent lubricant?

It is a well-known fact amongst riflemen that in order to get a rifle into good shooting trim, it is necessary to put a few so-called "warmers" through. In the case of the new K.N. ·22 cartridge might not these preliminary shots be more appropriately termed "lubricators"? and I would venture to suggest that the indifferent target obtained by the *Field* in the first group of ten shots, was not due to any fault of the bedding of the rifle in the rest but rather to the condition of the barrel. Once the barrel became sufficiently lubricated, the shooting was constantly accurate.

L. BARTON.

Charlton, Kent, Dec. 20th, 1906.

APPLICATIONS FOR PATENTS.

NOVEMBER 19—DECEMBER 15, 1906.

3,094A. Elevating Gear for Guns. A. T. Dawson and G. T. Buckham. (Date of application under Rule 5, February 8, 1906).
3,094B. Recoil Apparatus for Guns. A. T. Dawson and G. T. Buckham. (Date of application under Rule 5, February 8, 1906).
26,156. Bullet Proof Shields. S. C. N. Macklin.
26,251. Targets. A. Chapman.
26,346. Cartridge Belt. M. Pedersen.
26,373. Slings for Rifles, R. N. Kelsey.
26,386. Firing Mechanism for Ordnance. A. T. Dawson and G. T. Buckham.
26,440. Miniature Rifle Targets. F. Bode.
26,611.* Device for Attaching Revolvers to Walking Sticks. H. Renfors.
26,740. Targets. G. Griffin.
26,749.* Automatic Pistols. A. Martin. (Date of application in France, November 25, 1905).
26,859. Rifle Magazines. J. H. Matthews and J. Mues.
26,903. Drop-down Small Arms. W. Baker.
26,906. Targets. R. A. Rogers and F. Cantelo.
26,924. Rifle Magazine and Attachment. G. MacLeay.
26,939. Elevating and Loading Gear for Guns. A. T. Dawson and G. T. Buckham.
26,948. Loading Derricks for Breech-loading Guns. A. T. Dawson and G. T. Buckham.
26,960. Ordnance Sighting Apparatus. A. T. Dawson and G. T. Buckham.
27,115* Percussion Fuses. C. Puff.
27,131. Air-Guns. L. B. Taylor.
27,200. Rifle Ranges and Targets. E. W. Chant.
27,281. Target Cards. G. W. Green.
27,295. Gun Sights. A. F. Petch and R. Redpath.
27,318. Apparatus for Electrically Firing Mines. K. Schaffler.
27,342. Bullets. G. Hookham and Kynoch, Ltd.
27,366. Sighting Optical Appliance. D. C. Taylor.
27,394. Ordnance Breech Mechanism. C. Holmstrom and E. Middleton.
27,422. Machine Gun Trigger Mechanism. A. G. Bloxam.
27,444. Ordnance Percussion Tubes. H. Hale.
27,538. Rifle Practice Apparatus. F. Mitchell.
27,696. Machine Gun. W. H. Fitz-Gerald.
27,765. Ordnance Percussion Tubes. H. Hale.
27,848. Shrapnel Shell. G. G. M. Hardingham.
27,890. Gun Recoil-Brakes. E. J. Mead.
28,029.* Gun Recoil-Brake. J. A. Deport.
28,053. Explosives. King's Norton Metal Co., Ld., T. A. Bayliss, H. M. Smith and H. W. Brownsdon.
28,188.* Small Arms. R. Hill and J. V. Smith.
28,208. Projectiles. A. Greenwood.
28,273.* Small Arms. R. Hill and J. V. Smith.
28,323.* Ordnance Elevating Gear. Fried. Krupp, A.-G. (Date of application in Germany, March 20, 1906)
28,324.* Ordnance Cartridge Loading. Fried. Krupp, A.-G. (Date of application in Germany, March 10, 1906).
28,391. Gun Carriages. A. T. Dawson and G. T. Buckham.
28,432. Chronographs. H. J. Robinson and Kynoch Ld.
28,501.* Projectiles. J A. Bon. (Date of application in France, March 13, 1906).
28,530. Sighting Instruments. A. König.
28,704. Quick-Firing Guns. A. T. Dawson and G. T. Buckham.
28,706.* Ordnance Firing Mechanism. E. Schneider.
28,717. Range Finders. R. W. J. Johnston.

* These applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

NOVEMBER 22—DECEMBER 20, 1906.

COMPILED BY HENRY TARRANT.

23,533 (1905). **Automatic Rifle Mechanism.** T. R. R. Ashton, London. The mechanism described in this patent is an improved form of that dealt with in specification No. 19,096; 1903. The bolt is re-designed, the gas cylinder is situated below instead of at the side of the barrel, two recoil springs are provided—one each side of the cylinder, and other parts have been modified to improve the mechanism generally. Accepted November 15, 1906.

25,081 (1905). **Solvents for Nitrocellulose.** A. T. Cocking and Kynoch, Ltd., Birmingham. It has been discovered that strips or sheets of nitrocellulose after treatment with ether and alcohol are liable to curl or become distorted on leaving the machine on account of the rapid evaporation of the ether. Certain manufacturing difficulties are also experienced in the gelatinisation of the higher forms of nitrocellulose when either acetone, acetic ether, or amyl acetate are used as solvents. It is proposed by the patentees to overcome both these difficulties by using a mixture of acetone and alcohol—the proportion of the two ingredients being chosen with an eye to the degree of nitration of the nitrocellulose used. Accepted November 1, 1906.

25,208 (1905). **Motor Gun Carriage.** E. B Ludlow, Oundle. A motor gun carriage in which the gun is mounted on the fore-part on two road wheels. The motor is arranged at the rear on a single wheel, and may quickly be turned on a rotatable table to alter the position of the gun. Accepted November 29, 1906.

25,885* (1905). **Drop Down Barrels of Small Arms.** C. F. P. Stendebach, Germany.

25,890 (1905). **Target Apparatus.** H. Phillips, London. The apparatus for miniature ranges described in this patent consists of a tabular framework carrying the targets. A standard at the firing point also carries a wheel operated by a handle and adapted to wind the targets backwards and forwards from the firing point to the end of the range. Accepted November 8th, 1906.

241 (1906). **Rifle as Aiming Tube for Ordnance.** A T. Dawson and G. T. Buckham, London. The barrel and lock of an ordinary service rifle minus bolt cover and sights are combined with an adaptor for holding and centering them in the barrel of a big gun. The firing gear is constructed to enable the rifle to be discharged either electro-magnetically or mechanically. Accepted November 15, 1906.

933 (1906). **Breech Mechanism of Ordnance.** C. Holmstrom, London, and E. Middleton, Sheffield. The mechanism particularly dealt with in this patent consists of a pair of cranks mounted on the swinging carrier of the breech block at a point behind the block. These are adapted to co-operate with flanges or cam grooves on the face of the block for exerting a powerful rearward pull to unseat the obturator after the block has been angularly displaced to unlock it. Accepted November 22, 1906.

2,577 (1906). **Target Apparatus.** W. J. Geary and J. Little, Birmingham. A target is provided with a spring operated plunger, the head of which acts either as a "bull" or is situated just behind the hole representing the "bull." When it is struck by a pellet it actuates a ball which rolls up an incline and strikes a bell. Accepted November 15, 1906.

3,093 (1906). **Firing Mechanism of Ordnance.** A. T. Dawson G. T. Buckham, London. Semi-automatic and quick-firing guns are dealt with in this specification and particularly the firing pin actuated by a cocking arm operated in the manner described in patent No. 9,462, 1904. The recocking device now described comprises a trigger bar cocked automatically or by hand adapted to be moved against the resistance of a spring into a position in which it is held by a sear until the latter is released electromagnetically. Accepted November 29, 1906.

3,217 (1906). **Position Indicator for Shooting Parties.** A. Riley, London. A little device for the pocket is provided with a roller carrying several series of numbers from one to ten. They are intended to represent the position of the shooters of a party at each drive. When one drive is finished another series of numbers is turned round and the shooters are re-arranged accordingly. Accepted November 15, 1906.

5,495 (1906). **A Military Air Rifle.** L. Taylor and L. B. Taylor, Birmingham. An air rifle of the well-known type manufactured by the B S.A. Co., Ld. is illustrated as made up to the same weight and balance as an actual service rifle. A service stock, a dummy bolt handle and magazine, and the sights of the short L.-E. rifle are attached to make the air rifle as nearly as possible resemble the service rifle. The trigger mechanism and the cylinder of the air rifle have had to be modified to allow of this construction. Accepted November 1, 1906.

6581* (1906). **Nitroglycerine Manufacture.** Lieut-Col. F. L. Nathan, R.A., J. M. Thomson, W. Rintoul and A. Scott.

6,705* (1906). **Detonating Composition.** W. Venier, Austria.

7,954 (1906). **Liners of Ordnance.** Colonel H. C. L. Holden, F.R.S., Woolwich. Apparatus worked hydraulically is adapted to insert or withdraw the liners from the barrels of ordnance. The hydraulic device bears against either the breech or the muzzle of the gun according to the direction the liner is to be moved, and a long piston is adapted to carry the liner towards the hydraulic apparatus. Accepted November 1, 1906.

8,246 (1906). **Loading Plug of Fixed Barrel Air Rifles** The Birmingham Small Arms Co., Ld, A. H. M. Driver and G. Norman, Birmingham. The rotatory loading plug of the B.S.A. air rifle is modified so that a spring takes up any wear and preserves an air-tight fit of the plug in its socket. A plate screwed to the side of the body serves as an abutment for the spring. Other modifications are described. Accepted November 22, 1906.

11,007 (1906). **Machine Gun.** A. Christophe and P. Menteyne, France. The machine gun described in this patent has specially designed magazine apparatus, and close attention has been paid to the prevention of discharge until breech block is safely locked. The mechanism is of novel character and is worked by the recoil in the usual way. Accepted November 22, 1906.

11,340 (1906). **Armour Piercing Projectile.** The Marquis Roberto Imperiali, Italy. An armour piercing shell is adapted to contain another shell which carries the explosive charge and the detonating fuse at its nose. The inner shell is inserted only when the projectile is to be discharged and the impact crushes the soft metal nose of the charge carrying portion and ignites the fuse. Accepted November 8, 1906.

13,203 (1906). **Target and Bullet Catcher.** W. Baker, Reading. A square metal box is padded at the back so that pellets entering through the front which is covered by a target may be collected and used again. The pellets drop into a tray at the bottom. Accepted November 8, 1906.

13,570 (1906) **Automatic Pistol Mechanism.** W. J. Whiting, Birmingham. This automatic recoil operated pistol is that which Webley and Scott are manufacturing. The pistol and its novel features are fully described and illustrated in the specification. Accepted October 25, 1906.

14,327 (1906). **Automatic Pistols.** Sociéta Siderurgica, Glisenti, Italy. Automatic pistol mechanism in which the barrel and breech are temporarily locked together during recoil by a block pivoted in the butt. The continued backward movement turns the block over and unlocks barrel and breech. The trigger arrangement will not allow of the trigger being pulled until the breech is safely "home." Accepted November 8, 1906.

14,434 (1906). **Ordnance with Recoiling Barrels.** Rheinische Metallwaaren und Maschinenfabrik, Germany To prevent guns with recoiling barrels from sinking into soft ground, and from shifting in a longitudinal direction and to "brake" the wheels, a "foundation" is provided consisting of a plate so connected with the axle tree of the mount that it can be firmly pressed against the wheels. Accepted November 8, 1906.

14,635 (1906). **"Progressive" Combustion Cartridge.** A. W. Schwarloze, Germany. In order to provide for the complete combustion of a powder charge in a cartridge, a progressive effect is obtained by separating layers of the powder by discs of wire gauze. Not until the gauze is brought to a state of incandescence is the flame from one layer allowed to penetrate to the next. Accepted November 1, 1906.

15,216 (1906). **Breech Fastening of Drop-down Guns.** B. Behr, Germany. The sides of the barrel or barrels of a sporting gun are provided with undercut projections adapted to grip into undercut grooves inside cheeks carried by the action. The "trunnion" on which the barrels hinge work in a slot as the undercut fastenings take the form of an arc of a circle and are eccentric to this pivot. Accepted November 8, 1906.

17,060 (1906). **Shrapnel Shells.** Fried. Krupp, A-G., Germany. A shrapnel is provided with a separate charge and a percussion fuse in the bottom of the projectile. A time fuse is provided in the nose of the projectile so that the shell may be made to act as a shrapnel or to explode on impact. Accepted November 8, 1906.

17,414 (1906). **Ammonium Nitrate Explosives.** B. G. Reschke, Germany. In a former patent, No. 12,716, 1906, the inventor covered the use of fennel alone or in conjunction with wood-meal in the manufacture of ammonium nitrate explosives. Extended experiments have proved to him that the seeds of most other specimens of the umbelliferous plants such as anise, carraway, coriander, parsley, etc., can be used with the same effects as fennel. Several examples of an explosive combining these in their constitution are set out in the patent. Accepted November 22, 1906.

18,222 (1906). **Breech Mechanism of Ordnance.** Fried. Krupp, A-G., Germany. Horizontal wedge breech mechanism for ordnance provided with a thrust lever and apparatus for discharging the gun by means of a trigger arranged upon the breech end of the gun is described in this patent. Accepted November 1, 1906.

20,126 (1906) **Fore-End Band for Rifles.** T. C. Johnson, U.S.A. To allow for the expansion or contraction of the fore-end of a rifle the nose cap may be adjusted by a screw ring working on a thread on the barrel. The screw ring is held in position by a spring plunger, the round head of which fits into recesses in the face of the ring. Accepted November 8, 1906.

20,531 (1906). **Hand-Guard for Gun Barrels.** W. S. Alves, U.S.A. A hand-guard for the barrels of sporting guns is designed to fill the hand of the shooter, besides protecting it from heat, when grasping the gun at the shoulder. The guard is provided also with a spring clip to secure it to the fore-end of the gun. Accepted November 15, 1906.

19,157 (1906). **Locomotive Torpedoes.** —. Cooke. The vessel adapted to contain the compressed air or gas in torpedoes is usually cyclindrical with rounded ends. To increase the tensile strength for a given pressure the patentee makes this vessel spherical instead of cylindrical. Accepted November 29, 1906.

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

SELECTED PATENTS.

MANUFACTURE OF NITROGLYCERINE.

6,581 (1906). Lieut.-Col. F. L. Nathan, R.A., J. M. Thomson, W. Rintoul and A. Scott, Waltham Abbey. It has been the custom to manufacture nitroglycerine by adding glycerine to a mixture of nitric and sulphuric acids. The nitric acid in the mixture is what is known as fuming nitric acid and the sulphuric acid contains about 96 % of H_2SO_4. By this method it is possible to obtain a yield in ordinary apparatus of about 210 – 215 parts of nitroglycerine to every 100 parts of glycerine used.

The patentees modify the manufacture to obtain an increased yield of nitroglycerine. The amount of mixed acids necessary is decreased and a plant of reduced capacity for a given weight of nitroglycerine can be used by the new method. The quantity of waste acids requiring dinitration and concentration is decreased involving less loss of nitroglycerine in the waste acids. The cost of finished nitroglycerine is reduced.

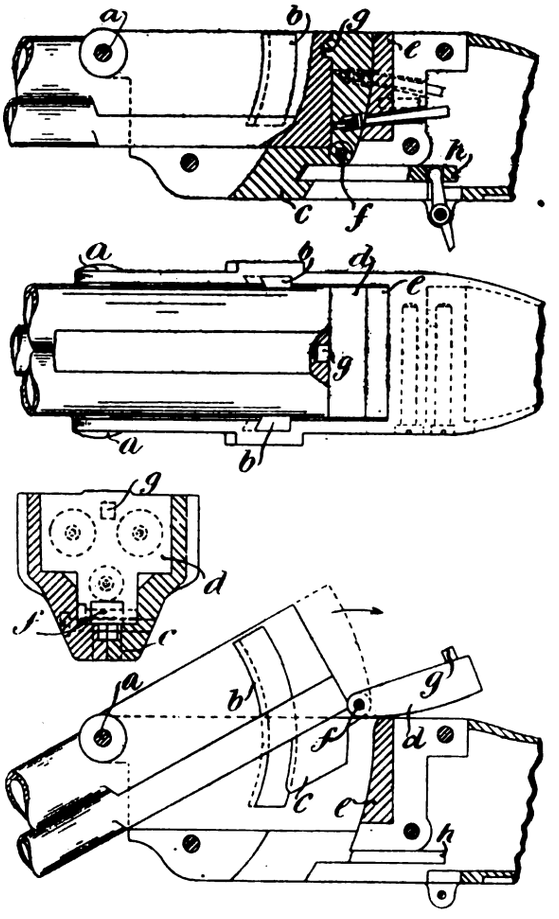
The method consists in nitrating the glycerine in a mixture of hordhausen acid and fuming nitric acid, the proportion of nitric acid to sulphuric acid being greatly increased compared with the proportion in ordinary use. The resulting acids are approximately the same as usual. Ten parts by weight of glycerine are gradually run into a mixture of acids containing 28 parts by weight of nitric acid (of which 91·5 % is HNO_3) and 34 parts by weight of hordhausen sulphuric acid (containing about 20 % of SO_3). The nitroglycerine formed is separated from the waste acid in the usual manner, the yield being 230 % of the glycerine used. As temperature and physical considerations rule, other proportions than 20 % of hordhausen acid may be used. Accepted November 29, 1906.

BARRELS OF DROP-DOWN GUNS.

25,885 (1905). C. F. P. Stendebach, Germany. The arrangement described in this specification of the barrels in break down guns is designed to offer as much resistance as possible to the two different directions of strain which the pressure of the powder gases is stated to set up. The one tends to draw the barrel away from the breech and the other to cause the barrel to drop, whilst in the case of double-barrelled guns the discharged barrel has a tendency to turn sideways. To prevent these movements the joint pin or the pivot on which the barrels work when opening or closing the gun has been placed in the axis of the bore and dovetail ribs concentric with this pivot have been made to engage with grooves in the breech frame. Even this arrangement is said to be attended by certain disadvantages and the patentee proposes therefore to set the pivot of the barrel above the axis of the bore as is illustrated in the drawing reproduced.

The pivot *a* is situated above the axis of the bore and the ribs *b* are arranged upon the sides of the barrels and are intended chiefly to carry the pull of the barrels when the gun is discharged. The lump *c* is constructed to move concentrically to the pivot *a* and to have a hook-like hold in the breech body when the gun is closed.

To lock the cartridges within the chambers the "lock piece" *d* is adapted to fit tight against a locking body face *e*. The piece *d* is pivoted to the barrels at *f* and its back surface forms an arc of a circle struck from the joint pin *a*. To relieve the hinge the projections *g* engage recesses in the faces of the barrel walls. The barrels are locked on the closed position by a bolt such as *h* which engages a recess in the lump *c*.



In a modified arrangement described in the patent, the "lock piece" is not pivoted to the barrels. It is held in the action by a pin and slot connection, and is moved upwards when the gun is broken down. In another construction of a three-barrelled gun the joint pin is situated between the two top shot barrels and the bottom rifle barrel. Accepted November 22, 1906.

DETONATING COMPOSITION.

6,705 (1906). W. Venier, Austria. A new explosive composition is dealt with in this specification. It consists of chlorate of potash, a mercuric compound prepared in a special manner, and sulphur, and is of especial use in the preparation of primers. The mercurial compound is prepared by passing acetylene gas (C_2H_2) through an ammoniacal solution of a suitable mercuric salt, such as nitrate of mercury ($Hg(NO_3)_2$). A white compound is produced by this preparation and it is said to be much more explosive than fulminate of mercury. Two parts of this compound are mixed with four parts of chlorate of potash, and one part of sulphur. The explosive so formed may be exploded by a very weak electric current, and is safe to handle. Accepted November 15, 1906.

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CONTENTS.

CURRENT TOPICS.

The New Express Calibres.—A very short time has sufficed to justify in some measure the belief which was expressed in this column to the effect that the new Indian Arms Act order might prove a blessing in disguise. As a set-off against the trouble and inconvenience which undoubtedly arose from the wastage of much valuable stock in trade hands is the corresponding need for sportsmen to admit that their old and well-tried ·450 rifles have been rendered obsolete as regards use in India. Whatever may be the losses which the trade have incurred those losses are to some extent covered by the boom in novel calibres which has undoubtedly begun. A careful examination of conditions has already convinced certain gunmakers that the new ·465, ·470 or ·475 rifle can be made a better all-round sporting weapon than the ·450 whose place it takes. A larger space for powder, a greater area of bullet base, and the opportunity to develop relatively light bullets with enhanced velocity, all favour the opening up of new conceptions and specifications. Why the high-power express rifle should for so long have been dominated by the military density of bullet is difficult to see. Mr. Purdey in years gone by departed from the ·450 military and substituted an "express train" bullet of less weight propelled at an enhanced velocity. History has been long in repeating itself, but there can at last be no reason to doubt that coincidently with the nominal enlargement of the ·450 calibre there will be a very real lightening of the bullet and enhancement of velocity. The deerstalker cannot afford to use a rifle firing with ·303 trajectories when the flatness of the Mannlicher is available. The full weight bullets with enhanced velocity have an excess of power which produces various inconveniences in recoil and elsewhere. But with lessened weight of bullet, and an increased velocity giving over-compensation as regards trajectory, it may prove possible to combine properties hitherto regarded as essentially separate and distinct. However, the introduction of new calibres must not be too closely associated with the improvements which are possible in all bores as regards bringing the bullet weight into closer relation than at present with the work it is called on to perform. The enlarged ·450's nevertheless pave the way for increasing bore without adding proportionately to weight.

The Service Rifle Cartridge.—The prolonged delay in turning to account the improved conditions presented by M.D.S. cordite can only be attributed to the disability which was so clearly emphasized in these columns when it made its first appearance. Strip cordite of the new composition is hard and unyielding. It cannot, therefore, be accurately measured into charges by the operation of a knife which severs a predetermined length. Its ballistic and other advantages are thereby put out of reach until the question of its granulation into leaflets has been settled. New machinery for loading and manufacture will be necessitated by the change, and so radical an alteration of existing methods will be delayed until other items of the service cartridge have been settled. International competition in small arms equipment makes a high velocity light weight bullet an immediate need. The interior ballistics of the gun and cartridge can easily be settled, but the greater problem has still to be faced. Flat trajectory is not necessarily assured until the factor of air resistance has been settled for each bullet. Supposing this element is found to fit in with the conditions aimed at, the

flat trajectory only gives relatively accurate results as regards mean elevation. Dispersion then becomes the most urgent problem of all. Scientific rules do not exist for settling the best size, weight and balance of bullet to give a small ratio of dispersion around the mean trajectory. Experiments covering a large number of constructions can only settle such a point. Even then the result is only final as regards the particular rifle used. The short Lee-Enfield exists in large quantities; and it is not in the slightest degree certain that a length of barrel which was conceived under wrong beliefs will do justice to a cartridge which may only prove satisfactory given a certain measure of assistance in respect to the design of the rifle from which it is fired.

The Neglected 20-Bore.—Evidence is always cropping up which tends to show that the 12-bore gun may not for ever enjoy the precedence which makes it the most popular calibre for game guns. Those who cultivate alertness with regard to future developments must naturally have examined 20-bores from the point of view of endeavouring to ascertain whether modern improvements in nitro powders have brought small-bore guns nearer to conditions of level competition with the 12-bore than before. The practical man's answer must be substantially that all recent improvements have been directed towards enhancing the efficiency of the full size cartridge, and that the smaller bore has only been incidentally improved by the crumbs falling from the master's table. From the ballistic standpoint, therefore, the relative aspect of the two sizes of cartridge has remained unaltered. Yet on the other hand a quiet change has been taking place which alters the balance formerly existing between the two cartridges. Handiness of balance in the gun is more closely studied than ever before, weight has been diminished, and the quantity of shot put into the 12-bore has been reduced and reduced until for the moment bottom level has been reached. Any further attempt at diminution seems likely to demand a coincident change in the bore of gun used. Whether the 16 or 20 will be the size chosen for the next stage of development is as yet uncertain; but no one has made it publicly clear what can be done with the 20-bore by way of a perfectly balanced arm, nor as regards shooting properties what are the most favourable conditions of pattern to aim for. Certain it is that the conditions which have made the one ounce charge of shot a full-grown man's load, justify progression towards the 7-8ths oz. charge and the still lower one of ¾ oz., which is the ideal for light recoil in a 20-bore.

Our Lecture on Velocity Tests.—The current month's lecture to young gunmakers presents a curious blending of abstract suppositions with hard facts. Taking the now widely adopted test of shot cartridge velocity by the breaking of wires at a 20 yards range a brief and obvious test shows that each pellet constituting the charge has one chance in 60 of coming into contact either with a wire or where a wire has been. A further analysis of chances shows that the average of a series of records is likely to display the characteristic velocity of the 60th pellet, this falling within the cluster which represents a fair measure of the efficiency of the whole charge. Other practical deductions have been drawn from the accepted conditions of the test. To the practical man the problems put forward indicate several possibilities for improving the test. The present basis of working comprises a total of five wires placed four inches apart, the area so covered being capable of allowing a large margin for variation in the alignment of the gun. Now supposing that the proof guns ordinarily used can be much more accurately laid than the spacing of the wires suggests then it might be possible to concentrate the five wires into an 8-inch band giving a separation between wire and wire of two inches. By thus bringing the whole of the wires into the centre of the charge a greater probability of hitting would be introduced, and it might conceivably happen that while the general standard of the readings obtained would not be unduly elevated so as to influence accepted standards of behaviour the number of low readings from back pellets might be reduced, thereby eliminating what appear anomalous results in the absence of the true explanation. The one and only aim of the velocity test is to gain a practical appreciation of the efficiency of the gun or cartridge under examination. Consistency from round to round is of ever increasing importance now that a degree of harmony between recoil and velocity is looked for, beyond what existed in the ante-pendulum gun period. To know for certain that the variations shown from round to round in a series of velocity tests are materially greater than really exist in respect to the behaviour of the charge as a whole points towards the development of an improved distribution of the wires comprising the screen. The sound wave has abolished the swinging plate, and in any case the movement of a body having mass introduces bad conditions, but there is no reason why the wire system should not be further developed, so long as the relative velocity of the front and back pellets of a charge of shot is not a constantly changing factor liable to falsify the conclusions derived from the tests made.

The New Master-General of Ordnance.—By the transference of General Hadden to the highest post it is possible for him to fill, contractors have lost a good friend. The more one reads about War Office red tape the more difficult it is to harmonise these slurs with the personality of such men as the gallant General. No time is ever wasted in convincing him that business matters are urgent. He is, in fact, a man with a singular ability for dealing out prompt and business-like decisions. Whatever the nature of the difficulty, and no matter how it may be hedged around with apparent complications, to gain access to General Hadden has always been synonymous with getting it settled. His face undoubtedly reflects the idea of a mind singularly free from worries and distractions. He tackles a problem with the same directness with which he views his visitor, and the only anomaly which his personality presents is the youthfulness of his demeanour, and the fact that he has risen so high in the service whilst showing no signs of wear. To say so much is to risk the charge of applying undue adulation to one whose success in admistration depends on the co-working of many master minds; but it is impossible to resist the charm of a strong personality, and however the credit for the achievements of General Hadden's department may be allocated, of one thing there is no doubt, that he is a chief of the highest order, and one whose departure can only be excused on the grounds that there is higher work for him to do in another direction. As Master-General of Ordnance he becomes fourth military member of the Army Council, and as such is brought into direct contact with the most vital problems of national defence.

COLLIERY EXPLOSIVES.

THE issue of a new Order under the Coal Mines Regulation Act, 1896, dated the 17th December last, marks a further advance in the steps which have been taken by the Home Office to secure an ever increasing measure of safety for workers in coal mines. The new Order, which comes into force on the 1st of March next is a codification of all previous orders, and does not include any strikingly new matter except as regards the employment of safety fuse and igniters as distinguished from electric firing apparatus. A strong wish was expressed by various colliery proprietors to be allowed to continue the use of fuse in dangerous mines, subject to such restrictions and prohibitions as would make their use safe in such circumstances. A schedule of the tests and conditions with which such fuse must comply was issued in May last in the form of a memorandum. In spite of the apparent severity of the conditions laid down, Messrs. Bickford Smith & Co., Ld., have been successful in getting an igniter fuse on to the "permitted igniter fuse" list. It consists of a length of fuse, with the igniter permanently attached thereto by a cemented joint. The combined arrangement has shown itself capable of satisfying severe tests as regards incombustibility of the wrapping and inability to ignite a gas mixture. It accordingly appears in the Second Schedule as *Bickford's Igniter Fuse*, and a very ample specification ensures a strict adherence to the system of construction which enabled the fuse to pass the tests laid down. The enterprise which has enabled Messrs. Bickford to submit the only fuse and igniter which has so far achieved the distinction of being permitted is worthy of high commendation. The only difficulty which for the moment besets the path of its wide commercial use is concerned with the classification under which it may fall in the list of explosives. Safety fuse falls within Class VI., Division I., and has all the privileges which are accorded to "safety cartridges" for instance. The addition of the igniter introduces conditions governing transport which hardly seem appropriate for a box of material not obviously liable to explode *en masse*. Safety cartridges contain their own means of ignition, but are not liable to explode in bulk, and it may well happen that tests will demonstrate the same in regard to igniter fuses, and thereby make out a case for modifying the present classification. As regards the explosives themselves the new Order gives no indication of the present trend of view in the Home Office. The intention is to superpose the German test on that conducted at Woolwich, and not to allow any explosives to be used in dangerous coal mines unless they pass both tests. The prohibition will not be absolute in that those which have passed the Woolwich test only will still be eligible for use in coal getting, but not for the more dangerous work of brushing. Even then this qualified permission will only apply to mines naturally wet throughout, or artificially watered so as to be secure from the risk of a widespread explosion throughout the mine. The obvious policy of H.M. Inspectors of Explosives is to raise the standard of security year by year, at no time asking impossibilities of the manufacturer but always stimulating him to devise explosives which will minimise risk even though they can never hope to attain the ideal of complete immunity from danger. The present instalment of reform is justified by past experience.

WAR OFFICE PATENTS.

The muteness which has followed another incident in War Office adminstration, whilst showing a praiseworthy desire to avoid unhelpful newspaper comment, demonstrates none the less clearly that the system which governs War Office patents is bad for everybody. A technical committee is formed for the curiously related duties of examining ideas submitted from outside and hatching novelties from within. Individuals cannot be attacked when acting within the four corners of specifically sanctioned regulations. This much may, however, be said, viz., that for a body composed individually of gentlemen of the highest personal honour, the War Office do things which in the abstract do not seem right. Invention consists in a happy combination, usually of well known ideas, to produce a new result and so give embodiment to something which comprises as a whole a patentable novelty. When a new need arises manufacturers are invited to submit rival plans for carrying out a skeleton specification. In submitting their plans they must disclose what is, and what is not, patented. By a process of judicious selection the War Office arrive at a concrete device or combination. With the knowledge which becomes theirs they can usually take a clearer survey of the problem to be solved than any individual contributor of ideas. Oftentimes the greatest merit exists in an unpatented item amongst the competing plans submitted. This is selected. Where honours are easy between the patented and the unpatented, the former is chosen. In the rare instances where the protected idea is the only one practicable it stands a chance of adoption. The employee may feel sore if his prospects of a bonus, towards which he has laboured unceasingly, evaporate in thin air; but the contractor adopts the philosophical attitude, that he lives by manufacture rather than by invention. Up to this point the War Office principle is so well known that the individual who feels surprised at the treatment he receives must be ruled out of court as an innocent with his wisdom teeth still to cut. But the wound cuts deep into the flesh when it is realized that there are inventors and inventors. The judicial function of deciding on the merits of another's ideas cannot be harmonized with an attitude of direct competition with the person whose claims are under consideration. Whether the judicial person be aiming at evading the patents submitted for adoption by achieving the now clearly defined purpose by an unpatented process, or whether he aims at taking out a private patent, the result is the same, professional etiquette has been infringed and a sense of grievance has been created. It is destructive of the highest conceptions of administration that individuals working on War Office pay should acquire vested rights in the ideas they make their own. Too much of their knowledge is acquired by the privileged conditions under which they work, and the only patentee of War Office inventions should be the Secretary of State himself. The bonus of money or money's worth should be abolished in respect to all who act in a judicial capacity, and the examination of outside inventions should be conducted on the elementary basis of giving reward where reward has been earned. On the lowest grounds of self interest the fair policy should pay. The War Office is the trustee of the nation's security, and that security will be forwarded by cultivating cordial relations with those who are in a position to submit valuable ideas and suggestions

THE SINGLE-TRIGGER LITIGATION.

THE hearing of the action Robertson *v.* Purdey was resumed on January 17th before Mr. Justice Parker in the Chancery Division of the High Court of Justice. On January 23rd and January 24th counsel for the plaintiff addressed his Lordship. Judgment was reserved.

Mr. T. Terrell, K.C., and Mr. Courtney Terrell appeared for the plaintiff, and Mr. A. J. Walter, K.C., and Mr. Gray for the defendants.

In this action the plaintiff, Mr. John Robertson (Boss & Co.), sought an injunction restraining defendants, Messrs. James Purdey & Sons, from infringing a patent of 1894 granted to plaintiff for an invention relating to single trigger guns. Defendants denied infringment and pleaded that plaintiff's patent was invalid by reason of anticipation. The hearing, extending from December 15th to December 21st, was reported in these columns last month.

At the resumed hearing on January 17th rebutting evidence was called on behalf of the plaintiff respecting certain guns alleged to have been made in or about 1883 which witnesses had stated were fitted by Mr. W. Baker with single-trigger mechanism of the three-pull type.

Mr. A. F. Randall gave evidence concerning an article which had appeared in the *Shooting Times* of December 19th, 1893. In it was described a single-trigger gun made by Mr. W. P. Jones, of Birmingham. Witness said he did not understand this to be a three-pull gun. In the year 1900 witness had seen in the shop of Carr Bros., Huddersfield, a single-trigger gun. It was in a defective condition and only one hammer would go down. Cross-examined: He could not positively identify the gun produced as the Carr gun.

Mr. Dudley Wilson said he was the writer of an article appearing in *Land and Water* on August 17th. 1893, describing a single-trigger made by Mr. Jones. He was sure the gun was not of three-pull type. Cross-examined, he adhered to this opinion.

Mr. W. R. Leeson, of Ashford, said he had received from Mr. T. W. Webley a letter dated February 7th, 1883, and with it a single-trigger hammerless gun for trial, The gun was accurately described by Mr. Webley. It was a three-pull. He had in due course sent to Mr. Webley a report of the trial. The report was not favourable. The gun worked best with heavy charges, and it worked as a three-pull when it worked at all.

This concluded the rebutting evidence, and Mr. A. J. Walter, K.C., addressed the Court on behalf of the defendants. In a speech of considerable length he summarised the evidence given, and dealt with the points raised. Anticipation by the Baker guns was, he said, admitted, and the only question to be dealt with was that of sufficiency of publication. There had been four guns fitted with the Baker mechanism of 1882, and three of the four were accounted for. He contended that the "Webley," the "Carr," and the "Jones" guns were all fully published anticipations. He came then to the alleged anticipations by the Purdey guns made under the Nobbs patent of 1894. Here again there had been a suggestion that the anticipating mechanisms were not of the three-pull type. That contention had broken down. The fact that they were three-pull guns was no longer in dispute. A question of prior grant (the patent of Nobbs predating the patent of Robertson) arose in this case. It had been sought to show that in the patent of Nobbs disconformity and insufficiency of description existed, but this suggestion had been disproved. In concluding his speech Mr. Walter asked his Lordship to state that the plaintiff's invention had been anticipated both by Baker and by Nobbs; that in the Nobbs specification there was neither insufficiency nor disconformity; that to Nobbs a prior grant had been made by the Crown; that there had been no infringment by Messrs. Purdey & Sons; and that the defendants succeeded on all the issues raised.

On January 23rd, Mr. T. Terrell, K.C., on behalf of the plaintiff, dealt with the alleged anticipation by the Baker single-trigger mechanisms, devoting to this question the whole day. Baker was said to have made his three-pull mechanisms in 1883, eleven years before Robertson's invention was patented. There were only three or four of these guns and not one of them had been successful. Leeson's report showed the Webley gun was defective. There was evidence that the Carr gun was returned because it did not work properly, and Jones said that he had had to have his gun fitted with a new trigger plate because he could not get off the second barrel. All the guns failed, and they all failed for the same reason. If the Jones gun and the Carr gun, as they existed to-day, were as they were in 1883 anticipation must be admitted But anticipation must be proved up to the hilt. Counsel cited a large number of cases on the question. The evidence of anticipation rested on Mr. Jones and Mr. Baker. Mr. Baker had said that in all the guns the mechanism was exactly the same, and Mr. Leeson's report, in 1883, showed the first of them to be defective. It followed that all were defective for they were all the same. His Lordship must be convinced absolutely and beyond all shadow of doubt of the character of these mechanisms. If any element of doubt existed, it was not necessary to reject the evidence, but on that issue the case for the defendants should be regarded as non-proven. Counsel contended that the Baker mechanisms had never had the capacity for a commercial success, and that they could not invalidate the patent of Robertson. The sales of guns containing the Baker mechanism were not public sales in the course of commerce, and there was no evidence of public user. He submitted in conclusion that the Baker guns had been abandoned, that of them there had been no sufficient publication and that the evidence given was insufficient to establish the plea of anticipation. For these and other reasons dealt with in detail, he should ask his Lordship to regard the alleged anticipation by guns containing the three-pull mechanism of 1883 as non-proven, and to hold that it did not invalidate the Robertson patent of 1894 which concerned a thoroughly successful mechanism of considerable monetary value.

On January 24th Mr. Terrell dealt with the alleged anticipation of Nobbs. The specification of Nobbs, No. 13,130 of 1894, was earlier in date than the specification of Robertson of the same year. At that time two-pull single-trigger guns were well-known, and Nobbs purported to have discovered something on a different principle. In his provisional specification there was not one word to show what that new principle was. Mr. Purdey's letter to his patent agents

disclosed that it was in fact a three-pull, but it was by the provisional that the invention must be identified, and counsel submitted that that condition had not been fulfilled. It transpired in evidence that Mr. Newton, who drew up the specification, was blind. Here he thought was to be found the explanation of the errors of description. There were such errors also in the complete, although the complete contained one undoubted reference to three-pulls. Apparently Mr. Newton had believed that the mechanism worked on the involuntary release, whereas it actually did work on the involuntary pull. On the construction of the patent counsel contended that the provisional and the complete were alike insufficient. He cited and considered at length cases bearing on these points. Another question, apart from that of the validity of the Nobbs' patent, was the allegation of prior user by Purdey guns made with the three-pull mechanism of Nobbs. That mechanism undeniably existed before the date of the Robertson patent, but nothing in the user of it amounted to publication. He submitted in conclusion that there had been no sufficient publication of the Baker three-pull mechanism of 1882, no prior user in public of Nobbs' mechanism of 1894, and no prior grant to Nobbs. If on these points he had satisfied his Lordship, the case for the plaintiff had been made out.

His Lordship reserved judgment.

MR. J. T. PEDDIE.

No apology is needed for introducing to our readers the personality of Mr. J. Taylor Peddie, whose entry to the gun trade brings to an industry none too well provided with young recruits a man of undoubted capacity and energy. Like so many of our alertest men Mr. Peddie is a famed rifle shot, and he holds views on the relation of rifle shooting to business enterprise which though in a measure original carry conviction to the mind when properly stated. He maintains that the faculties which make a good shot, and enable him to triumph over his fellow competitors comprise before everything else the quality of keen perception, and that whilst this trend of mind must be present in the embryo marksman, nothing develops it quicker and gives it a higher form than a course of competitive target practice. At any rate, Mr. Peddie has already many solid achievements to his credit. He organized the team of Canadians which first captured the Palma trophy from the Americans. He shot for Scotland in 1905 and last year in the International and Mackinnon teams, was ninth in the King's Hundred in 1904, seventh in 1906, and is the winner of endless badges and trophies signifying his high merit as a rifle shot. Coming to more technical achievements he is the inventor of the Peddie windgauge military rifle sight, and though etiquette forbids giving him credit for the design ultimately adopted for service, it is at least certain that he did a lot to educate the official mind to appreciate the need for such a refinement, even though he received no direct acknowledgement of his services. In a similar fashion there can be no doubt that the sudden conversion of the powers that be to the idea of a cadet rifle was largely owing to his convincing arguments. The weights and measurements contained in the specification to which the War Office Miniature Rifle is now manufactured were taken from the models Mr. Peddie submitted to the National Rifle Association. That the War Office took an interest in his plans was evidenced by the fact that before anyone knew that Sparkbrook was for sale Mr. Peddie had concluded arrrangements for its purchase. Though the money market was not ready to finance the large scheme he put forward, the stir his plans had made placed him in a position to negotiate favourable terms with the B.S.A. Company, who took over his option, and created a mild sensation by immediately executing the deed of purchase. Mr. Peddie was, himself, one of the assets taken over in the deal; and it

was not surprising to find that the active development of an arms business in addition to Government work soon produced a niche suited to Mr. Peddie's qualifications. No chief of industry better knows than Mr. Kirkby, how to delegate work whilst maintaining close touch and sympathy with all that goes on. Mr. Peddie's sphere of activity comprises all that concerns the management of the commercial side of the gun and rifle departments of the B.S.A. Company. This brings our story up to date: we shall watch with sympathy and interest the efforts which Mr. Peddie can be relied upon to make in the direction of strengthening the British gun trade in its weakest spot. Machine made arms are a legitimate aspect of gunmaking, but in spite of the competence of our mechanicians the world's trade is not catered for in Birmingham's workshops. The obstacles which have so far hindered the development of proprietary lines can doubtless be overcome, and even though the new trade must be sought in other channels than those falling within the scope of ordinary gunmaking, a rifle is a gun and it is real gunmaking to turn out rifles by machine processes.

ROUND THE TRADE.

Sir Andrew Noble has been reviewing for the benefit of the members of the Royal Society his experiences with explosives during the past 50 years.

Press references to an army order curtailing the repairs to be done on rifles in possession of the volunteers is held to be the forerunner of an issue of the new short rifle. The *Standard* says the military authorities are quite unanimous concerning the qualities of the new weapon. This is quite true: they are.

Mr. Perry F. Nursey has laid down in a letter to the *Morning Post* that "explosive force always makes its escape through the line of least resistance." His statement might perhaps have been less open to criticism had he taken into account the circumstance that the gases are frequently in such a hurry to find a vent that a way is oftentimes made along the line of greatest resistance. Time is the essence of this problem.

The latest *Kynoch Journal* contains many good things, notably a courteous and perfectly fair reply to our criticism of the arguments which had been used in recommendation of the new K.S.G. powder. Another article deals with the celebrated Woolwich curve denoting the growth of velocity of the service bullet along the barrel. What with soap, metrics, gun terminology and mathematical gymnastics, the number is well worth reading.

The new War Office buildings are now in full occupation, and the various documents necessary for the transaction of business have been sorted and re-arranged since the removal. The department which is of main interest to the trade has been located on the ground floor at the back of the building near the corner which is overlooked by the National Liberal Club. The most speedy means of entrance and exit is by the back door, so to speak, immediately behind the Whitehall frontage.

The Teignmouth magistrates recently had brought before them the case of Ernest Finch, a local ironmonger, who had sold a revolver and cartridges to a lad named Barge without complying with the obligations laid down under the Pistols Act, 1903. The clerk to the magistrates, in response to the defendant's plea of ignorance, expressed surprise that all sellers of firearms did not receive information from some society as to what new Acts are passed. The defendant was not fined, but he had to pay 15s. costs.

At an executive meeting of the Birmingham and Provincial Gunmakers' Association held on the 10th ult., Mr. F. C. Scott, of 80-81, Bath Street, Birmingham, was appointed a member of the executive committee, and he also undertook the duties of honorary secretary in succession to Mr. R. J. Petersen, who recently resigned. Mr. F. C. Scott is the son of Mr. J. C. Scott, a very active committeeman of the association. A hearty vote of thanks was accorded to the retiring secretary in acknowledgment of past services.

The *Financial News* had an article on the 4th ult. dealing with the first report and balance-sheet of the Explosives and Chemical Products Company, which had been capitalized in France to take over the explosives works at Great Oakley. It seems that the total cash received by the Company in respect to the shares issued was £7,917. Office expenses, fees, salaries, etc., had absorbed £3,066, development work at Great Oakley, £1,637, preliminary expenses, £914. The accounts do not make it clear that any trading profit has been realized.

According to the *Daily Mail*, Mr. Austin, besides his other invention, has brought from Australia a military rifle sight which he hopes through the influence of Lord Roberts and Lord Methuen to get introduced throughout the British army. One of the chief recommendations of the new sight is that it makes an audible click every time a point of adjustment is put on or taken off. Somehow the notion seems to possess familiar features. The use of Lord Roberts' name is doubtless unauthorized. Certainly he no longer occupies the position which enabled him to plump for the short rifle.

Subject to a final audit, the directors of Messrs. Eley Bros., Ld., have decided to recommend a dividend of 10s. per share, free of income-tax, for the year ended December 31st last.

The Rexer Arms Company have issued to the shareholders a statement concerning the notice by the Dansk Rekylriffel Syndikat which have been advertised in various newspapers. The reply is of a reassuring character.

The President of the board of direction of the Fabrique Nationale d'Armes de Guerre, Herstal, Liége, has issued a letter notifying the appointment of Monsieur Alfred Andri, engineer of State railways, etc., to the post of *Directeur* of the Fabrique Nationale.

On December 22nd last British Westfalite was registered with a capital of £10,007 to adopt an agreement with K. Kent, and to carry on the business of manufacturers of, and dealers in, Westfalite and other explosives, electric and other detonators, etc. There is to be no initial public issue, and the directors are to be appointed by the signatories.

Recent issues of *The Field* have contained full advertised particulars of new rifles and cartridges designed to take the place of the prohibited ·450 calibre. It is understood the ammunition makers are pushing on fast with the design and manufacture of sample bullets and cartridges, and that deliveries are on the point of being made. Messrs. Holland appear to be the only firm up to date which has publicly produced the actual article.

An extraordinary general meeting of the shareholders of the Morris Aiming Tube and Ammunition Co., Ld., was held on the 4th ult., at the offices of the Company, for the purpose of considering resolutions having for their object the voluntary winding up of the company and the appointment of liquidators.—Captain J. W. Reid (chairman of the company), in submitting the resolutions, said that, after conference with the shareholders and others who were likely to give them financial assistance, the directors had failed in their endeavours to raise fresh capital or to pull the company into anything like a workable condition. The issue of preference shares of the Morris-Hawkins Electrical Company, Limited, which had been suggested at a meeting held in the autumn of the year, had practically found but few supporters, as out of 322 shareholders they had had only applications from 53 for the shares offered. Of course, the position of the company was fully known to all, and the directors had been tiding on from day to day, living from hand to mouth, to keep the business going. Now it had come to this—that the debenture-holders had decided to step in, in order to protect their interests. Notice had been received that application would be made to the court by the debenture-holders for the appointment of a receiver and manager; but what the debenture-holders would eventually do he could not say. They, however, were not acting in any antagonistic spirit, and he believed they would do all they could on behalf of the ordinary shareholders, as they were large shareholders themselves.—In answer to Surgeon-General Sinclair, the chairman said that the Morris Tube Company's difficulties were owing, in a great measure, to the advances of money to the Morris-Hawkins Electrical Company, which company had, in the two years of its existence, done very well, and was just on the point of making profits when the parent company became unable to assist it further, owing to the cessation of orders from His Majesty's Government. In fact, he attributed the present position of the Tube Company to the paucity of Government orders. He might hold out the hope that when the debenture-holders took over their affairs there might be the possibility of a reconstruction of the company; but he could not say.—Mr. Pemberton suggested that, in order to avoid liquidation, the shareholders should submit to an assessment of 5s. per share; but the chairman remarked that, seeing the non-success which had attended the debenture and preference share issues, there was little possibility of the shareholders subscribing such a sum.—The resolution for the voluntary winding up was then put to the meeting and unanimously agreed to, and Mr. E. J. Husey and Mr. W. C. Luff were appointed the liquidators.

LECTURES TO YOUNG GUNMAKERS.

XLI.—SHOT VELOCITIES OVER 20 YARDS.

Written with the Collaboration of Mr. F. W. Jones.

IT is now about 15 years since the Smokeless Powder Company established a method for testing shot cartridges which was designed to give for each round the recoil, pressure, time up the barrel, velocity and pattern. At first the velocity was taken over the distance between the muzzle and the 40 yards target; the interruption of the target electric circuit being made by a light swing plate forming the centre of the 6 ft. by 6 ft. target. These 40 yards velocities were not reliable. If the swing plate were hung too lightly on its terminals the velocity of the sound wave was registered, and on the other hand if hung too heavily the velocities were low and irregular, especially with thin patterns. Obviously the swing plate system could not be used for less distances than 40 yards except at the loss of the pattern record. These difficulties led two or three years later to the adoption of the rifle bullet wire screen for recording the velocity over 20 yards, it having been proved that with a ten-wire screen the patterns were not affected. This it is believed was the introduction of the wire screen for shot velocities. Since the *Field* recommended the wire screen for taking the velocities of shot-gun cartridges its adoption has become more general, and enquirers as well as critics have said—"What is the velocity registered by the wire screen?" This question we propose to try and answer in this Lecture.

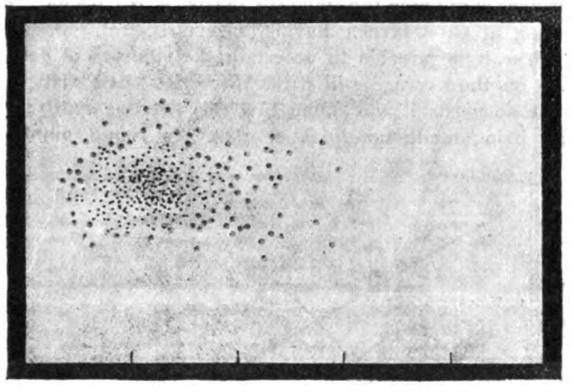


FIG. 1.—Reproduction of Mr. Griffith's Chart of the stringing effects at 20 yards from a choke-bore gun, the outside pellets having been enlarged to ensure satisfactory reproduction. Each division equals 15 inches.

To investigate this matter it is necessary to establish the distribution of the shot charge not only at right angles to the line of fire, as is customary when taking patterns, but also in the direction of the line of fire. In fact to determine the space which contains the charge of shot at the moment when it arrives at the 20 yards screen, and the distribution of the pellets in this space. Mr. Griffith made experiments to determine the lag of the pellets in shot charges at various ranges. The results of these experiments were described in the *Field* of April 9th, 1887. Briefly, Griffith's method consisted of shooting at a large plate having a 48-in. diameter aperture in it and behind this hole revolving a 12-foot diameter wheel so disposed that the pattern fell on a 4-foot band. The wheel was marked by radial lines six inches apart at the perifery and concentric circles three inches apart, thus dividing the plate into sections. The velocity of the 4-foot band being greatest at the rim the patterns obtained were not true to scale, to make them correct the pellet marks in each section were transferred to a surface set out in rectangular figures representing 3 ins. by 6 ins. to scale. This transposed pattern then gave the appearance of a target, say, carried on the side of a train, moving at a velocity at right angles to the line of fire, equal to the rim velocity of the wheel, viz., 200 f.-s. The stationary pattern was observed by placing a sheet of paper over the 48-in. diameter aperture. Two of the patterns thus obtained are here reproduced. The cartridges used contained 42 grs. Schultze and 1⅛ ozs. No. 6 shot. Fig. 1 is from the choke at 20 yards, the stationary pattern has a diameter of 21 inches and the wheel pattern a length of 40 inches. Fig. 2 is similarly from a cylinder barrel and has the following characteristics, viz., stationary pattern of 39-in. diameter and a wheel pattern of 60 inches long.

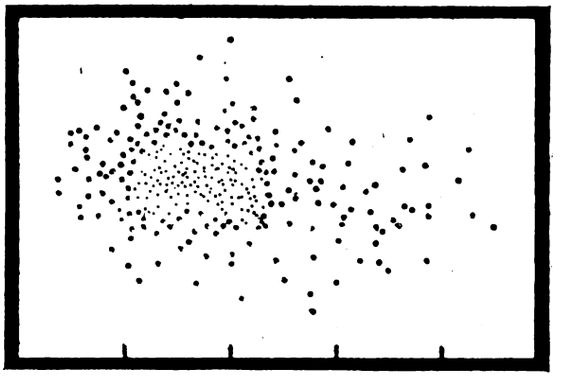


FIG. 2.—A similar reproduction of a cylinder pattern.

A very little consideration will show that these wheel patterns do not represent the true lag of the pellets. In the first case the wheel does not travel as fast as the shot, consequently the length shown is short for this reason, and then again the stationary target has a dimension in the direction given for lag and the measurement is erroneous for this reason. To illustrate these points and to show how to obtain the true length, the choke pattern at 20 yards has been taken and dealt with in the Fig. 3.

The arrow represents the direction of the wheel's motion. B C is the diameter of the stationary pattern and A C the length on the wheel. Now let us assume that the front pellets near C strike the target as soon as any other pellets and that the rear pellets near E as late as any other pellets. Then let B E be made as much greater than A B as the shot velocity is greater than the wheel velocity. The pattern

in the direction of fire will then be contained in B C D E, moreover, if lines be drawn parallel to A E from points dividing A C into equal parts, these parallels will show from what part of the real pattern the wheel pattern is obtained. Griffith's choke pattern at 20 yards was divided into nine equal bands, and the figures shown in the rectangle are those obtained. Obviously the wheel pattern does not give a view of the pattern at right angle to the line of fire, but in

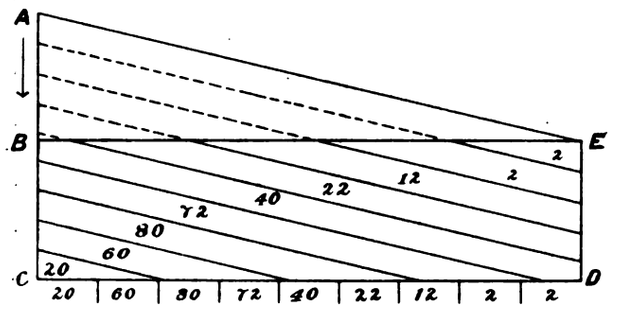


FIG. 3.

the absence of a better hypothesis it has been assumed, in what follows, that it does, the distribution taken being that shown on the right of C D in Fig. 3. This assumption is near the truth, because it is similar to that observed in the much longer patterns at 50 and 60 yards where the parallels make a much smaller angle with the direction of fire B E. The lag of the pattern is obviously A B, obtained by deducting the diameter of the stationary pattern from that obtained on the wheel. To convert this into the actual length it must be increased in the ratio of the striking shot velocity to the wheel velocity. The striking shot velocity has been obtained from figures published within recent years in the *Field;* thus the length for the

Choke at 20 yds. $(40 - 21)\ \frac{850}{200} = 81$ inches.

Cylinder at 20 yds. $(60 - 39)\ \frac{850}{200} = 89\frac{1}{2}$ inches.

The actual length of pattern will be longer than these figures by as much as the central pellets are in front and behind the side pellets, not a material amount by the appearance of Prof. Boy's photographs and Griffith's targets at long ranges.

For the purpose in view the patterns must be represented in a diagramatic form. Thus in Fig. 4 the choke and cylinder patterns at 20 yards are shown. The curves B indicate the density of the patterns from the first to the last pellets. It will be seen that the main body of the shot charge is nearer the front pellets than the rear pellets, and also that with the choke pattern the dense part occurs sooner than with the cylinder. The curves A indicate the growth of the pattern as it passes the screen. Also the straight line shows the velocity of the various parts of the pattern assuming the first pellet has a velocity of 1,070 f.-s. over 20 yards. It will be seen that in the choke the thickest part of the pattern has a velocity between 1,040 f.-s. to 1,035 f.-s. and that half the pellets have a velocity above 1,030 f.-s. On the other hand with the cylinder the thickest part of the pattern has a velocity between 1,025 f.-s. and 1,015 f.-s. and half the pellets have a velocity above 1,025 f.-s The following table gives further velocity details:—

	Choke.	*Cylinder.*
First 5% of pellets ...	1070 to 1056 ...	1070 to 1054
Next 45% „ ...	1056 to 1030 ...	1054 to 1024
„ 45% „ ...	1030 to 994 ...	1024 to 973
Last 5% „ ...	994 to 950 ...	973 to 938

The other characteristic differences between the two patterns are obvious from the diagrams.

When taking velocities with a swinging plate over 20 yards, the first pellet may register if the plate is sensitive enough, and in any case, the first 5 or 10 % may be taken as making the record. It must not be forgotten, however, that the registration of the sound wave is always possible, and not easily detected, because it is very near that of good shot cartridges. With wires the sound velocity is not a factor, and the problem is solved by determining that part of the charge which is the first to break a wire. At the present day it is the practice to use five wires four inches apart, thus covering the choke pattern at 20 yards. In the further consideration of the subject the choke pattern will be taken, the cartridges containing the standard $1\frac{1}{8}$ ozs. of No. 6 shot. By shooting at paper screens having lines ruled on it, representing wires, it is possible to ascertain the number of pellets which on the average will strike the wires. In a particular test at 20 yards it was found that this average was 5, the series being made up of 6, 6, 4, 4. In round numbers

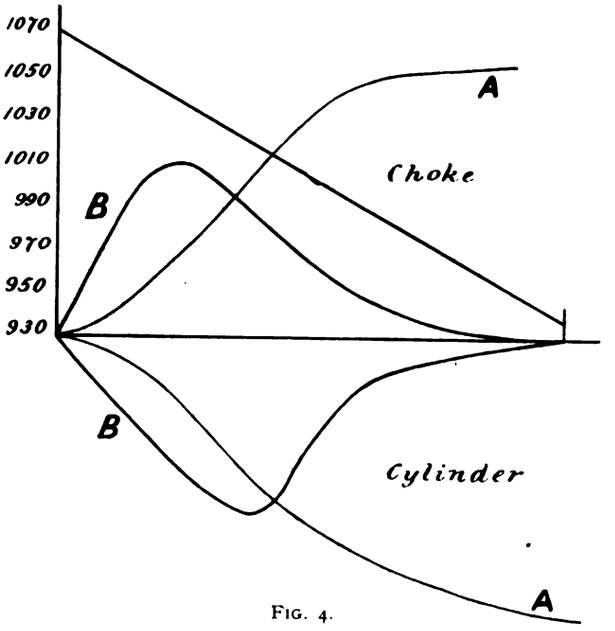


FIG. 4.

5 pellets in the charge is one in every sixty, and the first pellet to hit is the one which makes the record. Our problem then becomes one in probabilities. It is a reasonable assumption that each pellet has the same chance, viz., $\frac{1}{60}$ th. Moreover, each group of ten pellets have $\frac{1}{6}$ th chance of containing the lucky pellet as they arrive at the screen. This $\frac{1}{6}$ th chance is the same as throwing a *six* with a single die when playing dice, and to give our problem a concrete form it will be investigated and explained with dice.

If unity equals certainty, the probality of throwing a *six* in one try with a single die is $\frac{1}{6}$ th, and not to throw a *six* $\frac{5}{6}$ th. Now, not to throw a *six* on the first try, but to do

so on the second is $\frac{5}{6} \times \frac{1}{6} = \frac{5}{36}$, because this is a compound event, similarly to

throw on the third try $= \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = \frac{25}{216}$

fourth „ $= \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = \frac{125}{1296}$ and so on.

To determine the chance order of throwing a *six* a die was thrown and note taken of every time a *six* appeared, the test was continued until the *six* had been thrown a hundred times, this required 606 tries, or six above theory. On 17 occasions the *six* was thrown first try; on 14 occasions on the second try; and 10 times on the third try. Theory requires 16·6, 14 and 11½ respectively. The actual record is shown on Fig. 5, the smooth curve being the calculated one.

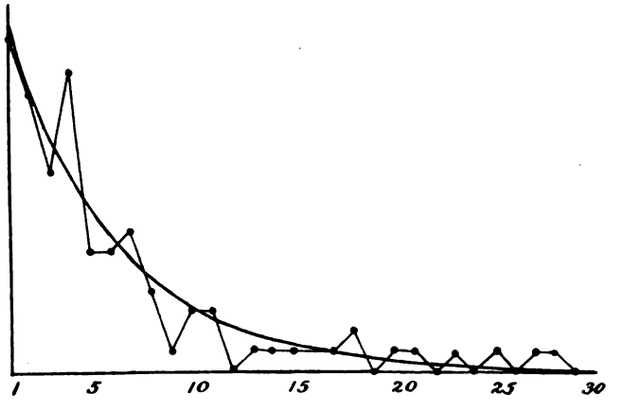


Fig. 5.

With probalities the coincidence of practice with theory is the nearer the greater the number of events. The test, however, was continued far enough to show the truth of the law, and as it is intended to take these actual results to read velocities from the curves of Fig. 4, it will then be apparent how much the recorded velocities may vary by chance, when, as a matter of fact the real velocity does not vary. Each throw of the die represents the probality of 10 pellets containing the one which makes the record. Now, let it be taken as near enough that when a group of 10 pellets breaks a wire the velocity is that of the last pellet of the group. Then when chance gives a six at the first throw of our die this may be taken as equal to the velocity of the 10th pellet, and similarly for the 15th throw the velocity of the 150th pellet, and so on. The sequence of the number of throws necessary to get the *six* was divided into ten groups, the velocity for each number was read from Fig. 4, and the averages for the ten groups were as follow, viz., 1044, 1049, 1047, 1049, 1049, 1051, 1045, 1047, 1037, 1049. Average of all = 1047. The two series made up of the least and greatest number of throws were as follow:—

Throws	7	Velocity 1043	Throws	13	Velocity 1033
„	5	„ 1047	„	18	„ 1024
„	3	„ 1053	„	2	„ 1056
„	4	„ 1050	„	4	„ 1050
„	1	„ 1060	„	22	„ 1016
„	4	„ 1050	„	2	„ 1056
„	11	„ 1036	„	1	„ 1060
„	3	„ 1053	„	7	„ 1043
„	2	„ 1056	„	10	„ 1038
„	1	„ 1060	„	28	„ 996
	41	1051		107	1037

These figures show that the tail pellets seldom make the record. As a matter of fact, of the 100 shots with the die there were

17	shots due to first 10 pellets.	Velocity above	1060
69	„ 11th to 120th	„	1050 to 1036
12	„ 121st to 245th	„	1036 to 1010
2	„ last 54th	„	below 1010

The average velocity of all the 100 rounds is within two feet of that of the 60th pellet, in fact if the probality of each pellet making the record is $\frac{1}{n}$ then the average velocity given by the wire screen is very near that of the n^{th} pellet. The wire screen, therefore, gives the velocity, not of the front or back pellets, but of those more nearly representing the velocity of the main body of the charge.

To show the probality of recording any given average velocity in a most graphic manner, what is known as a curve of probality must be constructed, *i.e.*, a curve showing the chance of only one pellet striking the wire as the charge passes through the screen. It is exactly the same problem as determining the probality of making a number of throws with a single die and throwing the *six* only once. The curve rises from one to six throws, and then decreases thus to throw a *six* in two tries, once only is about as probable as to throw it once in 10 tries. Take for example four tries with the die, then the probality of a *six* turning up on the fourth try is $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6}$. Obviously this is the same as turning up on the first try and missing on the other three or turning up on any of the four tries, and missing the other three. Therefore, to determine the probability of the *six* being thrown once only in the four events is the sum of each event, or 4 $(\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6})$. To put this in algebraical language if p = the probality in one trial then the probality of the event happening once in n trials is $\frac{n}{p} \left(1 - p\right)^{n-1}$. By this formulæ the curve in Fig. 6 has been obtained, which shows clearly that the

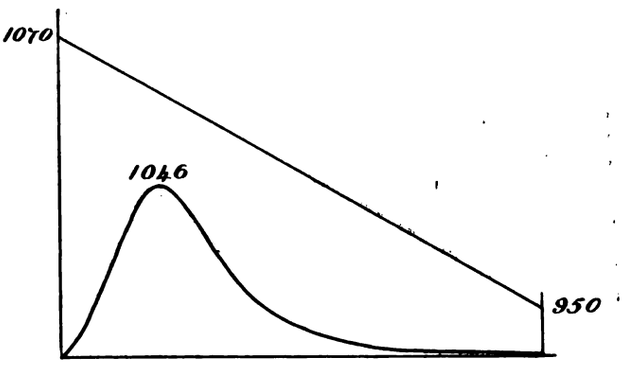


Fig. 6.

most probable average velocity to be recorded is 1046 f.-s., the curve decreasing rapidly on each side of this point.

Up to this point the consideration has been restricted to five pellets striking the wires and one velocity. If more than five pellets would strike the wires the most probable velocity is greater than 1,046 f.-s. and the curve falls rapidly after this velocity. On the other hand if less than this number are effective, then the most probable velocity falls, e.g., if only two pellets would strike, the probable velocity is 1,032 f.-s. and the curve is much fuller for lower velocities than Fig. 6. It is for this

reason that a record made with only one wire broken is often a low shot. Again, if the velocity of the first pellet is greater or less than 1,070 f.-s. it will affect all the results equally, e.g. 20 f.-s. more velocity will raise each end of the velocity line that amount to within a foot.

Enough should have been made clear that taking shot velocities with wire screens, although first introduced to overcome difficulties, and since adopted more generally on account of its practical teaching, has a good deal to recommend it when considered from an abstract point of view.

THE GRADUAL DETERIORATION OF NITROCELLULOSE ON STORAGE.

DR. SILBERRAD and Dr. Farmer, of the Laboratory of the Ordnance Research Committee, previously the Explosives Committee, read in October, last, before the Society of Chemical Industry at Liverpool, a most important paper on the above subject. Some of the results of their researches had previously been made known in a paper read before the Chemical Society earlier in the year. The results detailed by these gentlemen are apparently those obtained in the ordinary routine work of the Laboratory of the Ordnance Research Committee at Woolwich, and this Committee and the Director of Artillery have given the necessary permission for their publication. If one can take this disposition of the authorities as an indication that in the future the purely academical work carried on at Woolwich, at great expense to the nation, is to be published from time to time, then the trade in particular and readers of explosives literature in general may congratulate themselves. It is to be hoped, however, that if this is a true forecast the treatment will not be half-hearted. For instance, in connection with the above subject similar details regarding the behaviour of cordite would be interesting. Maybe cordite is the second chapter on the subject of storage.

It was known even before the general adoption of smokeless powders that nitrocellulose, the base, gradually but continuously decomposes, very slowly of course, at ordinary temperatures. But the rate of decomposition rises very rapidly with the temperature. Previous to the researches under consideration investigations had been made on a small scale and in a qualitative manner. In the present work for the first time quantitative and systematic examination of the progress of decomposition is published. The nature of this examination is in part made evident by the tables which have been published. In addition a complete analysis was made at each stage, whereby it was shown that the loss of nitrogen was not greater with the higher nitrate constituent than with

TABLE I.—STORAGE TESTS ON LOTS OF 500 LBS. AND UPWARDS, TUBULAR NITROCELLULOSE, GELATINIZED WITH ETHER ALCOHOL.

POWDER UNHEATED.			CONDITION OF TEST.			RESULTS OF TEST.				REMARKS.
Nitrogen, %	Heat Test. Mins.	% Aqueous Extract.	Duration. Months.	Temperature. Fahr.	MODE OF STORAGE.	Nitrogen. %	% Loss on Storage.	Heat Test. Mins.	% Aqueous Extract.	
12·32	26	0·21	6	65	6 in. cartridges, wrapped in silk and packed in wooden boxes. *Dry atmosphere*	12·23	—	21	—	Not any appreciable change in appearance.
,,	,,	,,	4½	100		12·28	—	13	—	
,,	,,	,,	9	,,		12·13	—	5	—	
,,	,,	,,	10½	,,		12·10	—	2	—	
,,	,,	,,	12	,,		11·77	6·75	3	0·57	
,,	,,	,,	3	120	Ditto	12·32	1·93	8	—	Ditto.
,,	,,	,,	6	,,		12·24	2·40	9	—	
,,	,,	,,	4½	130	Ditto	12·17	—	2	—	Sticks darken and smell of Nitric-peroxide and Ethyl Nitrite.
,,	,,	,,	10½	,,		11·78	—	—	—	
,,	,,	,,	12	,,		10·56	9·46	¾	12·08	
,,	,,	,,	9	130	*Atmosphere dry*. Powder freely exposed ..	12·31	3·49	1	—	———
,,	,,	,,	3	130	*Atmosphere wet*. Powder in oil paper and rubber sheeting	12·34	—	8	—	Action greatest on the surface, which had become strongly acid and lost most of its Nitrogen.
,,	,,	,,	5¼	,,		11·56	—	—	4·03	
,,	,,	,,	4½	140	6 in. cartridges, packed in wooden boxes. *Atmosphere dry* ..	12·24	—	1½	—	Spontaneously fired. See Reference.
,,	,,	,,	9	,,		11·81	—	½	—	
,,	,,	,,	10¾	,,		10·32	28·2	Cold	28·2	
,,	,,	,,	4½	140	Powder freely exposed. *Atmosphere dry* ..	12·19	—	2	—	Very little. Evident deterioration.
,,	,,	,,	9	,,		12·04	—	½	—	
,,	,,	,,	10¾	,,		11·91	3·55	¾	3·55	

the lower, the insoluble in ether-alcohol decreasing very little for half a per cent. drop in nitrogen. The loss in weight on storage does not bear any definite relation to the loss in nitrogen contents, and yet solvent does not appear to enter into the question. The authors promise, however, a further communication on this point giving measurements of the velocity of gas evolution. One of the main features of this research is the analysis of those products of decomposition soluble in water and dealt with in the tables under "aqueous extract." We learn that the products formed during decomposition which are soluble in water consist mainly of oxalic acid, and although this extract amounted to over 30 per cent. in one instance, the insoluble residue was practically unaltered nitrocellulose.

The nitrogens in the above are given on the dried substance, thereby making an allowance for the volatile ingredients. With regard to the samples at 140° F. which spontaneously fired, the authors make the following statement:—The sample weighed 555 lbs., and "it ignited spontaneously one day, after the last sample was withdrawn. It yielded an alcohol extract of 50·5 per cent. The alteration in the physical condition of the powder was not marked after nine months, but after 10¾ months (*i.e.*, just before the spontaneous ignition of the powder) it became extremely brittle and porous, falling to powder by gentle pressure. The sticks were yellow to black in colour, and smelt strongly of nitric peroxide and ethyl nitrite."

Experiments on a large scale are not only costly but dangerous. It was found that reliable tests could be made in air-ovens with a sample of about 100 grammes, the conditions of packing being the same as on a large scale. The details in Table II. were obtained from such tests on the 100 grammes scale.

The U.S.A. powder for 4·7 in. gun can hardly be correctly described as a pyrocollodion; the nitrogen is far too high. Probably this powder is one of the many nitroglycerine compounds the U.S.A. have at times adopted. It is certainly the only American powder that stood the storage tests with any degree of satisfaction.

No general conclusion can be drawn from this Table II. With all but the American powders and No. 62 the moist atmosphere produced less effect than the 20° C. hotter dry atmosphere. But where the moist atmosphere was more destructive the difference is great. A powder prone to decomposition has this tendency best demonstrated in the moist atmosphere. Thus the difference in behaviour of Nos. 55 and 62 must be due to purity of the powder.

TABLE II.

Nature.	POWDER UNHEATED.			AFTER HEATING IN DRY ATMOSPHERE AT A TEMPERATURE OF 140° F.								AFTER HEATING IN MOIST ATMOSPHERE AT A TEMPERATURE OF 120° F.							
				3 Months.				6 Months.				3 Months.				6 Months.			
	Nitrogen.	Heat Test.	Aqueous Extract.	Nitrogen.	Heat Test.	Loss on Storage.	Aqueous Extract.	Nitrogen.	Heat Test.	Loss on Storage.	Aqueous Extract.	Nitrogen.	Heat Test.	Loss on Storage.	Aqueous Extract.	Nitrogen.	Heat Test.	Loss on Storage	Aqueous Extract
	%	mins.	%	%	mins.	%	%	%	mins.	%	%	%	mins.	%	%	%	mins.	%	%
Nitrocellulose No. 53 ..	11·92	12½	0·91	11·84	6½	2·15	0·94	11·34	2	6·12	5·81	—	—	—	—	11·75	20	—	1·09
Nitrocellulose containing 2 % Vaseline No. 55*..	11·83	47½	0 51	11·83	12½	1·89	0·78	11·79	8	3·02	1·27	11·90	25	1·27	0·60	11·92	18¾	1·96	0·55
Ditto No. 62	11·72	66	0 92	—	48	1·48	—	11 43	2½	6·23	2·41	11·87	34	1·85	1·35	8·00	¾	—	16·39
Nitrocellulose containing 1½ % Vaseline No. 59†..	12·09	27	0·28	11·80	15	0·69	0·62	11·67	3	2·08	1·23	12·04	18	1·15	0·53	11·87	12	2·00	1·03
Smokeless Rifle Powder	11·78	90	0·75	11·71	16	—	1·11	11·92	9½	1·20	—	11·68	58	—	1·18	11·81	18½	2·40	1·54
Pyroc'dion Rifle Powder	11·50	36	0·51	—	1½	—	—	8·84	3¼	23·0	1·55	11·73	—	—	0·55	11·69	—	4·0	1·37
Smokeless Artillery Blank Powder..	12·68	32	—	—	25	2·34	0·60	12·58	10	2·91	2·02	—	35	0·32	0·61	12·61	15½	0·61	1·11
U.S.A. Pyrocollodion Powders—																			
15-Pounder	11·90	17	0·24	11·68	1½	3·57	2·08	10·72	1	10·3	7·76	9·58	cold	16·25	6·62	5·69	—	51·60	33·73
4 in. Gun	11·79	11½	—	11·48	½	3·70	1·79	10·92	—	11·61	9·58	10·56	cold	9·17	5·58	6·65	—	37·66	25·25
4·7 in. ,, ...	13·13	36	0·76	—	36	2·39	1·02	13·13	13	4·02	0·98	—	35	0·69	1·00	13·20	15	2·81	1·06
6 in. ,, ...	11·79	10	1·17	11·68	3	3·34	0·76	11·14	1½	7·90	8·37	8·88	cold	7·80	26·63	5·92	—	50·66	29·89
8 in. ,, ...	11·73	33½	1·17	11·76	½	2·51	1·13	11·59	—	4·51	2·64	11·65	cold	2·85	1·17	9·98	cold	22·28	1·32

* *No. 63 same composition behaved similarly to No. 55.* † *Nos. 60 and 61 same composition and behaviour.*

An interesting conclusion to these papers consists in some ballistic results of a powder subjected to decomposing influences in a moist atmosphere at 120° F.

	Weight of Charge.	Muzzle Velocity.	Pressure Tons per Sq. In.	Heat Test.
Unheated	34½ lbs.	2741 f.-s.	14·75	26
After 6 months in air-tight iron case	34½ lbs.	2790 f.-s.	15·79	4
After 6 months in wooden box ..	34½ lbs.	2723 f -s.	15·19	¾
After 6 months freely exposed ..	34½ lbs.	2629 f.-s	13·51	¾

Memorial Des Poudres et Salpetres. Tome XIII. 1905-6. Paris, Gautier-Villars. A new volume of this most interesting production has just come to hand, too late, however, to give anything approaching a proper idea of the important subjects dealt with. A series of experiments are reported at length, having reference to the injury which is caused to buildings by explosives stored in bulk. Another article concerns the effect on the stability of nitrocellulose with reference to the amount of water contained in the acid mixture used for nitration.

REVIEW.

The Citizen Rifleman. By E. J. D. Newitt. Published by George Newnes, Ld. Price 2s. net.

A new sport, as miniature rifle shooting may fairly be described, is bound to bring forward a large number of handbooks giving miscellaneous information to the recruit. Amongst them, a two-shilling booklet, bearing the above title, is likely to rank as one of the best for some time to come. No club has shown itself more alive and more active in the pursuit of new ideas than the one which lies in the lee of the railway bank near Southfields station. On the opening day of the club one of its prominent officials announced it as his matured opinion that a certain type of French rifle was the best miniature weapon in existence. Since then the members of the club have accumulated an ever-increasing share of wisdom, and there is probably very little about miniature rifles which has not been exhaustively tested by the members at one time or another. Mr. Newitt, the author of the present volume, may be described as the leading spirit in the Southfields rifle club. His selection to represent Metropolitan clubs on the Council of the Society of Miniature Rifle Clubs affords evidence that he is entitled to speak on the subjects dealt with in the series of essays which constitute the present volume.

His chapter headings show that he has discoursed upon, one by one, the various items of club formation and management, and has said something interesting about each of them. It is certainly a proof of the vitality of the rifle club movement that exponents of the pastime should show themselves capable of turning out the requisite instructional matter, a duty which is frequently assumed by the organising association. The volume concludes with a most interesting appendix, which summarises the achievements up-to-date of the Society of Miniature Rifle Clubs. Commencing with the Crystal Palace meeting, and continuing with the various meetings since held in London and the provinces, the reader is given a bird's-eye view of the successes which have been achieved by individual shooters and also by teams shooting for the various challenge trophies, a full list of which is given. The appendix also contains a list of the rifle clubs which are affiliated to the above Society, and it is really astonishing to find how many counties are represented by quite a considerable list of rifle clubs apparently in active existence.

APPLICATIONS FOR PATENTS.

DECEMBER 17, 1906—JANUARY 19, 1907.

28,728. Instrument for Adjusting Range-Finders. A. Barr and W. Stroud.
28,732. Field Gun Mountings. W. Beardmore & Co., Ld., and A. Bremberg.
28,733. Ordnance Firing Mechanism. W. Beardmore & Co., Ld., and A. Bremberg.
28,799. Sporting Rifles. R. J. W. Brown.
28,907.* Sights for Small Arms. H. T. Ashton, W. B. Wallace and W. J. Robinson.
28,909.* Ships' Guns. E. Schneider.
29,021.* High Explosive. M. A. G. Himalaya.
29,130. Shot Gun Cartridge Wads. A. Brown.
29,161.* Transforming Metal-Coated Bullets. E. Polte.
29,210. Air-Gun Ammunition A. T. Saunders.
29,221. Automatic Firearms. J. Carter and F. T. Murray.
29,289.* Explosives Société de Produits Chimiques et d'Explosifs Bergès Corbin & Cie. (Date of application in France, January 3, 1906).
29,301. Rifles. H. J. Blanch.
29,388. Ordnance. A. F. Petch and F. W. H. Shepherd.
29,389. Sights. A. F. Petch, R. Redpath and J. R. James.
29,429. Sight Adjustment Device. F. Paterson.
29,467.* Ordnance Pressure Brakes. Fried. Krupp, A.-G. (Date of application in Germany, April 12, 1906).
29,528.* Automatic Gun Firing Mechanism. Rheinische Metallwaaren und Maschinenfabrik (Date of application in Germany, December 28, 1905).
29,689 Mountain Guns. A. Bremberg.
29,724. Cartridge Holders C. J. Ross.
29,732. Automatic Gun Mountings. A. T. Dawson and G. T. Buckham.
29,742.* Projectiles. A. Meyer and F. N. Rogers.
29,747.* Compound for Shooting and Agricultural Purposes. L. Pilkington and P. Doran.
29,761. Ammunition Hoists. A. F. Petch and F. W. H. Shepherd.
29,762. Ammunition Hoists for Ordnance. A. F. Petch and F. W. H. Shepherd.
142. Apparatus for Recording Gun Practice. A. J. B. Légé.
143. Ammunition Supply to Heavy Ordnance. A. F. Petch and F. W. H. Shepherd.
273. Sighting Apparatus for Guns. A. T. Dawson and G. T. Buckham.
289 * Hydraulic Brakes for Recoiling Barrel Guns. Rheinische Metallwaaren und Maschinenfabrik (Date of application in Germany, January 17, 1906).
295. Sighting Apparatus. A. T. Dawson and G. T. Buckham.
345.* Automatic Breech Opening of Recoiling Barrel Gun. Rheinische Metallwaaren und Maschinenfabrik (Date of application in Germany, February 3, 1906).
573. Sights. P. Fitzpatrick.
613. Single-Trigger Guns. H. W. Holland and T. Woodward.
673. Ordnance Sighting Apparatus. A. T. Dawson and G T. Buckham.
791.* Explosives. C. Duttanhofer.
795. Apparatus for Setting Time Fuses. C. R. B. Owen and W. J. Griffiths.
860. Rifle Breech Chambers. A. Vennewald.
874.* Improvements in Rifle Breech Mechanism for Miniature Ammunition. R. Wake.
936. Sling Swivels. Birmingham Small Arms Co., Ld., and G. Norman.
988.* Semi-Automatic Guns. La Société Anonyme des Anciens Etablissements Hotchkiss et Cie (Date of application in France, January 13, 1906).
1,000. Bolt Action Rifles. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
1,001. Locking Mechanism. Birmingham Small Arms Co., Ld., and J. L. J. Gobiet.
1,088. Cartridge Feeding Device for Machine Guns. F. Ruszitszka.
1,104. Shot Hole Gauge. A. A. Carnell.
1,114 Air-Gun Pellet Charger. W. Bowdler.
1,251.* Ordnance Pointing Telescopes. M. da S. Netto (Date of application in Germany, January 19, 1906).
1,376.* Gun Mountings. A. F. Petch and R. Redpath.
1,422. Rim-Fire Rifles. F. Greener.
1,437. Quick-Firing Guns. R. J. W. Brown and A. Pyke.
1,471.* Brake for Recoiling Barrel Guns. Rheinische Metallwaaren und Maschinenfabrik (Date of application in Germany, August 21, 1906).

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

DECEMBER 27, 1906—JANUARY 24, 1907.

COMPILED BY HENRY TARRANT.

18,692 (1905). **Nitroglycerine Explosives.** O. Silberrad, London. The difference in the absorptive powers of "dopes" containing wood meal, saw dust, cellulose, coal napthalene, paraffin and other hydrocarbons and oxydising agents, is used to produce explosives of different powers and velocities of detonation suitable for various grades of rock, but at the same time to be of perfect plasticity. Suitable proportions of such a wood meal or resin dope are added to a jelly of nitroglycerine and soluble nitrocellulose. Accepted December 15, 1906.

24,710 (1905). **Automatic Small Arm Breech Mechanism.** T. R. R. Ashton, London. The improvements described in this specification are applicable to the automatic mechanism set out in patent No. 23,533, 1905. They consist of a method of facilitating extraction of the empty case by providing an "auxiliary cartridge shifter," and a device for automatically withdrawing, locking and unlocking the firing pin. Accepted November 29, 1906.

791 (1906). **Howitzer Mountings.** Maj. F. J. Fisher, and C. H. Dewett, Woolwich. To enable howitzers to be shifted rapidly from the loading to the firing position, the gun is arranged in the mounting so as to be able to move in a vertical plane about one or other of two axes. One is the axis of movement for loading whilst the other is that for firing, and is well in the rear of the first so that the breech end of the gun shall not strike the earth when fired at high angles. Accepted January 3, 1907.

1,218 (1906). **Electrical Indicating Targets.** G. Hunter, Fulham. The target apparatus described in patent No. 14,711, 1891, is improved by affixing guide rods to the face plates by means of bosses cut in the back of the plates to receive the screwed ends of the rods. The signalling mechanism by which the value of hits is conveyed at the firing point is also modified. Accepted December 13, 1906.

2,863 (1906). **Improvements in Air Guns.** C. Gardner and L. B. Taylor, Birmingham. The improvement dealt with in this patent is applied to the air rifle of the well-known fixed barrel type manufactured by the B. S. A. Co., Ld. By means of an external link working on the cam system the cocking lever when operated to compress the plunger spring is made also automatically to turn the breech plug into position ready for receiving the pellet, Accepted December 6, 1906.

2,902 (1906). **Nitration of Cellulose.** Count G. C. de Briailles, Paris. A process is described for nitrating cellulose by electricity in which the cellulose is enclosed in a chamber where it is subjected to the treatment of acids, and therein it is washed. No fumes are allowed to get to the outside air. Accepted January 3, 1906.

3,097 (1906). **Sighting Attachment for Howitzers.** A. T. Dawson and G. T. Buckham, London. To remove various existing difficulties in respect to sights of indirect firing guns, the sight proper is pivotally mounted on a pillar adapted to slide on a bracket which partakes of the movement of the gun. At highest elevations of the gun the sight pillar is carried to the top end of the bracket so that no obstructions obscure the sight. The bracket and pillar arrangements also eliminate vibration. Accepted December 20, 190.

3,247 (1906). **Targets for Miniature Ranges.** A. C. Fawcett, Harrogate. The target apparatus set out in this patent is intended for miniature ranges and combines stationary disappearing and moving targets. The two last named are worked by cord and pulley arrangements from the firing point. Accepted December 13, 1906.

3,464 (1906). **Adjustable Sight for Air Guns.** J. Betteridge, Birmingham. By means of a couple of screws one working in a vertical and the other in a horizontal fashion the back-sight notch carrying bar of an air rifle may be either raised or lowered or carried from side to side. Accepted December 6, 1906.

4,622* (1906) **Magazine Loading for Air Rifles.** A. H. Butler and F. G. Clark, Birmingham.

4,959 (1906). **Mounting for High Angle Guns.** W. Beardmore and Co., Ld., and A. Bremberg, Glasgow. Mountain guns adapted to be fired at high angles are usually mounted upon a cranked axle in order to keep the centre of gravity as low as possible. The patentees provide that by a link arrangement the cranked axle may be secured either in a high or a low position. Accepted January 3, 1907.

5,554* (1906). **Apparatus for Teaching Correct Aiming with a Rifle.** J. Rigby & Co., Ld., and E. J. Rigby, London. This device will be dealt with under Selected Patents in the next issue.

5,957 (1906). **Electro Magnetic Firing Apparatus for Ordnance.** The above apparatus is applied to existing guns of the Hotchkiss type by interchanging its bracket for the trigger guard. Only the re-cocking lever needs to be modified in order to render the mechanism capable of being actuated thereby. The armature of the electro magnet causes a spring catch which is disengaged from the plunger by the movement of the armature when the magnet is excited. Accepted December 20, 1906.

6,705A (1906). **Primers for Explosives.** W. Vernier, Austria. A priming composition adapted to be detonated by a weak electric current was dealt with in patent No. 6,705, 1906. The present specification contains a description of two metal discs insulated from one another for containing between them the priming. A stronger action is obtained by this method. Accepted December 20, 1906.

7,041 (1906). **Percussion Fuse Safety Device.** Sir W. G. Armstrong, Whitworth & Co., Ld., and Major J. S. Douglas, Newcastle-on-Tyne. In order to prevent the spring holding the percussion pellet from spreading a safety ring is employed. This ring is held by a pin which is removed before firing. Small shearing pins still hold the ring after removal of the safety pin. Accepted December 20, 1906.

7,042 (1906). **Graze Fuses for Projectiles.** Sir W. G. Armstrong, Whitworth & Co., Ld., and Major J. S. Douglas, Newcastle-on-Tyne. The passage to the magazine of a percussion fuse is closed by a pellet which is normally retained in position by a nut on a spindle. This nut is "vaned" and is rotated during the flight of the shell to release the pellet by the action of the air. Accepted December 20, 1906.

7,632 (1906). **Mounting Ordnance in Turrets.** W. H. Murray, U.S.A. The centre of the space inside a turret is stationary and clear but the outside flooring on which the guns are mounted is adapted to move on anti-friction rollers relatively with the main structure. This construction is quoted in reference to the floating body set out in patent No. 19,654, 1904. Accepted January 3, 1907.

7,921 (1906). **Time Fuse for Projectiles.** Sir W. G. Armstrong, Whitworth & Co., Ld., and Dr. W. H. Sordeau, Newcastle-on-Tyne. The less volatile of the products of combustion of the time fuse composition are found to collect in the single vent usually provided and the rise of pressure alters the time of burning of the fuse. Additional vents are therefore provided and the exposed surfaces of the composition at these escapes are coated with shellac to prevent absorption of moisture. Accepted December 6, 1906.

9,262 (1906). **Sight Protector for Front Sight of Rifles.** The Birmingham Small Arms Co., Ld , A. H. M. Driver, and G. Norman, Birmingham. A sight protector of the hinged hood type adapted to stand over and protect the foresight of a rifle, is locked in either the vertical or horizontal positions by a spring bolt which engages with the sight block. The pressure of the fingers when the protector is gripped to turn it either up over the sight or down to expose the sight releases the bolt and allows the protector to be moved. Accepted December 20, 1906.

9,645* (1906). **Charger Holder for Magazine Rifles.** Major W. B. Wallace, Enfield.

15,323 (1906). **Mounting of Sighting Telescopes.** Optische-Anhalt, C. P. Goerz, Ag., Germany. Telescopic sights for ordnance or small arms are provided with a mount on which is a "positioning surface" adapted to engage with corresponding surfaces in the socket constructed to receive it. A locking device holds the mount securely in the socket. Accepted December 13, 1906.

20,309 (1906). **Ammonium Nitrate Explosives.** B. G. Reschke, Germany. An explosive adapted for use in firing mines is composed of 90 per cent. of ammonium nitrate and 10 per cent. wintergreen oil. This is one example only but fennet, olive, mustard or birch tar and colza oil, wood meal, copper oxalate, paraffin, sugar, dinitrobenzol, are also quoted as forming parts of other compositions set out as part of an explosive containing ammonium nitrate as the principal ingredient. Accepted December 31, 1906.

20,634 (1906). **Cartridge Holders.** C. J. Ross, Exeter. A cartridge holder adapted to be attached to a shooting coat is constructed to allow a convenient number of cartridges to be carried lying one above the other horizontally. The lowest one lies in the rotatable semi-cylindrical bottom of the holder and is dropped out when this is rotated. Accepted December 6, 1906.

23,733 (1906). **Breech Mechanism of Ordnance.** Fried. Krupp, A.-G., Germany. A safety device is designed for preventing the breech block of ordnance from being opened should a missfire occur. The device consists of a locking member

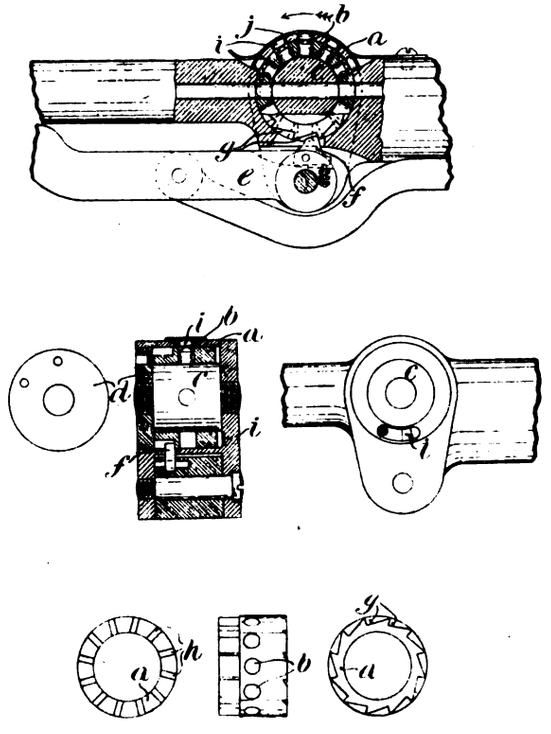
which is thrown out of its operative position when recoil takes place by another member moved by inertia. Accepted January 3, 1907.

* These Specifications are more fully dealt with under "Selected Patents."

SELECTED PATENTS.

MAGAZINE FOR AIR RIFLES.

4,622 (1906). A. H. Butler and F. G. Clark, Birmingham. The magazine-loading device described in this patent is particularly applicable to air rifles with a solid breech and barrel connection, and is adapted to take the place of the ordinary breech plug,

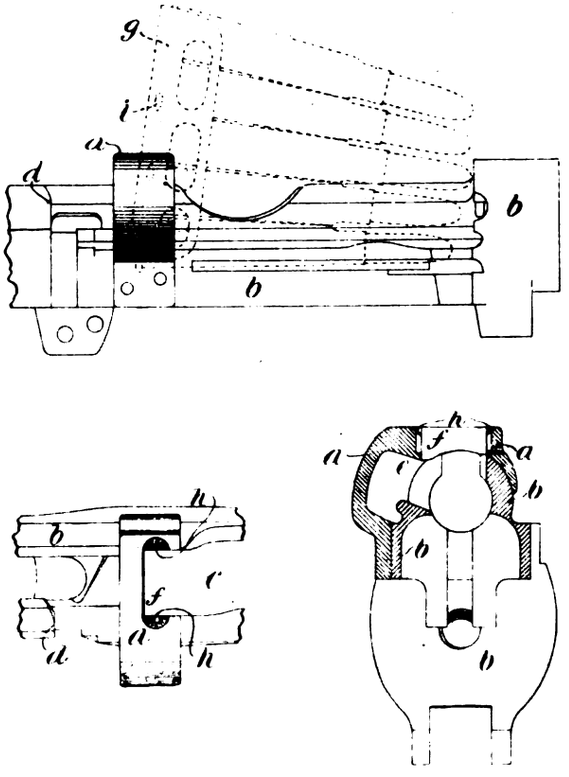


which is rotated from the loading to the firing position by a small lever. The magazine consists of a revolving cylinder containing chambers for receiving the pellets. It is loaded through holes in the body of the rifle, and these holes are covered by a sliding limb.

The device is illustrated in the drawing reproduced, and it will be seen that the revolving magazine cylinder *a*, provided with pellet chambers *b*, is adapted to rotate round the axis *c*, which is held in position by the end plate *d*. The pellet chambers are arranged radially in the cylinder, and as the centre of the axis *c* is in the line of axis of the bore, each chamber may be made to line exactly with the bore. The cylinder is rotated automatically during the movement of the cocking lever *e* when in the act of compressing the plunger spring. The pawl *f* is carried downwards with the lever, and by means of the rachet teeth *g* the magazine is revolved; notches *h* are formed upon the sides of the cylinder, and catch *i*, working in the body of the rifle slips into one of these simultaneously with one of the chambers, reaching the position of alignment with the bore. The slugs are held in position by the pivoted cover *j*, which is of a spring nature, and possesses pads *i* adapted to project through holes in the body. When the magazine is to be recharged this cover is lifted and five slugs are inserted in the five exposed chambers. When the cocking lever is pulled down to compress the spring the first pellet is presented to the entrance to the barrel. Accepted December 13, 1906.

CHARGER HOLDER FOR MAGAZINE RIFLES.

9,645 (1906). Major W. B. Wallace, Enfield Lock. The device described in this patent takes the form of a bridge piece, and is intended to hold the charger clip whilst the cartridges are pressed therefrom into the magazine below. This charger holder is constructed for magazine rifles of the Lee-Enfield type, and is intended to replace the present combination of fixed and moveable guide pieces connected rigidly with the body and sliding on the bolt head of the rifle respectively. The disadvantages attending this system are said to exist in the liability of the moveable part to be easily knocked off and to the wear increasing the distance between the recesses and so rendering it difficult to press the cartridges from the loosely held charger.



The system described in this patent, which is illustrated in the accompanying drawing, consists of the bridge charger guide *a* extending from one side of the body *b* to the other, above the bolt way and across the rear end of the magazine opening *c*. Sufficient space is left between the rear face of the bridge and the shoulder *d* to allow the bolt head to be lifted up when the bolt is to be withdrawn from the body. In the right-hand side of the bridge the passage way *e* is cut to allow the bolt head to pass backwards and forwards. The front of the bridge is slotted at *f* above the magazine opening to allow the charger *g* to be inserted and small slots *h* are cut for the stops *i* of the charger to rest in. The bridge charger guide may be made either as a separate part or solid with the body. In the former case it is attached either by dovetailing, brazing or screws. Accepted December 6, 1906.

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CONTENTS.

CURRENT TOPICS.

The Late Mr. R. T. Woulfe.—There are very few instances in which anyone brought up outside gun trade circles gains a full measure of confidence and brotherly feeling. The late Mr. Reginald Woulfe was pre-eminently a man who made friends with all whom he met in conference; and his loss becomes not merely that of a valued executive officer, but rather the breaking of a connection, unique in its way, and representing the fruition of years of development. Mr. Woulfe first became known to gunmakers by his masterly grasp of the intricacies of the Deeley patent litigation. As a private guest at the annual dinners he had already met members of the Gunmakers' Association on a social footing. It was, however, in the year 1896 that the arrangements for carrying on the Gunmakers' Association on a broader basis than was possible under the rules of the Armourers' Club called attention to the need for an official solicitor. Mr. Woulfe was offered this position by the Executive, and a letter accepting the office was read at a general meeting of the Association which was held on the 16th December, 1896. He thus lived to complete ten years of arduous and painstaking work on behalf of the Gunmakers' Association. During that period he had given the most valuable advice, and had acted in a legal capacity with reference to several matters of trade interest, particularly in regard to the Association's efforts which were brought to a successful issue, for preventing the fraudulent marking of guns. During this long period of close intercourse with the leading members of a highly technical craft he endeared himself to all. In fact no higher tribute to the position he occupied can be found than the warm and hearty thanks which were each year accorded to him at the annual meetings, where his past services were feelingly acknowledged, and the members recorded their appreciation of his willingness to act for a further term of office.

Clay Bird Shooting Prospects.—A very sad blow to the vitality of clay bird shooting, as carried on by club organisations, has been delivered by the determined, and apparently successful, efforts to extinguish the Middlesex Gun Club. In every sense of the word Mr. Gale was father to the club, and in one way and another he devoted many of the best years of his life to its care and management. If Mr. Holt Shooling's method of graphically representing facts and figures were adopted, Mr. Gale's life work up to date would be expressed by a fairly large mountain representing strenuous labour in business directions. A smaller but still very substantial mountain would represent the time and toil devoted to promoting the welfare of the Middlesex Gun Club. The hours usually devoted to leisure and recreation have been occupied in balancing accounts and working out score statistics. The owners of the club shooting ground expressed themselves unable to renew the lease for a further period. The relations between the club and its landlord were a little mixed by virtue of Mr. Gale's connection with both sides, and the notice to quit was accompanied by a resignation of office and a proposal to wind up the club. Great as have been Mr. Gale's efforts to give this child of his a strong constitution the severance of the parental tie convinces him that it is incapable of facing alone the buffets of the world. Opinions amongst the members are divided, and some have vigorously asserted that the loss of a ground and a secretary are only incidents in a club's existence, but by a majority of one it was decided to

disband the club and distribute its very substantial financial resources amongst the members. It is considered the highest form of parental affection to desire death rather than dishonour for one's offspring, but in the case of the Middlesex Gun Club the analogy seems to fail, because there is no right or just cause for supposing that a properly organised club is incapable of continuing an honoured existence because its prime worker and founder turns his attention to other matters. The most probable inference seems to be that the sport of clay bird shooting on the club principle has so far failed to show vitality that this club cannot exist apart from the semi-proprietary basis on which it has hitherto been carried on. If it is the members' club it has always professed the prosperity which its yearly accounts display should be taken as a real sign of life. The decision to wind it up is either murder or suicide according to the point of view taken.

The National Rifle Association.—The annual report and winter general meeting of this Association display the signs of progress which have come to be regarded as an ordinary part of its career. Notwithstanding the painful revelations contained in Major Richardson's manifesto, which is noticed in another portion of this issue, the records of the Association contain evidence of an ever increasing amount of rifle practice and a growth of shooting of the right sort throughout the country. The accounts show the handsome surplus of £969 on last year's working. The entire surplus of property, cash and other assets belonging to the Association now amount to £38,776, a sum whose gradual growth affords evidence of skilful administration and wise economy of management. The ordinary work of the Association has been largely increased during recent years as the accounts clearly show. Rifle shooting at Bisley is an ever increasing item, and the large number of shooters who visit Bisley outside the period of the annual meeting is always growing, and, therefore, add a due proportion to the labours of management. The rifle club organisation has introduced another department of business involving a large amount of correspondence and an infinity of small transactions, of which the report gives but a very slight idea. The organisation of a miniature meeting, such as the one which was held towards the end of last year, represents another considerable item of extra work. Add to this the Boys' Bisley, and the arrangement of incidental matters that arise during the course of each year, and it will be evident that the total amount of work accomplished is remarkable in its scope. The most extraordinary feature of the report is that so much should be accomplished at so small a cost, and by so compact a body of honorary officers and permanent staff.

The Chamber of Commerce.—One cannot help reading with mixed feelings Mr. Martin Pulvermann's curious document, which was apparently received with thanks and commendation by his fellow members of the gun section of the London Chamber of Commerce. A good deal of the own-wrought sentimentality might have been expunged without spoiling his address as a business document addressed to business men. Had the suggestions been expanded and enlarged as regards their practical application some assistance might have been gained by way of showing how to tackle a somewhat difficult problem. If the young gunmaker is to be technically educated with special reference to the requirements of his calling it would be interesting to know whether the educational process should be directed towards giving him a species of general knowledge which would be useful for showroom use, or whether he is to be taught mechanical deftness with or without permanent employment at the bench as an end in view. In fact one would like very much to know what kind of gun instruction should be given, and how that instruction should be co-ordinated with a general technical training of the kind which is to be obtained at the existing colleges. A specific programme, even if submitted subject to considerable amendment, would have produced a definite basis to work upon, as distinguished from generalities in the clouds, such as seem inclined to defy the laws of gravity and so never come to earth. The reference to the efforts which have been made in Birmingham to tackle the same problem on a practical footing, and the condemnation of these efforts as an absolute failure, is manifestly unkind and probably untruthful.

Our Lecture on the Lagging of Shot Charges.—The late Mr. R. W. S. Griffith obtained fame of an enduring character by the many original experiments which he carried out. His gun pattern records on a revolving target have always proved interesting and instructive to the sportsman, although their full meaning has frequently not been appreciated. Mr. F. W. Jones has recently spent more time on the examination on Mr. Griffith's published results than they have probably ever before received, and, with certain slight exceptions, the more Mr. Griffith's results are examined the more valuable are found to be the truths which have hitherto been allowed to lie unnoticed for want of the right kind of analysis. It must not be forgotten that the original experiments were conducted a very long time ago if time is to be measured by the progress which has since been made. Later experiments have created values which did not then exist; and these values, and the meaning which can be attached to them, make it possible to regard Mr. Griffith's experiments in an entirely new light, a light which may have the effect of modifying sporting opinion in several respects. The chronograph is at times blamed because it measures one velocity for a charge of shot and not the three hundred velocities of the 300 pellets which compose the whole charge. But progress is best attained by adopting a constructive rather than a destructive policy, and there seems to be a promising field for research in determining why a shot charge has so much more lag than lateral spread, and whether when the causes have been defined, the ranks can be closed up, and a straggling march of pellets be converted into a broadside charge. A most valuable outcome of the attention which has recently been devoted to the subject is the definite proof by Mr. W. W. Watts that the lag of the pellets does not materially influence the number of shots striking a crossing object. However much the pellets may lag, their velocity is roughly ten times that of the crossing bird, and this makes the effective lag equivalent to very little more than the lateral spread of the charge. Mr. Jones, has, however, shown that lag is a very serious item when regarded from the point of view of penetration; but here again further work is necessary, because the sportsman is not so keenly interested in the relation of striking power between the first and the last pellet as in those composing the effective 70 or 80 per cent. of his charge.

THE DECLINE OF MATCH RIFLE SHOOTING.

WHATEVER conclusion the reader may derive from Major Richardson's allegations that target rifle shooting lacks the support it formerly received, one thing is certain. The match rifle, as fired with aperture sights from the prone position, is slowly but surely becoming a thing of the past. The following are amongst the possible and probable reasons for the decline of this department of rifle shooting:—

1. New blood is not forthcoming from amongst the landed and wealthy classes who formerly made it their hobby.
2. Competition by other sports.
3. Success is now dependent on greater technical knowledge than was formerly necessary.
4. The short life of modern rifles as instruments of extreme accuracy, and, therefore, the high cost of equipment.
5. The fact that few of its votaries practise sufficiently to maintain a suitable lead over the service rifle marksman.
6. The general prejudice which holds that the back position is unpractical.
7. The smallness of the rewards by way of prize money in relation to the cost of the amusement.
8. The improved instrumental means of determining the efficiency of rifles and bullets.

Against all these objections is the circumstance that the match rifle, as shot at 800, 900, 1000, and at times 1100 yards, is the most fascinating form of marksmanship which exists. Its importance from a technical standpoint is now greater than at any previous period in the history of firearms. Military rifles are given a ranging power which makes them effective from a military standpoint at distances double those above named as usual for target practice. The temporary signs of stability of design which marked the general adoption of smokeless powder and compound bullets, has now given rise to a restless world-wide search for a better specification. The crucial test of all the new bullets is of a kind which the match rifle alone can perform. No fixed rest or other inanimate instrument can let off shots at 1000 yards with any certainty concerning the results which are obtained. The match rifleman knows more than any instrument of the wind variations which influence the flight of his bullet, and he alone can say with scientific precision the exact elevation which is necessary to strike the target at any given distance.

Air resistance is the main controlling factor in all modern bullet designing. The mathematical factor n is a necessary item in every calculation of trajectory, and trajectory is air resistance, remaining velocity and striking energy all rolled into one. Dispersion, or angle of aberration as *Scloppetaria* has it, is also only to be determined by the match rifleman of experience, because he alone can say how much of the spread of his diagram is due to causes apart from the wind, weather and eccentricity of alignment. Match rifle shooting thus determines angle for all ranges with a precision which military sights will not permit. The match shooter is brought up on degrees and minutes and he thus cultivates the habit of thinking in the only unit which advances scientific knowledge of the weapon. Wind is estimated and allowed for on the same basis, and that this basis is the correct one to work upon was proved on the historic occasion when a representative team of British service riflemen placed themselves under the direction of Col. Fremantle, a match rifle user of note and experience. The volunteer shooters, practising day by day on the ranges, learnt to rely absolutely on the judgment and guidance of one who had gained his experience with scientifically graduated and adjustable sights. The volunteer shooting in the prone position learns to hold the rifle with a degree of steadiness affording ample evidence that the time devoted to practice has been well laid out. But the real point is that the match rifleman with the help of his more scientific equipment can actually get nearer to measuring the forces of nature than any other class of shot, and when it is understood that these measurements should form the basis of modern rifle and cartridge design, fresh cause is provided for regretting the passing of the match rifleman. The value of n is essentially an element of trajectory. Instruments may succeed in demonstrating this constant over short distances of travel near the muzzle, but shooting alone can show whether the value remains constant for all ranges. At the Enfield factory a most valuable piece of apparatus has been set up for timing the flight of a bullet when it has covered 600 yards of range. The factor for air resistance which has been deduced from the experiments so far made, is said to differ materially from the measured trajectory of bullet as compared with its calculated flight as based on this empirically determined constant. It may well be suggested that so long as our chief inspector of musketry is one of the most skilled match rifle shooters of the day the importance of this department of target test is not likely to be ignored. But, however, optimistical may be the tone adopted it must be remembered that Col. Hopton was a match rifle shooter before he became a chief inspector of musketry.

The number of shooters engaging in the sport is too small to give adequate field for the operation of the laws of selection. An odd dozen or so men in the very front rank, and possessing a degree of skill making their shooting results of real scientific value is far too few for the importance of the work they are capable of performing. Some kind of notice should certainly be taken of the match rifle marksman to ascertain whether his skill cannot be turned to practical account. To attempt to propound a working scheme is beside the present question; but one cannot help feeling that the Hythe School of Musketry affords a suitable field for inculcating into the best shots of the army the principles of laying and firing rifles by means of match sights. The merits of the system would become more widely known if the musketry instructor's training included the eye-opening process of learning to use match sights. A new field of research would be opened up for the volunteer officer who essays to know more than his ordinary routine of instruction makes clear. Perhaps amongst those who go to Hythe there is a suitable field for preaching the gospel of the match sight and so preserving for national use a faculty and an acquired art which is not likely to be superseded by instruments and scientific appliances for many years to come. An ingenious invention might supersede the testing capabilities of the match sight to-morrow, but pending its arrival the human equivalent should not be allowed to take its place amongst the lost species.

IMPORTANT CASE ON EXPLOSIVES.

AT Gray's Petty Sessions on Friday the 22nd ult., Messrs. Kynoch Ld. were summoned for failing to observe the terms of the licence under which they carried on the manufacture of explosives at their Thames factory. The offence consisted in having in one of their magazines 650 lbs. of blasting gelatine containing an unauthorized ingredient, to wit mercuric chloride, in other words corrosive sublimate.

Mr. R. F. Graham Campbell, instructed by Mr. Prynne prosecuted for the director of public prosecutions. Mr. Horace Avory, K.C. and Mr. Kearby defended.

In his opening speech prosecuting counsel pointed out that the presence of the ingredient complained of was contrary to the licences granted to the defendant Company, and the breach rendered them liable to the forfeiture of the explosive and to a fine not exceeding £50. This was no trivial matter involving a technical offence against the Explosives Act. It would be impossible for H.M. Inspectors of Explosives to carry on their work if their tests were rendered abortive by the use of masking ingredients. The defendants' action made it impossible to judge whether an explosive could be considered safe for storage and use. Moreover the use of mercury salts would enable explosives to pass the heat test, which is the sole method by which purity and stability are determined, notwithstanding that they might be so impure as to be liable to spontaneous ignition, thus constituting a public danger. The presence of mercury salts was not only objectionable on the ground that it rendered the heat test useless, but the material itself caused the deterioration of nitro explosives under storage. The purification of nitro cotton and nitro-glycerine cost time and money in order to attain the standard required by the Explosives Department. The use of mercuric chloride would enable a manufacturer to stop these operations at an early stage, and yet pass the required test; but this could only be done at the risk of danger from spontaneous combustion. Hitherto the detection of mercuric chloride in an explosive in amounts sufficient to "mask" the "heat test" but not to serve any useful purpose has been difficult. Dr. Dupré has, however, discovered a spectroscopic method which enables the presence of mercury to be detected in an explosive substance when the amount is so small as to defy chemical analysis.

Subsequent evidence showed that the method consists in placing the explosive in a tube, exhausting the air, and then, whilst heating the explosive near the temperature of boiling water, passing a spark from an induction coil through the free top part of the tube and observing its spectrum. If the explosive does not contain mercury only the hydrogen lines are observed, but if mercury is present the characteristic lines of mercury vapour are also seen, viz., two yellow lines, one green and one violet.

Captain Thomson said: That the defendants might have had trouble with the heat test, and instanced the rejection of a quantity of the defendants' cordite by the War Office because it had failed to stand the heat test. He suggested that Kynoch's might have used mercury salts to lessen their troubles. He further stated that if an antiseptic was required many substances will serve this purpose and at the same time be harmless, whereas mercuric chloride not only "masks" the heat test, but it also has an injurious influence on the stability of nitro-compounds. He had issued a warning to the trade that no nitro-cotton imported would be allowed containing mercury salts. One firm who found the nitro-cotton supplied to them did contain this ingredient had returned the material, and cancelled their contract on the grounds of fraud. Whenever the presence of mercury in a specimen of explosive was disclosed by spectroscopic analysis he should say the quantity would be sufficient to affect the heat test. He was present at the experiments conducted by Dr. Dupré, and was satisfied that the explosive under siezure contained mercury. He admitted that in some countries, including Germany, mercury was an authorized ingredient. Collodion cotton being used as the nitro cotton ingredient in blasting gelatine, it could if imported in a wet condition, pass into the country without the qualifying tests which are an essential preliminary to the granting of an import licence when such is required.

Dr. Dupré, F.R.S., and his two sons, F. H. Dupré and P. V. Dupré, described in detail the spectroscopic test, and gave evidence as to the behaviour of the explosive under seizure. The Doctor said that in his experience of 35 years he had never known an explosive substance which had fairly passed the heat test to ignite spontaneously on storage. Also that, whereas mercury does not mask the Guttmann heat test, there were other objections to this test one being its unreliability for nitro-glycerine compounds. The Abel heat test in his experience was the only reliable one at present known. He had never experienced any difficulty with guncotton in respect to the formation of mildew, and did not consider an antiseptic was necessary. He had witnessed the growth of mildew around a piece of string mixed up amongst guncotton, whilst the latter remained unaffected.

Sir William Ramsay, F.R.S. said he had tested the blasting gelatine and undoubtedly mercury was present. The maximum amount of mercury vapour present in the tube during the test is the thousandth part of a milligram in 10 C.C's, and as the test tube had a volume of about 20 C.C's, the four grms. of explosive forming the test must have contained at least twice the thousandth part of a milligram; but it may have contained many times this amount.

Dr. Farmer, acting superintendent of the Chemical Research Laboratory at Woolwich Arsenal, said he had tested the effect of the presence of mercuric chloride on the stability of nitro-cotton, using one per cent. of the mercury salt. It undoubtedly caused deterioration in the explosive. He said it was well known that mercuric chloride hydrolysed in the presence of moisture, producing hydrochloric acid, a substance which would injuriously affect any nitric-ester with which it is mixed, such as nitro-cotton and nitro-glycerine.

Captain Desborough, Captain Lloyd and Mr. J. W. Thomson of the Royal Gunpowder Factory, Waltham Abbey also gave evidence. The latter, who confirmed the presence of the mercury, also stated that during his long experience of the manufacture of explosives he had only seen mildew once or twice, and in each instance it was when the nitro cotton was in contact with wood; but he had never seen it in lined tanks.

The case was adjourned till 11 a.m. on Tuesday the 12th inst., when the prosecution have one more witness to call, before completing their evidence.

THE W.O.M. RIFLE.

B.S.A. Handbook for the War Office Miniature Rifle. Published by the Birmingham Small Arms Co., Ld., Small Heath, Birmingham. Price 6d.

At a very appropriate time the Birmingham Small Arms Co., Ld., have submitted a handbook for the new miniature rifle, such as certainly goes far beyond the ordinary conception of a trade pamphlet. The book as book it must be called, aims at giving the beginner the class of instruction which will be most useful to him as the possessor of one of these rifles. In carrying out this programme the five chapters of the book have been allocated so that the first deals with miniature rifle shooting from the club point of view; the second chapter briefly reviews the various forms of rifle action, and shows why the bolt pattern may be accepted as the logical outcome of what has gone before; the next chapter is devoted to a careful review of the actual mechanism of the new rifle, the idea evidently being to give the reader the kind of information which will enable him to appreciate not only the design and construction of the rifle itself, but also the sights and the means provided for their adjustment. The chapter which deals with the flight of the bullet is very appropriately divided into two sections, the first relating to trajectory and the effect of gravity on flight, and the second portion to the dispersion of the individual shots around the mean trajectory, that is to say the deviation which does not result from the working out of any particular law. Into the final chapter is condensed a good deal of general instruction, covering hints on shooting and the care of the rifle. This portion of the book is necessarily brief and sketchy in treatment, but on the other hand no vital item seems to have been omitted. So far, therefore, as regards the letterpress of the book the general scheme of treatment fully carries out the promise made in the title. The essential principles of a handbook have been carried out by imparting to the beginner the information which will suffice to guide him in his efforts to make a proper use of the rifle, and to learn something of the principles which its use will make clear. There can be no second opinion as to the excellence of the illustrations which interleave the printed pages of the book. Men of eminence in the rifle shooting world have given their assistance by acting as models; and the result is a series of pictures of personal interest, apart from the instruction they convey. Altogether there is good reason for believing that the handbook for the new rifle should achieve a considerable sale amongst the large number of persons who are interested in miniature rifle shooting under the War Office conditions of open military type sights.

THE STORAGE OF EXPLOSIVES.

The Storage of Blasting Explosives. Published by Nobel's Explosives Co., Ltd., 195, West George Street, Glasgow, N.B.

Nobel's Explosives Co., Ld., have been associated in the past with the production of pamphlets and other publications, of which a prominent feature has always been a remarkably high grade of printing work. The material contained in the pamphlet now under review is exceedingly well written, whilst at the same time so brief and condensed that the collaboration of the printer has been well utilized by displaying, in due accordance with their importance, the various items and paragraphs which constitute a most valuable code of instructions. However carefully the Explosives Act may be studied, the many users of explosives cannot be expected to read one paragraph against another, so as to achieve a precise and complete knowledge of the particular portion of the Act which concerns their own relation with explosives. The Nobel Company have accordingly taken pains to ascertain the particular points upon which their customers for blasting explosives need special guidance. Drawings are given showing alternative forms of stores; and these are accompanied by a builder's specification in correct phraseology, so that the non-technical person may build a store suitable for the purpose in view. As showing the consideration which the Nobel Company are in the habit of showing for their customers it may be mentioned that the various notices and instructions which must be affixed to stores and other places can be purchased from the Company, so ensuring at a small cost the most suitable thing for the purpose.

THE STATUS OF RIFLE SHOOTING.

National Rifle Shooting and the N.R.A. By Major P. W. Richardson. Published by Crowther and Goodman, 124, Fenchurch Street, London, E.C.

Major P. W. Richardson's pamphlet as above contains a masterly analysis of the statistics which are contained in the annual reports of the National Rifle Association. Surprised as one is to find that matters are not going quite as well as appears on the face of things the array of figures which are put forward provide conclusive proof that the leading volunteer competitions are not so well supported as in the past. The number of entries is yearly diminishing, and a series of graphical curves emphasises the all-round deterioration which is taking place. The author concludes from the comparisons he has established that rifle shooting is becoming more and more a game for experts, and that it is ceasing so far as the Bisley Meeting is concerned to attract tyros and others who have not yet achieved a front position as marksmen. Amongst the causes which are held to account for the change which is taking place are: first, the heavy cost of practice which falls on individual shoulders, and second, the circumstance that an increased proportion of the prize money goes into the hands of the best shots. On general grounds it is quite obvious that, while no one will for a moment admit that rifle shooting is in a bad way, there are many directions in which its national importance might be more widely recognised, thereby shifting the burden from private shoulders to those of the community at large. Just how effect can be given to such a principle it is difficult to determine off hand. The author's demands may not produce very definite results, but one thing at least is certain, viz., that his whole policy fits in very closely with the public sentiment that the marksman should be treated as a national asset, and that the way should be cleared for relieving him of those portions of his burden which are more properly a national than a private charge.

THE RANGING POWER OF EXPLOSION WAVES.

THE third and fourth part of volume XIII. of the Memorials des Poudres et Salpêtres, referred to in our last issue, contains several researches of more than ordinary interest. In this notice we propose to review one of them, viz., the article entitled: "The effects produced at a distance by explosions."

In reviewing all previous work on this subject and continuing the incomplete experiments of others the French authorities have made this subject their own. The method they adopted was to detonate varying amounts of different explosives and observe the effects on structures placed at various distances from the explosion. Incidentally they measured the velocity of the air-wave chronographically recording the time elapsing between the breaking of electric circuits passing through screens, lightly held upon terminals.

To obtain the relation of the weight of explosive and the force of the air-wave, screens requiring a definite effort to set them in motion, were placed at varying distances, and note was taken of the distance at which the air-wave only just moved the screen. The following relation was found correct, viz., the square of the safe distance is proportional to the weight of the explosive detonated. Thus, if a building is safe at a given distance from a magazine containing one ton of explosive, it would be equally safe at double the distance for four tons of explosives. Mounding was found to lessen the area of danger by a half, so that 100 yards without a mound is equivalent to 50 yards with a mound. It was also found that all high explosives have practically the same safe distance, the distance being double that found for black powder, *i.e.*, one ton of explosive, other than black powder, requires the same distance for equal safety as two tons of gunpowder.

The French authorities placed the effects of an explosion in three classes. I. The distruction of masonry. II. The rupture of wood panels and the breaking of plate glass. III. The removal of tiles and the occasional breaking of glass panes. The following relation was obtained, viz., if D is the distance in yards, W the weight of explosive in pounds, and C a constant for each class, then

$$D = C\sqrt{W}$$

For explosives other than gunpowder the values of C for the three classes are as follow:

Class I. $C = 3{\cdot}65$
" II. $C = 7{\cdot}30$
" III. $C = 10{\cdot}95$

As regards class II. the following are distances for immunity from the effects noted, viz., one ton 326 yards and ten tons 1030 yards. The Home Office regulations for these amounts of explosive, for dwelling houses without consent of owner, are 200 yards and 850 yards respectively. From this, it would appear that dwelling houses at not more than the distances specified by the Home Office from a building containing explosives, would have the windows broken and tiles removed if the whole of the contents were detonated. Experience shows that for the great majority of explosive substances an accidental ignition does not cause the detonation of the whole of the material in the building. It often burns without explosion, and when explosion or detonation does result a great part is consumed before the violent action is initiated. The Home Office distances have obviously been framed on accumulated experience, and in many respects the French experiments support the practice of our inspectors. For instance one pound of explosive other than gunpowder is the storage equivalent of two pounds of gunpowder. Again mounding doubles the amount of explosive allowed in a building not so enclosed. Both these instances of our Home Office rules are in accord with the French experiments. On the other hand it must be admitted that the distances enforced, between buildings containing explosives and buildings used for other purposes, according to these French experiments, only afford a certain degree of safety from injury. This is more especially the case in regard to buildings lying in the direction of the wind, when the necessary distance for any degree of safety is greatly enhanced. Interpretating the Home Office distances in the light of these experiments, it appears that buildings inside a factory and dwelling houses outside the factory "with the consent of owner" are afforded a degree of safety within class I., whilst dwelling houses "without consent of owner" and public buildings are afforded a safety greater than class I. but within class II.

As regards the velocity of the air-wave, that observed near the explosion was considerably in excess of sound, in fact nearly double, but the records showed a very rapid diminution of velocity till the rate of sound was reached, thus the explosion of 650 lbs. of gunpowder produced an air-wave which travelled at the velocity of sound at 100 yards from the explosion, although over the first 20 yards the wave was 1·5 times faster.

THIS VERY EFFECTIVE PROCESS ENGRAVING HAS BEEN REPRODUCED FROM MESSRS E. I. DUPONT'S CALENDAR FOR 1907.

ROUND THE TRADE.

Judgment was delivered in the single-trigger litigation on the 26th ult. The defendant was held not to have infringed Mr. Robertson's patent for single-trigger guns on the ground that this patent was invalidated by reason of its anticipation by the Baker three-pull mechanism. The Nobbs patent was held not to anticipate the Boss patent; because it failed to make an explicit description in the provisional of the three-pull principle on which it had been constructed. The Nobbs patent was accordingly held to be bad.

Our advertisement columns show that Messrs. Curtis's & Harvey have enjoyed the pleasing experience of seeing the Grand Prix at Monte Carlo won with Smokeless Diamond.

There has been registered under the name of "F. & S." a company with £20,000 capital, whose business is to acquire and turn to account certain patents, and to trade as explosives manufacturers and vendors.

An explosion which occurred at the Nobel factory at Ardeer on the 5th ult. caused the death of three persons and injury to two others. It seems that the accident happened whilst thawing a gutter which had frozen during the night.

The Franco-Russian Chemical Products and Explosives Company, with factories in Slavyanoserbsk in the government of Ekaterinoslav, and in Borovitchach in the government of Novgorod made a net profit of 66,638 roubles in its eleventh (1905-6) working year, compared with 72,157 roubles in the preceding year.

A very interesting aspect of the cup, which H.M. The Queen has presented to the Society of Miniature Rifle Clubs, is the circumstance as disclosed by Lord Roberts in a letter to the *Times*, that the conditions for its competition will include the compulsory and exclusive use of open sights. This Society has hitherto been identified with the policy of advocating aperture sights to the exclusion of more military models.

The Harrington & Richardson Arms Co. have favoured us with an interesting budget of matter which includes their yearly calendar, with a very effective colour print of a sporting incident. Of greater technical interest is their latest catalogue of revolvers, and single barrel shot guns, the latter presenting neat and harmonious lines. A more compact catalogue contains a selection of the material appearing in the larger edition.

Messrs. Gamage were summoned by the police at Clerkenwell for selling an air pistol without duly observing the provisions of the Pistols Act. In defence it was contended that the pistol was not a fire-arm within the meaning of the Act, and that the pistol was sold as a toy. The magistrate held that it was a toy capable of inflicting injury, and was to that extent a weapon, but it was not a fire-arm, and he dismissed the summons.

We have received from Westfälisch-Anhaltische Strengstoff A.-G. a most beautifully prepared pamphlet showing a most comprehensive series of views of their explosives factories. The illustrations display the most life-like scenes of the very large works and factories owned by the company, and as the descriptive matter is in English, copies are doubtless available for distribution in English-speaking countries. The head office of the company is 129-130 Potsdamerstrasse, Berlin W. 9.

Apart from the very full accounts which have appeared in the daily papers of the explosion at Woolwich in the small hours of Monday the 11th ult. no particulars of a special technical interest have become known. It is well understood that the accident originated in a magazine of the chemical research department where explosives are stored at high temperature to examine their behaviour under tropical conditions. An article in last month's issue of this journal gives an idea of the class of experiment which was there being made. A correspondent has written pointing out that the article in question contained the following passage:—"Experiments on a large scale are not only costly but dangerous."

We have been asked to mention that Messrs. B. R. Banks & Co., Ld., are now dealing direct with the trade for their well-known air-gun slugs, instead of through a wholesale agent only as hitherto.

Though mainly concerning the cycle industry, it is nevertheless interesting to note that the Birmingham Small Arms Company have absorbed the Eadie Manufacturing Co., Ld., a very large firm of manufacturers of cycle components.

The Secretary of the Gunmakers' Association has forwarded the copy of a resolution passed by his Executive recording the keen sorrow and sense of loss with which they received the news of the death of their solicitor, Mr. Reginald Woulfe.

Mr. Robert B. Pollitt may be expected shortly in this country, his term of service at the De Beers Explosives Works having been brought to an end for reasons which in no way impair the good relations which have always existed between Mr. Pollitt and the De Beers Company.

A very interesting note in the *Daily Express* of the 31st ult. describes the careful course of shooting tuition which the elder sons of H.R.H. the Prince of Wales have received at the hands of the head keeper of H.M. The King. It seems that "they learned the handling and mechanism of guns; and when they could load, unload and clean their weapons, Jackson taught them how to sight their game, how to aim and the proper moment for firing, and initiated them into the mysteries of wind allowance." The Bisley correspondent of our contemporary is probably responsible for the reference to wind allowance.

The Vienna correspondent of *The Standard* has discovered the rifle of the future, in the form of an automatic weapon over 2 lbs. lighter than the Mannlicher, which carries a large magazine reserve of cartridges in the stock, and can be converted from the existing model for a few shillings apiece. Wonderful as it is that so much can be achieved by the adaptation of an existing weapon the capacity to be stimulated by the marvellous gets gradually blunted, so that one awaits with calm demeanour the arrival of the latest addition to the procession of rifles of the future. One sometimes suspects that the procession is chronically subject to delays on the journey.

The financial newspapers have reprinted at length an article which appeared in the *Berliner Borsen Courier* alleging that an undue amount of the control of the Nobel-Dynamite Trust Company is vested in the British directors, notwithstanding that so much of the capital is held in Germany. The general impression the article seeks to convey is that the financial position of the Trust is far stronger than the accounts disclose, and that the past year has been one of unusual activity. It is not often that grievances are established against company directors for the solidity of the concerns they administer, but the warning is issued to prevent German investors from parting with their script on the English market.

The report and accounts of Messrs. Eley Bros., Ld., for last year show a net profit of £26,515, which, with the amount brought forward, gives £28,349 available. Interest on debentures and loans, and directors' remuneration absorb £4,483. The balance has been appropriated as follows:—5 per cent. dividend £12,500, various writings down of property and plant £7,018, leaving £4,348 to be carried forward. The balance sheet shows £300,000 of shares and debentures and £65,000 reserve account. Debts and profit and loss make the total on the liability side of the account £396,732. This is balanced on the asset side as follows:—Gray's Inn Road estate £50,000, Angel Road estate £79,233, Birmingham estate £5,620. The Farringdon Road property stands at £2,850, machinery and plant £46,599, stocks on hand £123,394, debts due to the Company £62,426, cash £26,031, bills £579. It is satisfactory to notice that notwithstanding the very large amount of property which is represented by an apparently moderate capital valuation the depreciation stands at a substantial percentage on the items which are subjected to such charges.

LECTURES TO YOUNG GUNMAKERS.

Written with the Collaboration of Mr. F. W. Jones.

XLII.—THE TAILING OF SHOT CHARGES.

IN our lecture of last month the late Mr. Griffith's experiments on the lag of shot charges, made twenty years ago, were subjected to a careful analysis. These experiments are the most complete ever made on this subject, and an interpretation of the results in terms of present day knowledge is certain to be instructive. Lecture XLI. contained a description of the apparatus used by Griffith, and gave an example of the method determining from the results the actual lag at 20 yards range. It will be remembered that to determine this lag it was found necessary to deduct the diameters of the stationary pattern from the elongated wheel pattern, and multiply the result by the ratio of the velocity of the pellets and wheel. Twenty years ago the terminal velocities of shot charges were not known with any degree of accuracy. Mr. Griffith, moreover, did not give any definite method for estimating either the true length of the pattern or the true time interval between the arrival of the first pellet and the last pellet, but the results he published contain the material requisite for determining these details. The figures in the present lecture may, therefore, be regarded as the first attempt to elucidate the theory underlying the Griffith experiments.

The first table contains the more important of Mr. Griffith's results. The second and third columns set forth the actual measurements of the wheel patterns. Griffith obtained the velocity of the front and back pellets by drawing lines at right angles to the length of the pattern through the first pellet, also through the last pellet of the first 5% of the charge, and similarly through the end pellet and the last but 10 pellet. The middle of these two intervals was taken as representing respectively the arrival of the first and last pellet of the total charge, and the separation of those two points the time interval calculated from the rate of movement of the wheel, viz., every six inches equalling the 400th part of a second. An examination of the first table here given will show that the velocity of the front pellets, both over the whole range and every ten yards interval are fairly consistent, but that the velocities attributed to the rear pellets are not so. Note, for instance, the low velocity over the first ten yards as compared with the velocity over ten to twenty yards.

Now there can be no doubt about taking the lag of the wheel pattern as equal to the length observed, less the diameter of the stationary pattern. This is at once obvious if one considers the length of the pattern when the wheel is at rest. The consequent lag is thus determined in inches, and the resulting distance multiplied by $\frac{1}{2400}$, the time for each inch of movement, will give the time interval in seconds separating the arrival of the first and last pellets. Mr. Griffith shot separate cartridges for each observation, and an assumption has to be made that the muzzle velocities of the cartridges were equal. The slight differences in muzzle velocity which necessarily occurred would not materially affect the lag. In Table II. a uniform velocity over 20 yards has accordingly been assumed, and the velocity over other ranges has been determined from figures published during recent few years in *The Field*. It was shown by that newspaper that the mean velocity as measured over 20 yards is the absolute velocity of the shot charge at 9½ yards, and the precise velocity at any other range can be determined by the use of Bashforth's tables for spherical shot.

In Table II. the 4th and 5th columns contain the range, and striking velocities as derived from the *Field* results already mentioned. It is remarkable to find that up to 40 yards Mr. Griffith's front pellet velocities, although determined with apparatus much inferior to the chronographic instruments in use to-day, are nevertheless almost identical with those accepted on all sides as true to-day. Beyond 40 yards Mr. Griffith recognized that he did not register the full length of the pattern, because the fastest pellets probably struck above the 48-in. orifice through which the measured portion of the pattern passed and the slowest below. This circumstance affords an obvious explanation of the discrepancies which are found to exist beyond 40 yards. So much for the front pellets. As regards the rear pellets several methods are available for estimating their velocity, and the following has been adopted. The wheel lag in inches as set forth in column three of Table II. multiplied by $\frac{1}{2400}$ gives the time separating the front and back pellets. If this is added to the time of transit of the front pellet, as calculated from the velocity the total time over the range is obtained and thus the velocity of the back pellet. The range velocities of the front pellet and the back pellet so calculated, were set out on squared paper. It was assumed that the whole shot charge left the muzzle at the same velocity, and also that the curves containing the two sets of points should be similar in form. For 20, 30 and 40 yards this is true, but beyond this distance the values obtained were, as anticipated, too high in velocity. Curiously enough the 10 yards results were all too low differing very little from those deduced from the 20 yards experiments. The lag at 10 yards is only of academic interest. In ignoring it the real problem will not be affected, but if at any future date experiments are repeated, and what is now dismissed as an anomaly again occurs an explanation must be found. The velocity curve of the back pellet having been drawn through the 20, 30 and 40 yards points, conforming with the well-known curve for the front pellet, the velocities in column 6 of Table II. were read off.

The real length of the pattern can now be obtained. If R equals the range in feet, t the time of passage over this range and l the real length of the pattern, in other words the lag then when the front pellet is just at the target the back pellet will be at $R-l$, and we have the following relation

$$v_1 = \frac{R}{t} \qquad v_2 = \frac{R - l}{t}.$$

Therefore

$$l = R\left(1 - \frac{v_2}{v_1}\right).$$

Where v_1 is the velocity of the front pellet over R and v_2 the velocity of the back pellet over $R-l$.

Now the curve of velocity of the back pellet gives the velocity over any distance, and as there is only one relation of v_2 and l there can be no difficulty in finding the actual value. An example will show this best. Take the results at 40 yards in the choke-barrel with 49 grs. Schultze. The velocity over this range is 914 f.-s. for the front pellet and 750 f.-s. for the back pellet. Assume for a first approximation

TABLE I.

SUMMARIZING MR. GRIFFITH'S FIGURES.

Gun and Cartridge.	Wheel Pattern in Inches.		Middle of First 5 % Pellets.		Middle of Last 10 Pellets.		Range.
	Length.	Diameter.	Velocity over Range.	Velocity over each 10 yards.	Velocity over Range.	Velocity over each 10 yards.	Yards.
42 grs. Schultze and 1⅛ ozs. in Cylinder Gun	33	16	1,128	1,128	784	784	10
	60	39	1,062	1,003	762	742	20
	90	48	963	810	706	615	30
	144	48	870	674	642	504	40
	162	48	784	561	603	488	50
	172	48	667	382	550	382	60
42 grs. Schultze and 1⅛ ozs. in Choke Gun	20	9	1,132	1,132	896	896	10
	40	21	1,073	1,020	852	813	20
	72	31	976	825	788.	684	30
	108	40	884	691	699	523	40
	144	48	802	584	644	489	50
	162	48	675	376	561	342	60
49 grs. Schultze and 1⅛ ozs. in Choke Gun	27	12	1,209	1,209	888	888	10
	50	29	1,124	1,048	841	798	20
	81	38	1,031	885	788	699	30
	117	48	938	737	704	564	40
	153	48	855	633	665	527	50
	162	48	756	478	606	418	60

TABLE II.

PARTICULARS DEDUCED FROM MR. GRIFFITH'S RESULTS.

Gun and Cartridge.	Range.	Lag on Wheel.	Velocity of Front Pellet.		Velocity of Back Pellet.		Actual Lag.
			Over the Range.	Striking Velocity.	Over the Range.	Striking Velocity.	
	Yards.	Inches.					Feet.
42 grs. Schultze and 1⅛ ozs. in Cylinder Gun	10	17	1,150	1,045	1,040	890	2·5
	20	21	1,060	877	903	700	6·9
	30	42	967	754	787	565	12·1
	40	96	877	656	692	460	16·6
	50	114	815	576	609	380	23·7
	60	123	754	509	537	300	28·8
42 grs. Schultze and 1⅛ ozs. in Choke Gun	10	11	1,160	1,055	1,048	917	2·8
	20	19	1,070	884	940	745	6·0
	30	41	975	759	822	600	10·6
	40	68	884	660	732	507	15·0
	50	96	822	580	650	432	21·0
	60	114	759	512	580	360	27·6
49 grs. Schultze and 1⅛ ozs. in Choke Gun	10	15	1,215	1,100	1,083	930	2·8
	20	21	1,120	914	963	730	7·0
	30	43	1,015	788	845	610	11·1
	40	69	914	679	750	520	15·6
	50	105	851	595	682	450	21·6
	60	114	788	524	630	390	28·2

that this latter figure is the velocity over $R-l$ range. A calculation gives $l = 21{\cdot}5$ feet and on looking up the curve 40 yards less 21·5 feet the range velocity is 816 f.-s. Now use this latter figure and do the sum again, and so on until the velocity assumed coincides with the velocity given by the curve for the $R-l$ estimated. In detail this example works out as follows:

v_1 is constant, viz. 914.

Assume $v_2 = 750$ then $l = 21{\cdot}5$ feet v_2 by curve $= 816$ f.-s.
" $= 816$ " $= 13{\cdot}0$ " " $= 787$ "
" $= 787$ " $= 16{\cdot}8$ " " $= 800$ "
" $= 800$ " $= 15{\cdot}0$ " " $= 794$ "
" $= 794$ " $= 15{\cdot}7$ " " $= 796$ "
" $= 796$ " $= 15{\cdot}6$ " " $= 796$ "

These calculations are quickly made with a slide rule the real length of lag being determined in less than five minutes.

Having obtained l the velocity over this distance is given at once on dividing by the time given from the lag on the wheel, thus:—Time from lag on wheel $= \frac{69}{2400}$ seconds, therefore velocity over lag $= \frac{15{\cdot}6 \times 2400}{69} = 543$ f.-s. This is the velocity at 40 yards less $\frac{15{\cdot}6}{2}$ feet. To obtain the terminal velocity at the different ranges the various velocities at the middle of the lags were set out on squared paper and a curve was drawn from which these terminal velocities were read. It was in this way that the figures in column 7 of Table II. were obtained.

The terminal velocity of the back pellet is practically the same as is given with No. 10 shot having the same velocity over 20 yards. It would seem that some of the pellets in a charge of No. 6 shot become deformed to such an extent that they offer to the air the same resistance as No. 10 pellets. It is reasonable to assume that this deformation exists in every degree, and that the air sorts them out much in the same way as corn is separated from chaff, dust and light seeds, in a winnowing machine, the process giving rise to the elongated distribution observed by Mr. Griffith twenty years ago. May it not be said that modern methods of testing the cartridge and the recognition of standards for the cap, powder and wads, which have produced such a high degree of excellency in these components, should now be applied to shot. The standardization of shot with respect to tailing of the charge is as important as that of the standardization of velocity for powder.

CHAMBER OF COMMERCE.

GUN AND AMMUNITION TRADE SECTION.

THE Annual Meeting was held on Thursday the 31st January, 1907, at 3 p.m., and there were present:—Mr. Edgar Harrison, in the chair, Messrs. Martin Pulvermann, H. J. Blanch, Henry A. A. Thorn, J. J. Salter, Frank Dyke, W. Mayes, S. R. Hollick, C. Whitehead and Robert Linday.

The minutes of the meeting of 30th October, 1906, were read and confirmed, subject to a clerical alteration.

Chairman's Statement.—The Chairman gave a short résumé of the work of the Section during the year. It had, he stated, increased its membership, and was progressing very favourably. Twelve meetings of the Section and its committees had been held during the year, and much good work had been done. He referred to the action taken to alter the Gun License Act, the Pistols Act, and the opposition to the new orders under the Indian Arms Act, the latest of which is now under the consideration of the authorities in India. There were many other matters to be dealt with, but what had been done had fully justified the formation of the Section.

Election of Officers.—Mr. Edgar Harrison was re-elected Chairman of the Section for the ensuing year, and Mr. Martin Pulvermann deputy chairman.

Enquiry into Condition of Trade.—The Chairman, on behalf of the Special Committee, presented an interim report as to the work of the Committee in connection with this enquiry, and the same was duly adopted. The Chairman stated that the work of preparing these statistics had been most arduous, and as the returns obtained were of great value to the trade, he hoped they would be printed and circulated. Mr. Thorn was also in favour of the report being issued in a complete form.

Austrian Proof Mark.—Some discussion took place in regard to this matter, Mr. Harrison pointing out the disability experienced by Englishmen as compared with Belgian and French manufacturers, when Mr. Pulvermann moved "That the Foreign Office be requested to take the necessary "steps with the Austrian Government so that the English "proof mark may be recognised in Austria, and *vice versa*, "that the Austrian Proof Mark may be recognized in this "country." The resolution was duly seconded and carried without dissent.

Technical Education.—Mr. Harrison stated that although he had placed the resolution as follows on the agenda, Mr. Pulvermann had been good enough to prepare a short memorandum on the subject, which he would ask him to read. His (the Chairman's) resolution, however, was as follows:—"That the requirements of the trade would be better fulfilled if there were established in London a system of Technical Education."

Mr. Pulvermann then read his memorandum to the meeting as follows:—

In proposing to give you a short address on education, particularly with reference to the gun and kindred trades, I hope to awaken in you a desire to establish by combined action evening classes, where everybody who desires to improve his knowledge both for the benefit of employer and employee can attend. Although we know that education alone is not the only factor to bring a man to the top of the tree, you will all no doubt recognize the advantages of a general and technical education. We have errand boys and other uneducated people who by means of their inborn talent and industry will have reached the top positions in life. These men have become rulers of countries, Generals, multi-millionaires, etc., but all have recognized that men less gifted than themselves can, not only considerably improve their position through a good education, but that they can assist more effectually those who are destined to be masters. At various times successful men have endowed schools and spent large sums of money for the benefit of those who wish to acquire knowledge, well knowing that by doing so they not only benefit themselves, but they also raise the standard of their less fortunate brethren, the standard of those less gifted than themselves.

If we survey the inhabitants of the globe we will find nations who have fostered education the most backward and often the most degraded *sic*. The same thing applies to industries. Manufacturers in this and other countries who have surrounded themselves with educated and skilled men have been the most successful, and all merchants who cater for the needs of consumers have found it impossible to establish great concerns without adequate skilled assistance.

It has been my lot to be connected for many years with the gun and kindred trades. I have travelled in a great many countries; I have come in personal contact with great and small mercantile concerns, and a great many powerful and small manufacturers. Everywhere I found the same story, that it is the success of the skilled man and the failure of the unskilled. To have skilled men you want in addition to the often indifferent training received in factories or merchants' offices, evening schools where a young man can improve himself. Now, gentlemen, have we in the gun trade an educational centre for the benefit of its members, and for the benefit of those who wish to engage in it? No, there is in Birmingham a school which has its doors closed to all except those who are working at the bench making guns during the day, and a select committee can either admit or exclude applicants according to their notions. This reminds me of the times when education was the monopoly of a few, but I venture to say that in these days of competition it is necessary to attract pupils, and not to turn them away. It will not surprise you to hear that the Birmingham school under its present rule is an absolute failure. Why not have such a gun school in London? There are manufacturing and trading interests in London, and if young lads from London, the country, Birmingham included, would like to come, the doors should be opened to all.

But gentlemen, besides the manufacturing interest there is the trading interest of the gun industry anxious to supply its consumers all the world over with what is required, and if the merchants can secure the services of commercially and technically trained men, trained in England, I venture to say that the manufacturing interest in England will considerably benefit. We have merchants, and plenty of them, who trade with every part of the globe, who would be only too pleased to draw from a gun school properly trained assistants, and these assistants will sell your goods. It is well known that the London County Council has been spending our money pretty freely, and have wisely established, amongst other things, technical schools. Why not ask them to have a gun school added?

The gun trade in this country is peculiar; interested in it are gunmakers, ironmongers, stores and exporters, etc. There is no cohesion in the trade. Every section has its own interests. Its influence hitherto with the various Governments has been nil, and adverse legislation has sprung up from time to time practically unopposed by a disunited trade, the trade has become a comparatively small one, and it is being driven from this country to others. Let us combine by means of this Section and bring again prosperity to the gun trade. Education will help us. If you attract pupils to your schools you will attract them to your interest.

The Chairman thanked Mr. Pulvermann for his excellent memorandum, and a discussion followed on the general question, Mr. Whitehead, Mr. Linday and others joining therein. A suggestion was put forward that certain technical schools in London should be asked to include instruction in gunmaking in the curriculum of their schools. It was ultimately decided, however, on the motion of Mr. Pulvermann, seconded by Mr. Whitehead, to refer the matter to the general committee to find out whether any workable scheme could be arranged, such committee to report to the Section at a future meeting.

Importation of Arms and Ammunition into Abyssinia.—The Chairman called the special attention of members to certain Government publications of recent date which were of interest to the trade.

On the motion of the Chairman, seconded by Mr. Hollick, Mr. Henry A. A. Thorn was unanimously added to the General Committee of the Section. A vote of thanks to the Chairman concluded the business.

INTERIM REPORT of the Committee of the Gun Trade Section of the Chamber appointed at a Meeting held on the 29th November, 1905, to the Section. Presented at the above Meeting.

The terms of the reference to your Committee were as follows:—To ascertain if the trade is in an advancing, stationary, or declining position. If stationary or declining, to inquire into the reason therefor and to consider what steps can be taken to generally improve these conditions.

Your committee have held many meetings, and are pleased to be able to present the following report based on voluminous figures and data, obtained from various sources, but principally from the export and import trade returns of the countries enumerated. The export trade of the United Kingdom in the goods to which the investigations have been referred, namely; arms, revolvers, cartridges, gunpowder, and percussion caps, shows on the whole no material increase or decrease having taken place for the years 1901 to 1905

inclusive, but an increase or favourable exception is shown in the filled cartridges. The import trade shows both an increase in arms, and a slight increase in filled cartridges, gunpowder and percussion caps, whilst revolvers show a very marked decrease.

As is generally known, all fire-arms have to be proved in this country, should they be made here, or sold with English names, etc., marked thereon; in addition thereto, fire-arms proved in certain foreign proof houses can be sold in this country without English indications. Your committee have applied to the London proof house, for returns, but as these are not published they have not been successful in obtaining them, but from information obtained, the committee have reason to believe that the number of proofs in latter years have declined. The Birmingham proof house publish statistics annually, a copy extending over some years has been furnished by the proof master, for which the committee desire to record their thanks.

From the Birmingham returns it will be seen that a decline is decidedly apparent. The proof house in Liége issue annual returns, the contents of which must be very gratifying to those engaged in the Belgium arms trade, showing as they do an almost continued increasing trade.

According to the Census returns, the number of workpeople employed as gunsmiths in 1901 shows an increase over 1891 of about 700 hands, but when it is considered that the Transvaal war was in progress, no doubt this increase is more than made up by the abnormal demand of the time. The number of workpeople similarly employed in Belgium in 1896 is shown in the returns. There was, however, a considerably larger number of workpeople employed in 1901, as compared with 1891, in the manufacture of gunpowder, guncotton and other explosive substances, in fact, the increase amounts to the respectable figure of about 68 per cent.

The Gun Licence Act shows annual augmentations in licences taken out, which increment your committee, however, consider is considerably due to the introduction of the Pistols Act of 1893, (*sic.*? 1903.) and not to the greater use of fire-arms, and furthermore to the same Act do they consider due the great decrease in the imports of revolvers.

Your committee regret to point out that the export trade in fire-arms, etc., of this country does not show an increase, whilst the export trade of the United States of America, and Belgium are progressing so favourably. Latterly the annual exports of fire arms from the United Kingdom total about £265,000 per annum, whilst the United States of America are £240,000 and Belgium £589,000, excluding revolvers valued at £160,000, or a total of £749,000.

The home gun trade on all hands would appear to have declined since the opening of the Boer war, entailing as it did a stringency of the money market combined with heavier taxation, which have undoubtedly left their mark on the resources of those that shoot, a sport which is enjoyed by many various sections of the community, but especially by the monied or particularly affected classes. However, it is expected that with returning prosperity the home trade will regain its former position if not interfered with deleteriously by further adverse legislation. The prospect of everyone being able to use the rifle in defence of the country naturally appeals directly to this section, although the authorities have not gone so far as to foster this pursuit by abolishing the 10s. tax on the use of the rifle. Members of certain rifle clubs under specific conditions are released from this tax. (*Signed*) EDGAR HARRISON, *Chairman of the Section* (Cogswell and Harrison, Ltd.), M. PULVERMANN (Martin Pulvermann & Co.), S. R. HOLLICK (Messrs. Chas. Osborne & Co.) W. DARLOW (Darlow, Ltd.), M. HIRST (C. G. Bonehill), ROBERT LINDAY (Eley Bros., Ltd.), THE SCHULTZE GUNPOWDER COMPANY.

·22 CALIBRE CARTRIDGE.

To the Editor of ARMS AND EXPLOSIVES.

SIR,—In reply to Mr. Barton's criticism of my letter about ·22 cal. cartridges, I should like first to point out that I was not making direct statements, but only giving my ideas, and at the same time asking for information. I was trying to explain why the ·22-7½-45 Winchester inside lubricated cartridge was just a fraction less accurate than the ·22 long-rifle outside lubricated cartridge; although the first named is no doubt the better designed cartridge. What is Mr. Barton's idea on this point? Perhaps if the ·22-7½-45 cartridge was loaded with either the 45-grain bullet or a 50-grain one and *smokeless* powder sufficient to give the bullet the same muzzle velocity as the ·22 long-rifle cartridge it would be a trifle more accurate, in fact, quite as accurate as the ·22 long rifle; and with a 50-grain bullet it could be used up to 200 yards rather more satisfactorily than the ·22 long-rifle with its 40-grain one. Up to the present the great disadvantage of the ·22 long-rifle cartridges has been that if you carry them in your pocket or drop them, the bullets seem to collect all the dirt in the neighbourhood, also, if you want to unload your rifle, the bullet is generally left in the barrel. Of course if the ordinary ·22 long-rifle cartridge can be loaded with smokeless powder and a non-lubricated bullet lightly crimped in the shell, to give as accurate results and to extract as easily (after being fired) as the black powder, lubricated uncrimped bullet cartridge, then it is not much use trying to improve the present inside lubricated ·22 Winchester cartridge.

Mr. Barton says in his letter *re* my idea that the priming composition might be equal in force to 2 grains of black powder, as follows "Why do not manufacturers put twice the charge of priming and only 2½ grains powder, thereby making the cartridges much cheaper, etc." To anyone with a knowledge of ballistics the reply to this is very simple, viz:—Fulminate of mercury is a detonating explosive not a propellant, and although a small quantity of it may be used as a propellant with a light bullet, a greater quantity would very likely burst a rim-fire shell at the rim, especially with such a heavy bullet as 40-grains. The bulleted cap, some makes of which are loaded solely with fulminate of mercury, has only a light bullet (usually spherical) of about 22 grains which has a muzzle-velocity much less than that of the ·22 long-rifle. Your correspondent in a previous paragraph really says this, as he remarks "Any increase of priming or strength of priming, instead of adding to the velocity, will do the reverse, viz., the igniting of the black powder too quickly, etc." and I quite agree with him on this point, that an increase of priming is in no way beneficial. When I wrote my letter I thought perhaps that indirectly the priming might assist the powder charge a little, a supposition justified by the circumstance that some makes of bulleted caps are only loaded with fulminate composition, and other makes have less of this and a small charge (about 1½ grains) of black

powder; so that in small quantities mercury fulminate is used as a propellant. I was much interested in Mr. Barton's theory as to how the unlubricated bullet of the K.N. ·22 cartridge may get its lubrication, after a few shots have been fired, from the products of the burnt powder and priming chemically acting on the lead fouling. Regarding the boring and rifling of ·22 cal. R.F. rifles for the long-rifle cartridge, I have lately been enquiring from both English and American makers and they vary in their boring from ·216 in. to ·218 in. and in depth of rifling from ·003½ in. to ·005 in. In their total diameter to the bottom of the grooves the finished rifles vary from ·224 in. to ·226 in. The different ammunition manufacturers make the bullets from ·223½ in. to ·224½ in.; so this perhaps explains why ammunition of one manufacturer will suit one make of rifle, or one particular rifle, better than another make. In the above measurements there is of course a manufacturing toleration of either way.

C. H. MANN.

Bradford.

APPLICATIONS FOR PATENTS.

JANUARY 21—FEBRUARY 16, 1907.

1,545. Appliances for Night Shooting. C. A. C. Batten.
1,601.* Automatic Pistols. F. T. Murray and J. Carter.
1,689. Firearms. P. Lister.
1,693. Projectile Firing. F. H. C. Nordhorst.
1,788. Cartridges. P. B. Richardson.
1,929. Targets. A. Blackmore.
1,939.* Sighting Apparatus for Rifles. O. Strohbach and A. Nemeth.
2,041. Gunnery Instruction Apparatus. A. S. Susmann and W. Vaughan.
2,045. Projectiles. J. B. Henderson.
2,059. Machine Gun Cartridge Feeder. M. von Otto.
2,094.* Ammunition Wagons. Fried. Krupp, A.-G. (Date of application in Germany, May 29, 1906).
2,149. Moving and Self-recording Shooting Gallery Apparatus. J. Sutherland.
2,180. Telemeter. W. G. Gibbons.
2,221.* Gun Sighting Apparatus. Soc. Ame des Anciens Etablissements Hotchkiss & Co. (Date of application in France, February 16, 1906).
2,236.* Ordnance Sighting Telescopes. Fried. Krupp, A.-G. (Date of application in Germany, June 6, 1906).
2,286.* Explosives. H. N. Wessel (Date of application in Norway, February 7, 1906).
2,339. Gun Supports for Prone Position. J. Vuchetich & Paulus, B. Rauch.
2,341.* Ordnance. Fried. Krupp, A.-G. (Date of application in Germany, May 9, 1906).
2,418. Rifle Pull-throughs. F. Greener.
2,558. Gun Carriages. A. T. Dawson and G. T. Buckham.
2,589.* Rifle Sights. R. E. Reardon.
2,732. Gas Check for Firearms. T. Gilbert-Russell.
2,883. Rifle Practice Apparatus. F. Mitchell.
2,940. Tray for Delivering Air-Rifle Pellets from Automatic Machines. G. P. Workman.
2,983.* Automatic Electrical Targets. S. A. M. Rose and H. B. Crowle.
2,985.* Cartridge Cases. H. H. Lake.
3,004.* Ordnance Construction. H. C. L. Holden.
3,015. Cartridge Cases. T. Gilbert-Russell.
3,166.* Ordnance Projectiles. C. Grünwald (Date of application in Germany, April 24, 1906).
3,179.* Explosives. M. A. G. Himalaya (Date of application in U.S.A., February 16, 1906).
3,199.* Safety High Explosives. M. A. G. Himalaya.
3,200.* Strengthening Chlorated Explosives. M. A. G. Himalaya.
3,201.* Plastic and Safe High Explosives. M. A. G. Himalaya.
3,202.* Tundra Blasting Explosives. M. A. G. Himalaya.
3,220. Automatic Pistols and Rifles. G. F. Bouckley.
3,309.* Protecting Shields for Ordnance. Soc. Automobiles Charron Girardot et Voigt (Date of application in France, February 13, 1906).
3,319. Aiming Apparatus. G. Collins.
3,389. Pneumatic Run-out Gear for Ordnance. A. T. Dawson and J. Horne.
3,393.* Breeches for Machine Guns. F. R. C. von Stechow (Date of application in Germany, February 12, 1906).
3,420. Pneumatic Run-out Gear for Ordnance. A. T. Dawson and J. Horne.
3,422.* Magazine Small-Arms. A. Christophe and P. Menteyne (Date of application in France, May 7, 1906).
3,427. Projectiles. S. O. Cowper-Coles.
3,441. Rifle Cleaning Apparatus. E. Goodwin and Kynoch, Ld.
3,496.* Recoil-Loading Rifles. P. Mauser (Date of application in Germany, October 24, 1906).
3,498. Ordnance Loading Apparatus. A. T. Dawson and J. Horne.
3,584. Aiming Appliance. W. S. Freeman.
3,602. Ordnance Loading Apparatus. A. T. Dawson and J. Horne.
3,605. Ordnance Sighting Apparatus. A. T. Dawson and G. T. Buckham.
3,676.* Automatic Guns. T. K. North.
3,690. Ordnance Sighting Apparatus. A. F. Petch.
3,716. Rifle Practice Apparatus. F. Mitchell.
3,826. Artillery Instructional Device. W. A. Burns.
3,924. Gun Mountings. A. F. Petch and R. Redpath.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JANUARY 31—FEBRUARY 21, 1907.

COMPILED BY HENRY TARRANT.

1,573 (1906). **High Explosive Compounds.** G. Grobert, Switzerland. The patentee has discovered that if a volatile hydrocarbon and an animal fat such as suet be added to perchlorate of potassium or ammonium an explosive of greater power than usual is formed. The animal fat binds the hydrocarbon and prevents its evaporation. Accepted January 19, 1907.

2,985 (1906) **Chlorate Explosive Composition.** Dr. S. Laszczynski, Russian Poland. A chlorate explosive is formed by adding 10 % of petroleum to 90 % of chlorate of potassium or 12 % of petroleum to 88 % of sodium chlorate. These exact proportions must be observed in order to obtain the complete combustion and the best results. Explosives so made up can be detonated only by a 5-grain fulminate cap and therefore are claimed to be much safer than the known compounds in this class. Accepted January 17, 1907.

3,094 (1906). **Mounting of Ordnance.** A. T. Dawson and G. T. Buckham, London. The bending stress on the cradle during recoil of mountain guns is reduced by supporting the gun at the breech end by sliding blocks fitted to skids and at its forward end, as far to the rear of the muzzle as is practical, to a bracket affixed to skids. Accepted January 10, 1907.

3,094B (1906). **Recoil Brake for Ordnance.** A. T. Dawson and G. T. Buckham, London. In order to eliminate shock on the return after recoil of the barrel of ordnance the part capable of angular displacement (in that type of three-part buffer piston in which one part is fixed, another may be angularly adjusted, and the third part slides longitudinally) is situated between the fixed and sliding parts so that the flow of liquid is diminished both during recoil and return. Accepted January 24, 1907.

6,093 (1906). **Small Arm Stock.** W. F. Cole, U.S.A. The patentee has designed a stock for guns and rifles a narrow part only extending from the grip to the heel being of wood. The rest of the butt consists of a frame of metal and this construction is intended to lighten the complete gun. Accepted January 24, 1907.

6,355 (1906). **Ordnance Sight Apparatus.** B. T. Hamilton, Finchley, and L. Stroud, London. An improvement regarding the sighting device described in Patent No. 2,111 (1905) consists of the combination of a simple appliance with the controlling device for releasing the pinion of the adjuster from the rack on the sight bar so that rough adjustments may at once be made. Accepted Janury 24, 1907.

7,161 (1906). **Machine Guns.** A. T. Dawson and G. T. Buckham, London. In order to decrease the weight of the gun as a whole the water jacket is lightened by constructing it of thin corrugated steel. The surface exposed to the air is by this means increased Accepted January 10, 1907.

8,821 (1906) **Air Gun Target.** L. Jeffries, Birmingham. A target for indoor use is made so that the target and the bell device which are enclosed in a box-like arrangement may be easily got at. The box is for the purpose made to open on hinges fitted to the back. Accepted January 10, 1907.

8,848* (1906) **Low Density Compound Bullets.** H. W. Holland, London, and T. Woodward, Willesden.

9,437 (1906). **Bolt Action Miniature Rifles.** The Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman, Birmingham. The rifle described in this specification is constructed to meet the requirements of cadet corps, rifle clubs and similar bodies, and the bolt and firing mechanism are for this purpose designed to be manipulated in the same fashion as those of the actual service rifle. The rifle is intended to be used not only for target work, but also for military drill purposes. The bolt mechanism is arranged so that in closing the breech a cartridge such as the ·22 rim fire may be loaded straight into the chamber, and the bolt head is therefore made of smaller dimensions than the body of the bolt (which contains the main spring and striker) in order that it may work in a groove in the action body arranged in line with the breech and bore of the barrel. Accepted January 24, 1907.

10,882 (1906). **Combined Revolver, Walking Stick or Umbrella.** A revolver is attached to a walking stick or umbrella by means of a spring projection which fits into the barrel. The revolver is covered by a removeable shell handle the halves of which are held together by spring clips. Accepted January 10, 1907.

11,588 (1906). **Breech Plug for Fixed Barrel Air Rifles.** L. Jeffries, Birmingham. The rotatory breech plug of a fixed barrel air rifle is so constructed that by the removal of a screw cap it can be taken out of the rifle. The opposite wall to that in which the cap works is solid and a spring is made to take up wear. Accepted January 10, 1907.

12,426 (1906). **Clip Loader Holding Device for Magazine Rifles** H. T. Blanch, London. An attachment for magazine rifle such as the long Lee-Enfield which are not adapted for clip loading consists of a fork with a shank extending backwards for fixing to the bolt or bolt cover. The attachment turns with the bolt so that it lies out of the line of sight rear of the wood of the stock on the right hand side of the rifle. Accepted January 31, 1907.

12,715 (1906). **Ordnance Sighting.** Capt. G. Lanino, Italy. The backsight of ordnance need not be used if the idea described in this patent is adopted. The gunner's "dental plane" *i.e.*, of the upper jaw, is made to coincide with a certain level below the point usually occupied by the backsight. The level is raised or lowered to correspond with different ranges. Accepted January 24, 1907.

13,865 (1906). **Range Keepers.** A. T. Dawson, London, and J. Horne, Barrow. These improvements in range keepers apply to Patent No. 9,461, 1904. The modifications allow the keeper to register increased ranges whilst the display of figures on the dial is not cramped. Fine corrections may also be made by hand when fall of shot or range finder discovers an error. Accepted January 24, 1907.

14,373 (1906). **Fuse Apparatus.** H. P. Merriam, U.S.A. In a former Patent, No. 12,870, 1903, a fuse was described in which a series of centrifugally operated devices were used to arm the fuse. This device is simplified to render the working more efficient. Accepted January 10, 1907.

15,566 (1906). **Miniature Target Apparatus.** Col.-Sergt.-Instructor G. Collins, Manchester. By means of a cord running from the firing point to the butts a series of targets may be made either to disappear and re-appear or to run from one side of the butts to another. The string pulls the targets along against the resistance of a weight which serves to effect a return movement. Accepted January 17, 1907.

15,796 (1906). **Mechanical Time Fuses.** Capt. J. Pangher and E. M. Thomas, Austria. In order to avoid discrepancies due to the smaller circumference of the setting ring of mechanical time fuse, the setting wheel is connected to a disc provided with a spiral guide for a projection on the striker. By means of this projection the striker is kept in the cocked position until the projection slides off the end of the guide after having been several times the round of the setting disc. Accepted January 17, 1907.

16,523 (1906). **Ordnance Sighting Apparatus.** Rheinische Metallwaaren und Mf., Germany. In Patents Nos. 20,780, 1904, and 362, 1905, sighting apparatus and a sight turning appliance were described respectively. The apparatus applies to high angle guns the barrels of which may be elevated independently of the sights and certain improvements are set out in the present patent. Accepted January 17, 1907.

16,809 (1906). **Explosive Strip Cutting Machine.** J. T. Thompson, U.S.A. A machine is dealt with in this patent adapted to receive strips of explosives from another machine and to cut them into pieces of different sizes. The machine may be adjusted for different rates of strip delivery. Accepted January 17, 1907.

17,011* (1906). **Ammunition Store Rooms.** F. Fouché and A. Bochet, Paris.

19,641 (1906). **Cartridge Feed for Automatic Arms.** A. G. Bloxam, London (Agent for *Oesterreichesche Waffenfabriks Groselschaft, Upper Austria*). To allow a cartridge belt easily to be separated from an automatic gun, the feeding device is arranged in two parts coupled together and behind each other. The front part carries the feed wheel and the back part the rachet wheel and the coupling of the parts may easily be disengaged. Accepted January 17, 1907.

20,735 (1906). **Barrel Recoil Ordnance.** J. A. Deport, Paris By means of a double motion imparted through two pneumatic spring cylinders having their axis in a parallel plane but inverted relatively to each other a length of recoil is secured double that which can be obtained with a pneumatic spring having a single cylinder of the same length of either of the two cylinders and having together with its plunger a total length equal to both. Accepted January 24, 1907.

21,224 (1906). **Setting Appliance for Fuses.** Fried. Krupp, A.-G., Germany. A setting appliance too intricate briefly to be dealt with consists of two concentric setting devices capable of rotating relatively to each other to enable fuses to be set quickly and accurately. Accepted January 10, 1907.

21,240 (1906). **Chlorate Explosive Compound.** R. Weyel, Germany. A process for making explosives in plastic or granulated form (particularly nitroglycerine and chlorate compounds) consisting in treating the main constituents with products of formaldehyde and aromatic amines or phenty lamines. Explosives so heated are made safe to handle and are claimed to be non-susceptable to shocks. Accepted January 10, 1907.

23,836 (1906). **Sighting Device for Ordnance.** Fried. Krupp, A.-G., Germany. A supplementary sighting device is arranged for use when the ordinary sights of ordnance are rendered useless. It is simple, is laterally adjustable and is connected rigidly with the gun through an arc-shaped guide carrying a spirit level. Accepted January 17, 1907.

25,025 (1906). **Magazine for Pistols.** U. Pieper, Belgium. A catch to hold pistol magazines in position consists of a spring tongue adapted to force a projection into a recess in the wall of the magazine. A small lever operated by the fingers from without disengages the two when the magazine is to be removed. Accepted January 10, 1907.

26,001 (1906). **Electric Firing of Small Arms.** By the closure interruption of a primary circuit a current in a secondary circuit is interrupted at the ignition point and owing to sparking the cap of the small arm cartridge is exploded. A device is arranged to switch one barrel out and another barrel in when the appliance is used with double-barrelled small arms. Accepted 31, 1907.

26,749 (1906). **Automatic Pistol Mechanism.** The novel parts described in this specification of an automatic pistol consist mainly of a "flexible fork" breech block, and a "double beaked" tumbler. These parts are intended to simplify the construction of automatic small-arms. Accepted January 17 1907.

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

SELECTED PATENTS.

VENTILATING AMMUNITION STORE ROOMS.

17,011 (1906). F. Fouché and A. Bochet, Paris. This invention relates to insulating, ventilating and cooling ammunition store rooms, and is an improved form of the method which consists in providing double walls, the space between the walls forming a jacket through which an insulatiug medium such as air is caused to circulate. The improvement provides that not only is cooled air circulated through the jacket but a separate supply is introduced into the store room or chamber. The cooler has two compartments through which the air to be cooled is caused to flow by means of fans, and the air from the cooler having the lower temperature is supplied to the ammunition store room. Accepted January 10, 1907.

APPARATUS FOR TEACHING AIMING.

5,554 (1906). J. Rigby & Co. (gunmakers), Ld., and E. J. Rigby, London. The apparatus dealt with in this specification is so arranged that a rifle barrel carrying its own sights may be held between two supports, one of which is capable of being moved vertically or laterally. The sights may be trained on to a target, and novices taught how to aim. By rotating the barrel on its supports, the effect of sloping the sights can be practically illustrated.

The apparatus is depicted in the illustration appended. The support for the muzzle of the rifle (Figs. 1 and 2) consists of the stem *a*. At the end of this stem the cone *b* is provided, which is pushed into the muzzle by the spring *c*. The breech support is also coned, and the lug *d* (Fig. 4) is adapted to fit into the extractor way cut in the barrel to prevent the barrel turning relatively to the support. The handle *e* is provided so that the support may be turned in the collar *f*, which may be moved horizontally in the slotted plate guide *g* by means of the screw *h*. The guide plate *g* may be moved vertically in guides *j* fixed to the base *l* by means of the screw *i* (Fig. 3). The barrel supports are made hollow, so that a clear view may be obtained through the barrel.

An alternative arrangement is described in the specification, the pivots upon which the barrel is mounted being placed beneath the sights instead of at the end of the barrel. Accepted December 20, 1906.

LOW DENSITY COMPOUND BULLETS.

8,848 (1906). H. W. Holland and T. Woodward, London. The object of the present invention is to provide a construction of compound bullet of lower density than one composed of the ordinary cupro nickel jacket, and a lead core. The usual outer case is employed, but only the rear part is filled with heavy metal, the front part or nose being filled with light material such as wood.

Fig. 1

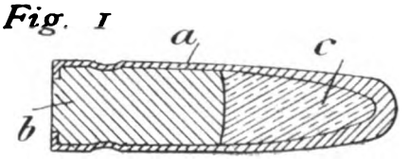
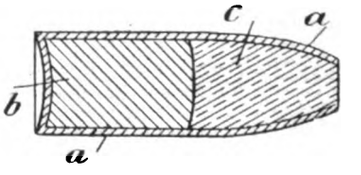


Fig. 2



The object of this special construction is to decrease the specific gravity of the projectile, at the same time retaining the ordinary length or even increasing the length, and thereby increasing the velocity of the projectile without increasing the pressure upon the interior of the small arm. Fig. 1 is a longitudinal section of a projectile for a military rifle constructed according to this invention, and Fig. 2 is a similar view of a sporting projectile. In these figures *a* is the nickel case, *b* is lead, and *c* is woad. In Fig. 1 the wood and lead are introduced at the rear of the case which is then closed by spinning, whilst in Fig. 2 they are introduced at the nose, the base being solid. There is only one claim in this patent, and the patentees therein set forth that what they claim is:—The combination of an outer case, a heavy filling for the rear portion of the case and a light filling for the front portion substantially as described. Accepted January 10, 1907.

Fig. 1

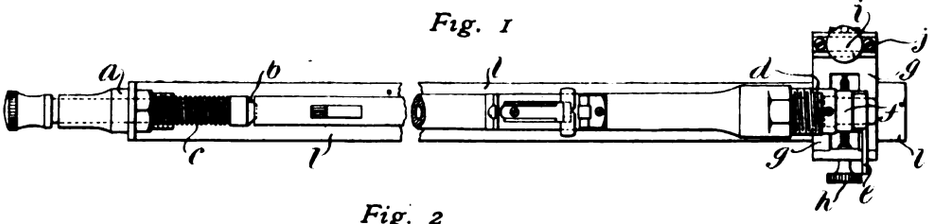


Fig. 2

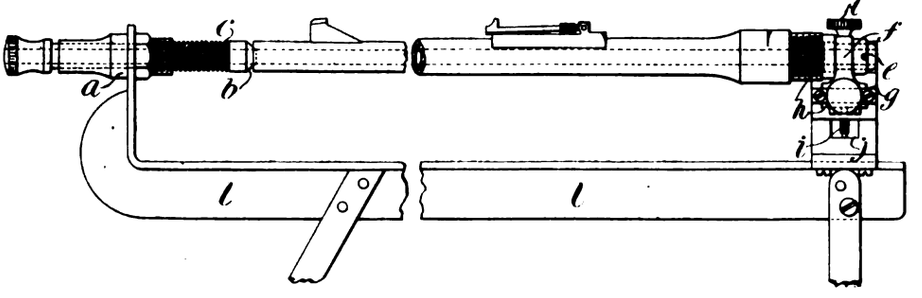
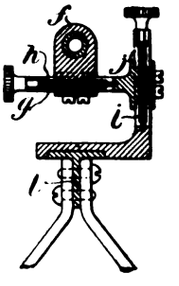


Fig. 4

Fig. 3



Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The New Service Sight.—Dr. H. T. Ashton, and his co-patentee Mr. J. J. Speed, are to be heartily congratulated on the exceedingly effective and ingenious sight which is described in this month's Selected Patents. The sight fitted to the new short rifle may have been fairly suitable for its purpose in the first form, previous to the demand for a wind-guage attachment, but with the added complication of a traversing movement the whole structure proved awkward and clumsy, both in mechanical design and practical manipulation. Screws which won't turn, a place for Tommy Atkins' thumb-nail when Tommy Atkins does not indulge in this luxury, and weird shapes of parts which constitute the despair of the machinist asked to manufacture them, combine to condemn the old sight as a cumbersome absurdity. In the new design ample use seems to have been made of the intervening period for thought and reflection since the present sight was first put into use. The result is a sight which seems to contain a well arranged and minimum number of parts, combined with a simplicity of manipulation which will no doubt earn the regard of the rifleman. The essence of the invention appears to consist in abandoning the obvious longitudinal screw for giving fine adjustments to the slide which controls elevation, and replacing it with an indented rack along which a wormed nut works. Anyone who has handled Vernier sight adjusters and other pieces of mechanism in which a slide is moved up and down by a longitudinal screw of considerable length will know that it is almost impossible to make the screw so straight and so true that the same amount of friction is experienced at every part of the turn and at every point of adjustment. By converting the long screw from male to female the whole difficulty seems to be overcome, and we shall look forward with pleased anticipation to seeing the new sight in solid form, as distinguished from a patent illustration.

The Single-trigger Case.—One cannot help feeling glad that Mr. Purdey has been victorious in the proceedings which were taken against him for alleged infringement of a single-trigger patent. In most cases of this kind sympathy generally goes with the inventor who is fighting for the reward of his ingenuity; but in the present instance the plaintiff and the defendant are both patentees, and though the plaintiff sets himself in the position of being the aggrieved party that attitude seems hardly to accord with the circumstances. The plaintiff has enjoyed the uninterrupted benefit of his mechanism during the whole course of the patent's existence. With the help of the credit which has been freely accorded to him for his most ingenious idea, he has built up in the course of a very few years a fine business in the very best class of guns such as seems likely to give him a name with posterity which will rank like that of Manton does to-day. In a word he has made honour and fortune by the product of his ingenuity. As the outcome of the case we find that Mr. Purdey's single-trigger mechanism was in reality of the three-pull type and preceded that of the plaintiff, but that the patent is bad because it failed to give a proper description of the invention. Both patents are, however, bad on another ground, viz. the prior use by Baker of the three-pull principle. The case thus falls to the ground: surely a small result for the large cost involved. Mr. Purdey deserves every sympathy for the heavy outlay which has been forced upon him in the defence of proceedings which one cannot help feeling would have served

no useful purpose to anybody whichever way the decision had gone.

Technical Instruction in Birmingham.—Mr. W. L. Powell has always associated himself with public measures for improving the status of the trade to which he belongs. His inspiring speech on the occasion of the distribution of the prizes to the successful students at the school of gunmaking, contains many items which are worthy of more than passing mention. Uppermost amongst these was his reference to the lectures on the theoretical side of gunmaking which are shortly to be initiated. He suggested that these lectures would be of such a character that grown-up gunmakers would find it worth their while to attend these classes, and thereby turn to useful account the information placed at their disposal. When the question of technical education was first raised, an effort was made by this journal to deal in simple language with the scientific aspect of many of the questions which affected the construction and design of guns and ammunition. Our series of lectures to Young Gunmakers have now reached the amazing total of XLII in number; and although they suffer from the necessity to compress explanations, and from the disjointed treatment which could not well be avoided, they at least represent a sincere and earnest attempt to fill the absence amongst first-class text books of volumes relating to the science of gunnery. There are plenty of sound works which deal with the class of information which is useful to sportsmen; but few of these enter into the why and wherefore of things as a text book should. In the many hours of labour which have been devoted to the preparation of these lectures, it has often been obvious that the quality of the information given made them worthy of the attention of grown-up gunmakers. Especially is this the case in respect to those lectures which have been produced with the collaboration of Mr. Jones. Written words are however at the best only the text upon which verbal instruction should be based; and one may, therefore hope that in the lectures to be given, the dry-as-dust details will be elucidated by life-like illustrations and arguments. More than this our own lectures have necessarily covered the kind of ground which is most susceptible to the application of pure science. There must, however, be many details concerning the why and wherefore of gun mechanism and construction which can be elevated to a high scientific level when demonstrated by a practical gunmaker with the true scientist's mind. If the information is sound and based on exact reasoning, the ideas need not be expressed in what is vulgarly described as scientific jargon.

Mid-range Ammunition.—It would be impossible to over-state the importance of paying very close attention in the near future to the new rules issued by the National Rifle Association in connection with mid-range ammunition. Cartridges falling within the old short range specification included many brands of ammunition which were far more powerful than was necessary for producing accurate results at such a distance as 100 yards. At any rate for various reasons the ·22 long-rifle cartridge has become the accepted type of short range ammunition, and heavier loads are now excluded. Its sphere of usefulness undoubtedly extends to 100 yards, and surprisingly good results have been obtained at double this distance. Between the ·22 cartridge and the service cartridge there is a large gap which has never been adequately filled. That is to say there are several cartridges highly suitable for mid-range use, but their existence has not been recognised by competitions designed to test their qualities and emphasise their usefulness. The National Rifle Association introduces this year for the first time a competition for mid-range ammunition at 100, 200 and 500 yards, and cartridges are eligible to be used therein whose ballistics do not exceed the results given by a 200-grain nickel-base bullet, having an observed velocity of 1700 feet per second. It might be argued that a smaller energy equivalent than the 1300 ft.-lbs., which the above figures give, might have been adopted; but the question which the future must decide is whether mid-range ammunition will become a reduced charge loaded into the service bullet, or a special cartridge fired from a special rifle. The liberal margin allows full freedom of choice. Public convenience would doubtless be best served by the finding of a suitable specification to govern the reloading of the service cartridge case. The interests of the manufacturer will on the other hand forward the production of a special rifle and cartridge. The two might, for a while at any rate, exist side by side, and practical experience will in the end show which style of cartridge is best suited to the needs of marksmen and those responsible for providing range accommodation. For the time being two distinct lines of research are opened up; the one to find out a suitable reload charge for the service cartridge, and the other to develop the nickel-base style of cartridge, and ascertain whether special chambering and rifling produce advantages in the direction of accuracy and economy, whilst keeping the weight of bullet down for safety considerations.

The late M. Berthelot.—By the death of M. Marcellin Berthelot on March 18th, the world has lost one of her truly great men. He was a scientist of the very first order: his researches applied to most branches of science and at the same time he was distinguished in philosophy and politics. Berthelot was born in 1827 and at school distinguished himself in history and philosophy. In 1854 he made his reputation as a chemist by his researches on the action of acids on glycerine, and five years later was appointed a professor of organic chemistry. During the Seige of Paris he was President of the Scientific Defence Committee, and it was the experience gained then of the manufacture of explosives which turned his attention to thermo-chemistry as applied to explosives. His researches were published in his book entitled "Upon the Force of Gunpowder and Explosive Materials" (1872). This book was followed by two others of a more general character of two volumes each: Thermodynamics (1872) and Thermo-chemistry (1897). These works and his publications in scientific journals on the specific heat of gases at high temperatures and explosive subjects in general have done more to establish the fundamental truths underlying the theory of explosive action, than the publications of all other workers in the same field. When one considers that Berthelot's researches on explosives represent only a small part of his scientific work and that all his life he was an active politician, and since 1889 the perpetual Secretary of the Paris Academy of Sciences, may we not agree that his was one of the most powerful scientific brains that France, or for that matter the world, has ever produced.

THE STATE OF BRITISH PATENT LAW.

A debt of gratitude is due to the present Government, and to Mr. Lloyd George in particular, for the masterly fashion in which the difficulties of the existing patent law have been met by the proposed legislation which it is hoped will be carried without opposition. Mr. Lloyd George's speech in introducing his Bill reads like one of the many articles which have appeared in these columns during recent years pressing for reforms in the patent system. In fact as recently as February last year a hope was expressed that many reforms short of positive protection, notably, a revision of the present system of granting patents, might be introduced by the Liberal Government. Prominence has been given by the discussion of protectionist principles to the many disabilities under which British industry labours. One of the most palpable amongst these is the system under which foreign patents are taken out in this country, not as Mr. Lloyd George put it, for the purpose of working the patents in this country, but for the purpose of preventing their being worked. There was, he said, a still worse abuse, and on the whole he thought it was the worst of all.

The British inventor who took out a patent was very often a poor man who had been able to get his patent financed up to a certain point. After he had started and set up works and purchased machinery, there came a powerful foreign syndicate which had found that there was something in his patent which they imagined was covered by an invention they had already patented—for these patents were very often in exceedingly vague terms. This syndicate then brought to bear the whole machinery of their powerful organisation to crush the inventor. He was brought before the Court of first instance, and if he won there he was taken to the Court of Appeal, and then dragged up to the House of Lords, by which time all the capital he had been able to raise for the purpose of working his patent was expended in law costs, and the patent which ought to have been an encouragement to his ingenuity had simply become a trap to his ruin.

On the subject of compulsory licences it is proposed to simplify the procedure, so that a foreign patentee may take the choice between abandoning his patent, or initiating manufacture in connection therewith after a reasonable time has elapsed. Concerning another point it would be an impertinence to attempt to paraphrase the following eloquent recognition of an existing difficulty:—

Big foreign syndicates had one very effective way of destroying British industries. They first of all applied for patents on a very considerable scale. They suggested every possible combination which human ingenuity could possibly think of. These combinations the syndicates had not tried themselves. But the syndicates put them in their patents in obscure and vague terms so as to cover any possible invention that might be discovered afterwards in this country. What happened? A British inventor made a *bona fide* discovery. He attempts to patent it. He probably secures a patent. But the moment he did so this powerful foreign syndicate brought an action against him for infringement of patent. The result was that the poor British inventor, before there was time for his invention to take root, or to become a success, was simply overwhelmed by this tremendous combination. In that way many British industries had been wiped out.

It is really interesting to refer again to the article which has already been quoted. It was therein suggested that it might be possible to secure by indirect channels some of the advantages which protection might give. This point evidently struck the introducer of the new Bill in the course of his speech. He explained that he had not time to deal with the objection that his was a protective measure. He thought it was in the interests of free trade. He was not afraid of foreign competition as long as British trade was free to fight it. He would free British trade from impossible conditions abroad, and from equally stupid tariff systems at home. At the present moment many British industries were bound hand and foot by the working of the patent system. Many British industries had been completely wiped out by privileges conceded by British institutions to foreigners. He proposed that these bonds should be cut; and that the British industry should be made perfectly free to engage on equal terms in the severe struggle with its competitors. It is not surprising to find the report of the speech punctuated by references to the cheers with which each remark was greeted. No trade suffers more than that of gunmaking from the barbed entanglements which surround every new line of new research in firearms. We grant the foreigner an unrestricted field in which to prosecute his business, and it is difficult to be enterprising when we voluntarily grant monopolies to foreign manufacturers who do nothing in return beyond supplying the consumer with guns and rifles which ought in the nature of things to be made in this country which grants the patent rights to the inventors.

If the patent law can only be revised on the lines of Mr. Lloyd George's new Bill British industry as a whole will derive immense benefit. The increased manufacture of machine productions will give immense impetus to the kind of repeat work which is characteristic of many branches of gun manufacture. Typewriters, and a host of other forms of mechanism will be made in this country, and a class of operative will be encouraged whose existence will re-act on the prosperity of British gunmaking. At the present moment the number of factories turning out repeat work is not large enough to provide a sufficiently liquid supply of labour. The fluctuations of business, which necessarily exist, leave the employer in a difficulty when he wishes to increase his staff at short notice. In a like fashion when the supply of orders is on the down grade the workers who are thrown out of employment suffer great loss and inconvenience. With an increased area of production a better average can be struck, so that semi-skilled labour of the class referred to can be concentrated on those sections of manufacture where trade is brisk. Altogether the new law seems to provide an excellent example of the belief that intelligent study of trade conditions will call attention to cases where seemingly simple remedies may produce important results. Though there is no reason to suppose that the bill will receive opposition of a destructive kind, its various passages will need the most careful scrutiny to make sure that they shall have their intended effect. It is said for instance that a single one of a particular kind of cycle lamp is made each year in Canada from component parts supplied by the foreign manufacturer, and that a duly attested certificate that this one lamp has been made is held to comply with the law that the patent must be worked in the country. There are so many instances where technical acts of this kind entirely fail to carry out their intended purpose that it is to be hoped that the proposed reforms will not at the finish be held over till an amending act has been passed.

TECHNICAL INSTRUCTION IN BIRMINGHAM.

THE distribution of prizes to the successful students attending the technical instruction classes conducted under the auspices of the Birmingham gun trade took place last night, at the school in Whittall Street. Mr. A. A. Bonehill (chairman of the committee) presided, and among those present were Mr. W. L. Powell (chairman of the gun trade), Councillor Kelly, Messrs. J. C. Scott, T. Turner (proof master), W. P. Jones, C. R. Smith, J. S. Turner, F. C. Scott, A. A. Edwards, T. Busst, &c.

The Chairman said the committee hoped soon to be able to provide technical education on permanently progressive lines by arranging for the instruction to be given in the daytime instead of at night. It was obvious that two or three hours a week after the ordinary day's work was done was an unsatisfactory substitute for apprenticeship, and altogether inadequate for the realisation of the sound ideal set up in their charter. In one class six youths had made a record attendance, not having missed once during the whole session. He intended to give a prize next session to the youth who produced the best invention connected with gun-making. He should do that to encourage the youths to think and use their brains as well as their hands. Since the opening of the Technical School eighty-seven youths had followed the trade, a gratifying fact, which proved the value of the instruction given to the students.

The committee had also established a theoretical class, and they had decided to make it free and open to both young and old. He trusted, therefore, that every working member of the trade would take advantage of that class. Mr. W. L. Powell said that during the past session thirty-three pupils had attended the classes, as compared with thirty-five last year. That was satisfactory, but there was room for a few more youths, and he hoped there would be a larger attendance next year.

Mr. Powell then distributed the money prizes, the total value of which was £27 17s. 6d. Of that amount £16 7s. 6d. was for merit in work, and £11 10s. for attendance. He congratulated the prize-winners, and hoped the awards would be an encouragement to them to persevere in the work in which they were engaged. The prizes were provided by the gunmakers of Birmingham to induce the pupils to make good progress. They wanted the school to be successful, and that the pupils should become expert workmen in the gunmaking industry. It was an old business, and the committee were anxious that it should make such progress that Birmingham's reputation for gunmaking would always be maintained. On the motion of Councillor Kelly, seconded by Mr. J. S. Turner and supported by Mr. C. R. Smith, the Chairman was thanked for presiding. In reply the Chairman expressed the hope that the workmen, young and old, would always do their best, and never "scamp" their work. By producing good work they would be able to beat the foreigners, whose competition was now so severely felt. Within the last few months his firm had received orders from customers abroad for guns upon which would be stamped, "Made in England." Those customers had been buying foreign guns, but it was clear the foreigners' cheap rubbish would soon be discarded if the English workmen did their work in the most skilful manner possible.

THE GUNMAKING INDUSTRY.

FOR statesmanlike thinking and exceptional powers of reference the anonymous author or authors of "The Causes of Decay in a British Industry" would be hard to beat. Every gunmaker should make it his first duty to buy this book (Longmans, Green & Co., price 7s. 6d.), and to read every page of it with care and attention. Those who are convinced by its arguments will feel inclined to realise the whole of their assets, and to retire with such assured income from their safe investment as may be available. The others will endeavour to fix in their minds the lessons which this book teaches, and where possible they will promote better conditions than at present exist or otherwise seek to evade the evils which cannot be removed. The treatment adopted in the volume is mostly historical. The rise of the Birmingham gun trade is traced with singular effectiveness, and the various causes which had led to a decline of turnover and profit are carried back as far as possible to their ultimate sources. A feeling of pessimism pervades the whole volume, and the brighter sides of the picture seem at times to be deliberately avoided. The first chapter, for instance, professes to show the origin of the industry of gunmaking. Birmingham occupies the first place, Liége the second, but London is apparently nowhere—a strange omission in a book with an all-embracing title. If, for instance, Birmingham gunmakers raised their standard of workmanship so high that none of their competitors could reach it, a question naturally arises as to what has become of London. On the test of pure quality the London gun occupies a very high position; and whilst avoiding comparisons which are odious, it is only fair to recognise the existence of *bona fide* manufacturers, such as Purdey, Holland, Lancaster, Atkin, Boss, Lang, London Small Arms Company, and many others who in varying degrees directly employ a large amount of highly skilled labour. To dismiss the London trade with sundry cursory notices, such as the number of names appearing in the Post Office Directory, is to say the least, unhistorical.

The merit of the book lies, however, in other directions. The author must be praised for the mass of useful information which he so skilfully presents rather than for the obvious limitations of his horizon in other directions. He shows with a true manufacturer's eyes how each item of our advancing civilisation tends to regulate trade out of existence. Some of the causes are special to gunmaking, others are shared alike by the whole community—in fact, with the ability to make guns with a degree of skill and economy largely due to hereditary influences the opportunity is withheld by the combined operation of a multitude of small causes. A little pressure here, a pinch somewhere else, and the inability to reserve for our own benefit the credit of the high reputation which our products have earned, all these combine to reduce the level of output which should be Britain's share of the world's output. The author is never dull, and at times he breaks out into really pleasing phrases. For instance, in discussing certain phases of manufacturing policy he gives utterance to the following: "England's position as first amongst manufacturing countries was won by individual manufacturers who put all their eggs in one basket and took exceptional care of the basket." The author's intimate acquaintance with the history of every

kind of enactment, English or foreign, pertaining only to guns or to all goods alike stamps the whole book as the work of a man of unusual grasp of mind. Subjects, old and new, are presented with a clearness which even contemporary records do not possess, and one may fairly state that this is the text-book of the British gunmaking industry present and past. One can only hope that the future is brighter than one's frame of mind after reading the volume. Perhaps in adopting the manufacturer's standpoint the author has been quite consistent in not saying too much about the few odd oases where orders for guns can be gathered by the omniscient bagman.

THE CASE ON EXPLOSIVES.

ON the 12th ult., the Grays Magistrates concluded the hearing of the case against Messrs. Kynoch, for having added an unauthorized ingredient to their explosives, and imposed a fine of £25, also making an order for the forfeiture of the blasting gelatine under seizure. It will be remembered that in the first day's hearing, as reported in our last issue, the Home Office Inspectors in their action against Messrs. Kynoch, showed that mercuric chloride had been added to the explosive under seizure, so masking the heat test and rendering it abortive as a means of examining the explosive as to its stability. The presence of this unauthorized ingredient was proved by the evidence of various experts, including Dr. Dupré and his two sons, Sir William Ramsay, F.R.S., Dr. Farmer of the Chemical Research Laboratory, Woolwich Arsenal, and Mr. J. W. Thomson, chemist at the Royal Gunpowder Factory, Waltham Abbey.

In the further hearing of the case, which took place on the 12th ult., the first witness called was *Sir Frederick Nathan*, Superintendent of the R.G.F., Waltham Abbey. He stated that he had been at that factory for 14½ years, and had never heard, till in the Court on the previous occasion, that mercuric chloride should be added to explosives to increase their stability. He had made experiments with this substance, and had found that ·002 per cent. added to guncotton after it had received the third boiling, raised the heat test of a material, obviously not stable, from six to 21 minutes. The Dr. Will's test, showed that the nitro-cotton was equally as unstable after as before the addition of mercury salt. The presence of mercury thus enabled an unstable nitro-cotton to pass the Government heat test. The Government or Abel heat test, is in use and adopted in all countries except Norway, Sweden and Belgium. The Guttmann test was not reliable, especially in the presence of nitroglycerine. He had made comparative experiments with the Abel and the Guttmann heat tests. Sufficient of each explosive was taken for 12 tests, six with the one and six with the other, and the observed times in minutes were as follows:—

Explosive.	Abel.			Guttmann.		
	Maximum.	Minimum.	Difference.	Maximum.	Minimum.	Difference.
Guncotton	21	19	2	20	14	6
Nitroglycerine ...	28	27	1	19	11	8
Cordite	17	15	2	14	8	6
Blasting Gelatine...	23	21½	1½	18	14	4

The Guttmann test is irregular, and gives a shorter time for nitroglycerine and its compounds. He said that antiseptic material is used only for compressed guncotton, which has to be stored wet for an indefinite period, but never for explosives which are intended for immediate drying and making up. Should an antiseptic be required, carbolic acid is the material used in this country. He had never heard of antiseptic being used for nitroglycerine compounds. Nitroglycerine itself has a toxic action, and would act as an antiseptic. Mercuric chloride is undesirable in an explosive, because it gives rise to mercury, hydrochloric acid and chlorine. One could not actually prove that mercuric chloride would do harm to an explosive under storage, but one must assume that a thing is bad which theoretically might introduce a source of decomposition. In his opinion the Abel heat test was one rather for purity than stability. For stability it left much to be desired, except, of course, so far as stability resulted from purity. As regards any confliction of view between his present frame of mind and the opinions he expressed in 1901 regarding the Abel heat test, he had done a lot of work on the subject since then, and he now looks on this test as primarily one for purity, but under prescribed conditions one for stability also. In connection with the presence of mould on the outside of slabs of guncotton, he had found by test that the explosive so affected was just as stable as the inner parts of the same slab which were free from mould. He had accordingly formed the opinion that fungoid growth *per se* does not affect stability.

Mr. C. A. Barnard, in the employ of Messrs. Baird and Tatlock, proved the purchase by Messrs. Kynoch of the following quantities of mercuric chloride:—January, 1904, 2 lbs.; March 10th, 1904, 5 lbs.; and May 25th, 1904, 5 lbs.

Major Cooper-Key, H.M. Inspector of Explosives, stated that on the occasion of a visit to the Kynoch factory, he found in a miscellaneous store at the end of a range of cordite buildings, a jar marked "bichloride, 5 lbs., poison," a word preceding the word "bichloride" having been erased. He was told it contained carbonate of soda, and under cross-examination admitted that this might have been so.

Mr. Horace Avory, K.C., in opening the case for the defence, urged that the general tenour of the licence was for the protection of the public and those working in the building and its neighbourhood. An ingredient certainly cannot include a residue from a process of manufacture, but the prosecution were here asking that the rule shall read that manufacturers must not put things into explosives which will make it difficult to test for purity. The authorities would not take the trouble to find a proper means of making tests to overcome difficulties. The evidence had not shown that the material would have failed to pass the test had no mercury been present. He questioned the right of the Inspectors under the statute to impose the heat test as an obligatory term in the licence. In fact the heat test was nothing but a piece of red tape. From the way in which the case had gone, he submitted that to effect a conviction the plaintiffs must prove, first, that the explosive contained an unauthorised ingredient, second, that this ingredient effected the stability of the explosive, and, third, that the Home Office heat test had a statutory value. As regards the first point he submitted that the word "ingredient" could not be taken as meaning so small a proportion as one part in two million, which he contended was all the evidence had shewn existed;

because, if so, all explosives must contain unauthorised ingredients. In regard to the second point he held that none of the evidence had shown that mercuric chloride present in an explosive, to the amount proved to exist in the blasting gelatine, could exert any injurious effects. And in the matter of the third point he submitted that the authorised list had no statutory authority, but that even if it had the heat test memorandum had not. This was a criminal Court, and the defendant must receive the benefit of any doubt that might exist. He asked that the case should be decided on these points, but the Bench ruled that the hearing must proceed.

The first witness called was *Mr. W. J. Gold*, manager of the high explosives department of Messrs. Kynoch's. He stated that until about three years ago his Company used German nitro-cotton treated with antiseptic, and that this nitro-cotton contained mercury salts. Since then they commenced making their own guncotton, and they treated their explosives with mercury as an antiseptic, because the German material gave them excellent results. They used one gramme per 200 lbs., one part in 100,000. In the course of manufacture they produced nitroglycerine and nitro-cellulose, and they ensured its purity by means of the Abel heat test, but adopted higher limits than those of the Home Office, viz., for nitrocellulose 20 minutes at 170°F. and for nitroglycerine 15 minutes at 180°F. It was only after these tests had been passed that an explosive was allowed to be used. The mercuric chloride was added when incorporating the nitroglycerine and nitrocellulose with the other ingredients.

Under cross-examination the witness mentioned that he was the only representative of the Company present, and that he was not a chemist by profession. Counsel pressed for information on technical points, and asked why Mr. Cocking who had come down there by train the same morning was not in Court. The witness had not read the evidence at the previous hearing, and Mr. Cocking had conducted the correspondence with the Home Office. It did not fall within his duties to read the correspondence from the Home Office regarding the grave aspersions which the latter had put forward with respect to the quality of their explosives, and the charges that a masking agent had been used. Mr. Cocking had the matter in hand, and he did not interfere. The witness did not agree that mercuric chloride masks the heat test. A letter was laid before the witness in which Kynoch's denied the use of a masking agent, and in which they suggested that the explosive should be tested by two other tests of a kind which cannot be masked. The witness was not aware that the Abel heat test was used by the Government. The letter stated that the sample of guncotton which Captain Lloyd took was as good as they had ever made, and better than that produced at Waltham Abbey or any other factory. Pressed to explain wherein lay the superiority of the Kynoch guncotton, witness stated it was a manufacturing secret. Witness said it was the Company's chemists who advised the addition of mercuric chloride to blasting gelatine. They followed the German custom in so doing. Counsel: "No! The German custom is to add the material to cotton which is going to be stored wet. You added it to the blasting gelatine."

George Fleckney, head tester at Arklow, was called and showed that it was his business to apply a heat test to all explosives in course of manufacture, and those which did not pass the test were sent back for further purification.

Mr. A. T. Henry, clerk in the employ of Kynoch's, gave evidence that he went under instructions to the Thames factory, and drew samples of the explosives under seizure, and handed some of each for expert chemical examination to Messrs. Guttmann, Ballantyne and Macnab. Under cross-examination he admitted that the explosives from which the samples were taken were under seizure by the Home Office.

Mr. Horatio Ballantyne, chemist, said that mercuric chloride was the most powerful antiseptic known, one part in 800,000 being said to be effective as a germicide. It is 1,400 times stronger in this respect than carbolic acid. As regards Dr. Farmer's experiments with one per cent. of mercuric chloride, he denied that any deductions based thereon could be held to apply to explosives in which the proportion is one part in 100,000. He admitted that the heat test is affected by mercuric chloride if used in sufficient quantity. One part in 50,000 sends up the heat test about 10 minutes. He had tried samples of the explosive seized, and found by many tests that it was well made and perfectly stable. The masking effect of the mercuric chloride could be eliminated in the Abel heat test by the use of silver foil. If a piece of silver foil was placed in the test tube. an explosive treated with mercury gave the same test as another which had not been so treated. The Guttmann test was in his opinion quite suitable for testing nitroglycerine explosives. He had been able to make fungus grow on dry as well as wet guncotton.

Mr. William Macnab, chemist, stated that he had experimented with the sample of blasting gelatine which had been submitted to him, and the heat test was well over 10 minutes. Under a destruction test it behaved equally as well as other explosives. He had used the silver leaf and found that with this addition an ordinary test was obtained. He believed that mercuric chloride is used as a sterilizer, and it will act as such. It is reasonable enough to suppose that after manufacture blasting gelatine might become infected. One-tenth of one per cent. mercuric chloride would not have a deleterious effect. In his opinion one part in 800,000 would about represent the limit proportion to produce a sterilizing effect. He agreed that this substance if used in sufficient quantity would affect the heat test.

Mr. Oscar Guttmann said he understood that one part in 100,000 was used in the blasting gelatine under consideration. Asked whether it was a proper thing to put it in, he replied that he could quite understand the reason for so doing. The addition of mercuric chloride would do no harm; and after subjecting the sample of blasting gelatine to every possible test, he had arrived at the conclusion that it was a well made and stable product. Answering another question he stated it as his opinion that if a manufacturer thought an explosive to be liable to fungus growth he would be entitled to use a preventative. One part in 100,000 could not be regarded as an adulterant, because it could not be called an ingredient.

After retiring to consider the case, the chairman of the magistrates announced that the bench had decided to convict. A fine of £25 would be imposed, and the blasting gelatine would be forfeited. Mr. Horace Avory asked the bench to state a case for the High Court, as he had decided to appeal on the points of law upon which he had asked, earlier in the proceedings, to have the case dismissed. The bench agreed to do so, acting in concert with the counsel on either side.

ROUND THE TRADE.

It is understood that a successor will be appointed to the position of Clerk to the Gunmakers' Company, rendered vacant by the death of Mr. F. T. Aston, at the meeting of the Court which will be held on the 11th inst.

With reference to the liquidation of the Morris Tube Company the various assets are being scheduled, and the staff appointments have been terminated, so making it seem not to be the intention to re-organise the business as a going concern.

Mr. Robert B. Pollit mentions in a letter dated the 28th February last that he is leaving South Africa, and that, until further notice, all communications, etc., intended for him should be addressed c/o. Messrs. Gudgeons. Peecock and Prentice, Stowmarket, Suffolk.

Mr. Henry Atkin, who died in the early part of last month, was head of the gunmaking business of Henry Atkin, Ld. His loss is the more to be regretted in view of the circumstance that he was himself a practical gunmaker of first-rate ability, and one moreover who devoted his whole time and attention to the turning out of best guns.

The London Small Arms Co., Ld., have forwarded to this office one of the War Office miniature rifles which has been chambered for the short Morris tube cartridge. A good many shooters and corps prefer this cartridge to the ·22 on account of its more certain ignition and better extracting powers, and the L.S.A. Company have with characteristic energy laid themselves out to supply the demand.

Amongst the latest N.R.A. announcements is one that the War Office miniature rifle may be fitted with a V backsight instead of the U-shaped notch of the official pattern. It was of course a pity from the start that the War Office departed from the conventional V and barleycorn which, when all is said and done, represents the best combination of open sighting for a military and target rifle.

The report and accounts of the Roburite Explosives Co., Ld., show a net profit of £6,183, after deducting directors' fees, office expenses and other such charges. Ten per cent. dividend on the preference shares will be paid, and one per cent. on the ordinary shares. The reserve fund has been increased by the usual addition of ten per cent. of the net profits, whilst the carry forward has been increased from £1,380 to £1,422. The directors call attention in their report to the further decrease in trading profits due to the continued excessive competition in the explosives trade. Sir Vincent Caillard has retired from the Board, and Mr. A. O. Scott has been appointed to the vacant position.

The India Office has addressed the following communication to the Birmingham Chamber of Commerce:—"Having regard to the representations from manufacturers of and dealers in arms and ammunition, both in India and in England, that the recent orders prohibiting absolutely the importation into India of rifles of ·450 bore, have caused heavy loss and hardship to the trade and individuals, the Government of India, while adhering to their decision to stop the importation of such rifles, have consented to permit the importation for a reasonable period of sporting rifles of ·450 bore, which manufacturers can prove were ordered and actually under manufacture on September 11, 1906. The Secretary of State for India in Council accordingly gives notice that applications will be received by him, up to and including May 1 next, from dealers and manufacturers in the United Kingdom, for permission to import sporting rifles of ·450 bore, ordered direct from them, either by persons resident in India, or by other persons who intended to import such rifles into India when completed (provided that such persons were in every case persons exempted from the provisions of the Indian Arms Act, 1878, with regard to the carrying of arms). Applicants must in each case, when making application, furnish evidence of the *bona fides* of the order, and that the rifle was actually under construction on September 11, 1906."

The directors of the Birmingham Small Arms Co., Ld., have declared the usual interim dividend for the six months ended 31st January last, namely, at the rate of 5% on the Preference Shares, and 10% on the Ordinary Shares.

An interesting article in *Page's Weekly* describes in detail some of the plant of machinery which has just been delivered by Messrs. Greenwood & Batley. Ld., to an Italian firm who have undertaken the manufacture of the Italian pattern of military revolver.

In connection with Messrs. Curtis's & Harvey's success in winning the Grand Prix with their Smokeless Diamond powder it is interesting to note that *Le Tir Illustré*, in writing on the subject expresses the desire that this powder should be granted the right of being imported into France.

At an extraordinary general meeting of the Rexer Arms Co., Ld., called for the purpose of raising capital to acquire a motor business, the chairman mentioned that a considerable number of guns were in an advanced stage of manufacture, but that there had been a delay in securing the orders which were anticipated. The main resolution having been passed, a further one was carried altering the name to the Rexer Company.

The accounts of Messrs. Vickers, Sons & Maxim, Ld., show a profit of £629,905 after writing off £250,000 from the goodwill and patent item of half a million. Five per cent. on the preference and preferred stock, and 15 per cent. on the ordinary shares leave a balance of £218,801 to carry forward, this item being thus increased by £3,655. The directors report that they have acquired a quarter share in the torpedo business of Messrs. Whitehead & Company.

The *Esmeralda* with 20 tons of explosives on board seems to have enjoyed an unusual experience. She left South Wales for Portmadoc on the 4th February, and was forced to take shelter twice at Ilfracombe and later on in Milford Harbour. She again met bad weather, and the crew abandoned her and took refuge on another ship. She was discovered on the 5th ult. and was towed to Holyhead, the captain and crew then re-boarding the vessel they had previously abandoned.

It is with regret that we have to record the death of Mr. Charles Cage at his residence in Ramsgate on February 17th last. Mr. Cage was 76 years of age, and for nearly half a century he represented Messrs. John Hall & Son, a firm which now forms a part of the Curtis's & Harvey combination. The deceased gentleman was one of the old style of commercial traveller, being the intimate friend of the leading gunmakers and ammunition dealers throughout his round, which covered the south of England.

The report of Messrs. Walkers Parker & Co., Ld., states that the trading results for the year 1906 are satisfactory, in view of continued severe depression in the building trade and the high price of pig lead which has prevailed. The market has been affected by frequent fluctuations, quotations having ranged between £15 7s. 6d. in March last—the lowest price for the 12 months—and £20 2s. 6d. in December, which is the highest reached for some 30 years. This advance has been brought about by a shortage of supplies, resulting from an increased demand for the Continent and America, yet the consumption of lead in this country shows a shrinkage of some 25,000 tons as compared with 1905. Spot lead has of late been more plentiful. Further instalments, amounting to £1,358, have been written off the special expenditure on plant, incurred during 1904 and 1905, and the company's buildings and machinery maintained out of revenue. The net trading profits amount to £33,410, and after providing for debenture interest and other head office expenses there remains £10,174. To this must be added £10,317 brought forward after payment of the dividend of 3 per cent. declared at last general meeting, making together £20,492. In view of the increasing difficulty in financing the company, occasioned by the necessary provision of additional working capital for the purchase of raw material, the directors consider it inadvisable to recommend a dividend this year. The surplus land at Chester, although laid out and ready for sale, has not yet attracted purchasers, owing to the general stagnation in the building trade.

The directors of Armstrong, Whitworth & Co., Ld., recommend a dividend of two shillings per share for the six months which ended in December last, the present half-year's accounts carrying out the scheme of altering the end of the financial year from June to December. £102,944 is the amount carried forward.

Mr. W. Poppelreuter of 54 Portland Street, Manchester, has forwarded a sample of a new German oil for cleaning rifle barrels, entitled "Ballistole." From the printed matter, which has also been sent, it seems that the main constituent of this oil is pure mineral oil, and that special chemical means have been adopted for combining with it an alkaline ingredient.

A dissatisfied shareholder, who is evidently subject to strange delusions, has written to one of the financial papers complaining that the 20 per cent dividend which he might reasonably expect from his holding of Curtis's & Harvey shares has been cut down, because the directors have spent their enormous profits on the sale of gunpowder by doing nitroglycerine business at less than cost price.

Arrangements have been made for holding at Antwerp, under the patronage of the King of Belgium, an international exhibition of shooting and fishing. Monsieur Henri Quersin, the well-known sportsman and editor of the leading Belgian sporting paper, is prominently interesting himself in connection with the arrangements for the exhibition. A list of influential and important patrons and officers has been published. MM. C. Francotte and Jules Polain are the presidents of the shooting section.

With characteristic enterprise and ingenuity the Winchester Repeating Arms Company have just completed a new model of their automatic rifle which is designated the ·351 high-power model 1907 self-loading rifle. The bullet weighs 180 grains, and the muzzle velocity is quoted at 1,861 f.-s. Altogether it is a wonderful tribute to the inventive capacity of a private firm that it should thus prove able by continuous stages of development to make such material advances towards the epoch when automatic reloading may be expected to become general.

The report of the American "E.C." and "Schultze" Gunpowder Company, Ld., states that, after allowing for dividends paid to shareholders on March 31st and September 29th last, there remains at credit of profit and loss account a balance of £2,915. The directors now propose to pay a dividend for the six months to December 31st at the rate of 4 per cent. per annum, leaving to be carried forward £1,415. The directors recommend that, pursuant to the terms of the agreement between this company and the E. I. Dupont Company, this company should call upon the Dupont Company to buy up the whole of the shares of this company at the rate of 12s. 6d. per share. Under the terms of the agreement the purchase would be spread over a period of four years, commencing with the present year, and a resolution will be submitted to the meeting in regard to the board's proposal, which will include a provision which will assure that no preferential right shall be given to any shareholder.

The report of Messrs. Webley & Scott, Ld., for the fifteen months ended December 31st last, shows a net trading profit of £9,668 which has been arrived at after charging against the same £4,167 for upkeep and depreciation of plant, buildings, etc. The allocations of dividend are complicated by the period which the accounts cover and the change in the capital value of the shares, which was confirmed in April last. The preference dividend has, however, been paid in full up to the end of June last, the re-constructive expenses have been written off and £1,000 has been placed to reserve, leaving a nominal balance to be carried forward. It is pleasing to note that the accounts show a continuance of the wise policy of writing off depreciation from the various items of property shown in the balance sheet. Under the revised valuation of assets, as arranged under the re-construction scheme, the balance sheet is greatly improved in appearance, and the prospects of the Company are proportionately brighter.

THE FRENCH SMOKELESS SPORTING POWDERS.

The last issue of the *Memorials des Poudres et Salpêtres* contains an article by M. Lheure entitled "L'aptitude á l'explosion des Poudres Pyroxylées." The French shotgun powders in many respects resemble those in use in this country and therefore these investigatious of M. Lheure should be of interest to our readers. The experiments included: I. Estimations of the velocity of combustion in the open; II. The determination of the necessary weight of fulminate to effect detonation; and III. The determination of the shock necessary to explode. The experiments were conducted with the following French shotgun powders viz:

J powder, composed of: Nitrocellulose 83%, Ammonium Bichromate 14%, Potassium Bichromate 3%. This is a style of powder which there is no equivalent in this country.

T powder, a gelatinized flake powder manufactured from nitrocellulose only, of the very highest degree of nitration. The powders Cooppal II. and Shotgun Rifleite are well known powders in this country of practically the same nature as *T powder*.

M powder, composed of: Nitrocellulose 71%, Barium Nitrate 20%, Potassium Nitrate 5%, Camphor 3%, Gélose 1%. This powder is somewhat similar to our 33 grain powders.

S powder, consisting of: Nitrocellulose 65%, Barium Nitrate 29%, Potassium Nitrate 6%. The French equivalent of our 42 grain powders.

I. The determination of the velocity of combustion unconfined, was made in half-round tubes 79 inches long and of 0·7 inch diameter. The time of burning in this trough was determined by means of a chronograph. The following velocities were observed, black powder being included for comparision: Black Powder 8·85 f.-s., J 0·78 f.-s., T 0·25 f.-s., M 0·16 f.-s., S 0·14 f.-s. These figures may also be taken as proportional to the rate of inflammation of an ignited charge of powder.

II. All the powders were detonated by nearly the same weight of fulminate, viz., 0·5 grm. or a No. 3 detonator. The differences observed, which were slight, would place the susceptibility in the following order, viz., J. S. M. T.; the gelatinized T. powder being the most difficult to detonate. This quality of the explosives was also examined by detonating about a 2 oz. cartridge with a No 7. detonator and observing the maximum distance at which this detonated cartridge passed the detonation to a similar cartridge. The distances observed were as follow, viz: T powder 0·4 in., J 0·8 in., S 1·2 in., M 1·5 in. This also places the gelatinized T powder as the one the least likely to pass a detonation from cartridge to cartridge.

III. The tests made of the effects ot shock were very extensive. The method consisted in dropping a heavy weight from a height on the powder free and enclosed in various packages. To represent conditions which may arise in manufacture a 66 lb. weight was dropped about 18 feet, and to represent exceptional conditions a 630 lb. weight was dropped about 20 feet. With the light weight the powders propagated the detonation only with great difficulty and from this it was concluded that the probability of a detonation in the manufacture of these smokeless powders is remote. This conclusion receives support from the fact that up to this date these powders have never given an instance of detonation in manufacture. On the other hand, with the heavy weight the powders M. and S. when in tins, not only detonated, but also passed the detonation to adjoining tins, the powders J. and T. were however only decomposed with a great noise but without detonation. One can infer from this that a shock great enough to detonate a tin of the powders M. and S. might lead to the detonation of the bulk of the powder in tins, whereas the same shock with the powders J. and T. would lead to an inflammation only, this however may be of so rapid a nature as to give rise to an explosion, but of a less violent character than a true detonation.

JUDGMENT IN THE SINGLE TRIGGER CASE.

ROBERTSON *v.* PURDEY.

Mr. Justice Parker delivered judgment in this case on the 26th of February last, too late for more than a brief paragraph to be inserted in our last issue. As the case is of historical importance certain portions of the judgment are still worthy of being placed on record. The defence roughly divided itself into a consideration of the Nobbs' patent as an anticipation of that subsequently granted to Robertson, and to a careful scrutiny of the Baker gun as an anticipation of both patents. His Lordship accepted the existence of the Nobbs' three-pull mechanism as proved, but he found that the invention had been insufficiently described in the patent so as to disclose its true nature. He concluded a very careful consideration of the Nobbs' patent with the following finding :—

"I, therefore, hold that Nobbs' Letters Patent are invalid for insufficiency, the mechanism they describe being a two-pull mechanism which does not fulfil the object aimed at and is useless, and that the plea of prior grant fails on this ground. The question of variance from the provisional specification does not therefore arise."

As regards the portion of the judgment dealing with that aspect of the case on which the defence was successful, the best course seems to be to reproduce in full His Lordship's introductory statement and then to proceed at once with the analysis of the contentions arising out of the existence of the Baker mechanism. This course is accordingly now followed.

MR. JUSTICE PARKER.—In this action the plaintiff, as the registered owner of Letters Patent No. 22,894 of 1894 for improvements in drop-down guns, claims an injunction and damages in respect of certain alleged infringements. On the construction of the Letters Patent, the plaintiff is undoubtedly entitled to the relief he claims, if his Letters Patent be valid, and the question which I have to decide is whether they are valid.

The invention, for which the Letters Patent were granted, relates to the mechanism of single-trigger guns. On the 26th November, 1894, when the plaintiff filed his provisional specification, single-trigger guns had long been in the market, and one type, at any rate, was operated by means of two sears and a movable part which, on firing the right-hand barrel, was shifted to the position for acting on the sear of the left-hand barrel. These guns had not, however been an unqualified success, because it was found in practice that upon firing off the first barrel, the second barrel was frequently discharged involuntarily at practically the same time. The reason of this does not appear to have been generally known before, but is clearly indicated in the plaintiff's provisional specification. On firing the first barrel the recoil of the gun causes an involuntary and unconscious release of the trigger, followed by an involuntary and unconscious pull on the trigger. Upon the involuntary release the movable part in single-trigger guns, constructed as above described, commences to pass into the appropriate position for acting on the sear of the second barrel, and if, as not infrequently occurs, it reaches that position before the involuntary pull, the second barrel will be discharged by the involuntary pull. The plaintiff's invention consists in a device for obviating this defect by means of an interceptor acting in conjunction with the movable part and preventing the latter from getting into the position appropriate for acting on the sear of the second barrel until after the involuntary pull has occurred. The plaintiff describes, in his complete specification, and the drawings annexed thereto, a number of ingenious ways in which this interceptor may be introduced and operated. It will be enough to say that in each of them the sequence of events when the gun is fired is as follows : (1) First voluntary pull operating the sear of and discharging the right-hand barrel ; (2) the first or involuntary release upon which the movable part commences the movement which, but for the interceptor, would bring it into connection with the sear of the left-hand barrel and is brought up against the interceptor ; (3) the second or involuntary pull by which the interceptor is removed and the movable part left free to continue its movement towards the position necessary for actuating the sear of the left-hand barrel ; (4) the second or voluntary release ; and (5) the third or second voluntary pull by which the left-hand barrel is discharged. If the gun be operated without live cartridges, each event in the sequence can be clearly noted and the gun will be obviously a three-pull gun, but if the gun be fired with live cartridges, the first release and second pull will be unconscious, and the gun will appear to be a two-pull gun.

* * * * *

The last objection to the validity of the plaintiff's Letters Patent is prior user, founded on what I may call the Baker anticipation. In considering this part of the case I will begin by stating shortly the history of this alleged anticipation as described in the evidence of Baker, Leeson, Jones and Thorn. William Baker is, like Nobbs, a maker of parts of guns, which he sells to the trade, or fits to guns supplied to him for that purpose by the trade. In 1882 he invented an action, or the trigger part of an action, for single trigger guns, and consulted one Bentley, a gunmaker, who has since died, with a view to taking out a patent. Bentley thought well of Baker's device, and arranged to finance him in applying for Letters Patent, which, under the then law, involved considerable expense. Accordingly, on the 6th October, 1882, Baker and Bentley filed a provisional specification in respect of Baker's invention. It is clear from such specification that the invention consisted of a mechanism acting by means of a single trigger, two sears, and a sliding movable part, which, after firing the first barrel, proceeded to move into the position necessary for operating the sear of the second barrel. There is no reference to an interceptor, and a gun fitted with this mechanism would be a two-pull gun.

After the specification was filed, some negotiations took place between Bentley and Baker on the one hand, and Webley, a gun-maker, on the other hand, with a view to the sale of the invention to Webley. Such negotiations fell through, though Webley offered a substantial price. Meanwhile Baker proceeded with the manufacture of gun-actions or the trigger part of gun-actions, according to the invention in respect of which the provisional specification had been filed. When, however, the guns into which these actions or parts were fitted came to be tested, it was found that the second barrel was fired almost simultaneously with the first, and, apparently, after a single pull on the trigger only. Baker was told that the firing of the first barrel caused the second barrel to jar off, but having examined one of the guns at Bentley's, and satisfied himself that it was impossible that the firing of the first barrel could cause the second barrel to jar off, he came to the conclusion that the second barrel must be fired by an involuntary or unconscious pull on the trigger following an unconscious release, both due to the recoil of the gun, and on this footing he set himself to find a remedy. He says he did devise a remedy in the nature of an interceptor which, on the involuntary release, operated to intercept the movable part and prevent its coming into the position to operate the sear of the second barrel until after the involuntary pull had taken place. On Bentley's instructions he applied it to two actions or trigger parts of actions made for him in accordance with the provisional specification, and found to be defective. One of these actions or trigger parts was fitted into a hammerless gun which either belonged to Webley, or was sold to him by Bentley, and passed into Webley's possession. Of the other there is no trace. It appears that Webley sent the gun, which came into his posession so fitted, to W. R. Leeson, a gunmaker of Ashford. Leeson was called as a witness, and was quite clear that the gun so sent to him was a three-pull gun, which

worked by the involuntary pull releasing the intermediate mechanism, but he could not remember whether he examined the mechanism, or, if he did so, what its action was. On the 13th February, 1883, Leeson reported on the gun, but not favourably. This report appears to have been communicated by Webley to Bentley and by Bentley to Baker, and the two latter determined not to apply for Letters Patent in respect of Baker's device for remedying the defects in the mechanism, the subject matter of their provisional specification, and not to proceed with their application for Letters Patent in respect of such last mentioned mechanism. It is possible and not improbable that they were influenced in this determination by Leeson's report, but Baker says that their real reason was that Bentley did not think any three-pull single trigger gun would be a commercial success or likely to find favour with customers, possibly for the reasons mentioned by Mr. Thorn in his evidence. We hear nothing further of the gun supplied to Webley.

Baker, however, appears to have subsequently supplied two actions, or the trigger parts of two actions, made under the provisional specification of 1882, and altered so as to embody Baker's subsequently invented interceptor mechanism, to W P. Jones, a gunmaker, and one of Baker's trade customers. The first of these actions or trigger parts was made and supplied to Jones in the month of May, 1883, and was fitted by Jones into a gun which he was making to the order of Messrs. Carr Brothers, of Huddersfield, also gunmakers. Carr Brothers had ordered this gun for the purpose of showing it at an exhibition. It was produced at the trial, and is referred to in the evidence as the Carr gun. Its history is as follows : Jones having fitted it up with the action or trigger parts supplied by Baker, and tested it and found it satisfactory, showed it to Adams & Co., gunmakers of Finsbury, and sent it to Messrs. E. M. Reilly & Co., of Oxford Street, for inspection. He subsequently delivered it to Carr Brothers in discharge of their order to which I have already referred. There is no evidence as to whether the latter firm did or did not exhibit it as they apparently intended, or as to what other use they made of it. On the 4th January, 1888, it was still in the possession of Carr Brothers, and apart from the possibility that Randall saw it in 1894 or 1895, the next we hear of it is some time after the filing of the plaintiff's provisional specification when it was sent by Carr Brothers to Jones to be overhauled. Jones says that when it came back it was in the same condition, so far as its mechanism is concerned, as when he originally sold it. Jones sent it on to Baker and requested him to overhaul it. Baker says that when he got it from Jones the action and trigger work were in the same condition as when supplied by him to Jones, but was clogged with oil. Baker cleaned it, and, he thinks, renewed a spring, but he says he did not alter it in any way whatever. He returned it to Jones, who apparently sent it on to Carr Brothers. Mr. Thorn heard of it from Jones, and, appreciating its value as a possible anticipation of the plaintiff's patent, endeavoured to acquire it. Ultimately Jones repurchased it from Carr Brothers and sold it to Thorn, who has since had it in his possession. Jones says that when he sold it to Thorn the mechanism was in its original condition. Thorn says that he has never altered such mechanism in any way, and had frequently used the gun and finds it a success. The gun produced by Thorn is a three-pull gun with an intercepting mechanism admittedly such that if made and published prior to the plaintiff's provisional specification, it would anticipate the plaintiff's invention.

The second of the actions or trigger parts of actions which Baker supplied to Jones was made by Baker and so supplied in August, 1883. Jones fitted it into one of his guns which is in the evidence referred to as the Jones gun. Jones says, that from the time he assembled this gun to some date in 1896, he kept it in his warehouse, showed it to customers, and used it himself both in the field and for shooting clay pigeons, finding it a success. At some date in 1896 he sent it to Baker to be overhauled. Baker says that when it was so sent to him it was in precisely the same condition as to mechanism as when he supplied it. The reason Jones sent it to be overhauled was, that on one occasion when turning round to shoot to the left he had to give three conscious pulls before getting off the second barrel, in other words, he found the recoil insufficient to cause the involuntary release and involuntary pull on which its success depended, a defect similar to that mentioned by Leeson in the case of the Webley gun. Baker advised that the trigger-plate and trigger-work should be replaced by a new and stronger mechanism, the original plate and trigger-work having been weakened by the alteration necessary to introduce the interceptor. Accordingly, the original plate and trigger-work were removed and replaced by a new and stronger plate and new trigger-work. The parts removed were produced at the trial and marked W.B.3. The gun with the new plate and trigger-work being also produced and marked W.B.2. The new plate and trigger-work differ in certain details from the original plate and trigger-work, but are the same in principle. The original plate and trigger-work are the same as the plate and trigger-work in the Carr gun. Except that for some period he lent it to Thorn, Jones has since retained the gun, W.B.2, in his possession, and used the same, and he has also retained and he produced at the trial the original plate and trigger-work, W.B.3.

Now up to this point I have, with regard to the alleged Baker anticipations, dealt only with the evidence of Baker, Jones, Leeson and Thorn, and it is, of course, entirely on the credibility of these witnesses that my findings of fact must turn. Now I agree with what Mr. Terrell urged, that when a patented invention such as the plaintiff's has immediately proved a commercial success, evidence of anticipation by a prior user must be examined with the greatest care and caution. On the other hand, if I am satisfied that the evidence of prior user is trustworthy evidence, I am not at liberty to disregard it merely because it was not attended with any commercial success at all, more especially if the want of such success can be otherwise explained. With regard to all the four witnesses in question, not being obliged to devote my attention to taking an accurate note of what they actually said, I had ample opportunity of observing their demeanour in the box and I am quite convinced that they are witnesses of truth, a belief which has since been confirmed by a careful examination of the shorthand notes of their evidence. With regard to Jones, Baker and Thorn, I cannot, I think, disregard their evidence in its most salient features without accusing them of something a good deal worse than inaccuracy, and, with regard to Leeson, he was one of the plaintiff's own witnesses. Starting with Leeson, we have it that the gun submitted to him by Webley was a three-pull gun, though Leeson cannot describe the precise nature of the mechanism. Baker who made this mechanism gives full particulars of it, and two other mechanisms are produced which Baker identifies as having been made by him and sold to Jones, and as having been made after the same pattern as the mechanism submitted by Webley to Leeson. It was suggested that these two mechanisms may have been altered since they were originally made by Baker, but there is no evidence whatever of such alteration ; and, having regard to the evidence of Jones, Baker and Thorn, I can only conclude that in the trigger parts of the Carr gun and in exhibit W.B.3, we have the actual things made by Baker in 1883, and that the mechanism in the gun tested by Leeson was constructed after the same pattern and on the same principle, and that the history of the Carr gun and the Jones gun is substantially as above stated from the evidence of Baker and Jones. Before, however, I pass from the evidence of those witnesses, I ought, perhaps, to deal with various points suggested in in cross-examination or put forward in argument. First it was asked why, if Baker made in 1883 so useful an invention, did he not at once patent it ? Baker's answer was that a patent then was too expensive for him, and Bentley did not think it would be a commercial success, and the criticism on Baker's answer was

that in 1883 he and Bentley did take out another patent in which they might have included the invention in question. Whether they could have done this, is, I think, extremely doubtful, but, even apart from Leeson's discouraging report, it seems to me that doubts as to the commercial success of a three-pull gun might be reasonably entertained. I am inclined to agree with Mr Thorn that in the shop there might be some difficulty in explaining to a customer that the action of the gun depended entirely on an involuntary pull, or clutch as Mr. Thorn described it, caused by his being unable to resist the gun's recoil, and that, therefore, many would prefer two-pull mechanisms. Secondly, it was pointed out that in 1895, after the plaintiff's provisional specification was filed, Jones and Baker applied for a patent in respect of a three pull gun with an interceptor, and, of course, in their application described the invention as new. The provisional specification filed on this application is undoubtedly wide enough to cover all three-pull guns worked with an interceptor, and is therefore, it was argued, quite inconsistent with any intercepting mechanism having been made and published by Baker before that date. This criticism is, I think, to some extent, a just one, but it seems to me to err in ascribing to Jones and Baker too complete a knowledge of the law Both Jones and Baker say that the invention which they desired to protect in 1895 was not a three-pull gun with an interceptor mechanism, but a particular sort of intercepting mechanism which they had then invented, and which is described in the complete specification of their 1895 Patent. The particular intercepting mechanism so described does as a fact differ materially from the interceptor mechanism in the Carr gun and W.B 3. It may be that their patent of 1895 could be objected to on the ground of variance or disconformity, but what I am really asked to do is to look upon the provisional specification of such patent, coupled with the application on which it was filed, as an admission that neither Jones nor Baker knew of any anterior intercepting mechanism at all, and therefore their story as to Baker's 1883 invention is untrue. I cannot do this unless I ascribe to them a somewhat extensive knowledge of the law as to variance or disconformity, more especially as I am satisfied that they knew when their 1895 provisional specification was filed that the plaintiff's gun was a three-pull gun.

Even if Jones and Baker had been applying for a patent in respect of the identical mechanism made by Baker in 1883, the strength of any criticism based on that fact would depend on their knowledge that what had happened to this mechanism since 1883 would avoid their patent, though, according to the argument of the plaintiff's counsel, there is at least a doubtful point of law. I cannot, therefore, give much weight to this criticism. Thirdly, Jones on cross-examination said that in 1883 he showed the gun we have called the Jones gun to Mr. Dudley Wilson, and that the latter fired it to test its action, and apparently found it satisfactory. Mr. Dudley Wilson was called on behalf of the plaintiff, and deposed that the gun shown to him was a two-pull gun He was sure of this, because he re-rembers snapping it off in the shop before firing it at the range. I rather gather that Mr. Dudley Wilson's evidence was relied on as suggesting that the Jones gun had been altered after 1893. Being unable to accept this suggestion, I think the discrepancy between Jones's evidence and that of Mr. Dudley Wilson can only be explained on the hypothesis rather that Jones is mistaken in thinking the gun he submitted to Mr. Dudley Wilson was the three-pull Jones gun, or that Mr. Dudley Wilson is mistaken in thinking that he ascertained the gun shown to him to be a two-pull gun by snapping it off in the shop On the whole, I rather incline to think that the mistake was on the part of Mr. Dudley Wilson. Even assuming, however, that the mistake was on the part of Jones, I cannot on that account alone disregard his evidence in other respects. Some stress was laid on the fact that Jones intimated that the mechanism was a new invention, but this may well be accounted for by the fact that it had not come into general use, and Mr. Dudley Wilson may have readily inferred that the invention was Jones's without the latter having intended to convey this inference. Fourthly, in 1893, Jones appears to have told Mr. Randall, a journalist, that he had a single-trigger gun which did not jar off the second barrel on firing the first, and that this was secured by the introduction of an intermediate release. Mr. Randall says that there was no mention of a three-pull mechanism, nor was any idea of such a mechanism conveyed to his mind. He did not see the gun. I do not think much importance can be attached to Mr. Randall's evidence in this respect, but it is curious that in Baker & Jones's 1895 complete specification the words "intermediate release mechanism" are used as describing a three-pull interceptor mechanism in single-trigger guns. Lastly, great stress was laid on Leeson's report. We know it was said that the Webley gun was faulty; we know that the Carr and Jones guns were after the same pattern. These must have been faulty too; therefore the Carr and Jones guns as produced must have been since altered or modified to remove the defect. It must be remembered, however, that the defect in the Webley gun may have been due to some mechanical imperfection in that particular gun, and not to any fault in principle. Baker, in making the mechanism of the Carr and Jones guns, after hearing of Leeson's report, may have paid greater attention to the perfection of the mechanism, and thereby secured the better result.

I have come, therefore, to the conclusion that I must accept the evidence of the four witnesses, Baker, Jones, Leeson, and Thorn, and accordingly I find that in 1883 Baker invented and made the mechanism in the Carr gun, the mechanism W.B 3, which was formerly in the Jones gun, and a similar mechanism which was fitted into the Webley gun and tested by Leeson, and that the history of each of these three guns, so far as we know it, is substantially as related above.

I have now therefore to consider whether as a matter of law these three guns were not only made but were used in such a way as to invalidate a patent for substantially the same invention granted in 1894. It was urged on behalf of the plaintiff that Baker's invention was abandoned before it passed out of the experimental stage. I agree that prior experimental user is not sufficient to invalidate a subsequent patent, but I have come to the conclusion that I cannot treat all that was done in this case as part of an abandoned experiment. Baker made four gun actions, or the trigger part of gun actions embodying his invention, and sold two to Bentley and two to Jones. I think that both Bentley and Jones ordered them in order to submit them to the trade, and that when they were so ordered and supplied the stage of experiment had passed. Bentley sold one specimen to Webley; Webley submitted it to Leeson. Even assuming that there existed between Baker and Bentley, between Bentley and Webley, and between Webley and Leeson a fiduciary relationship such as would preclude either Bentley, Webley, or Leeson from making use of the invention for their own purposes, still we have the two sales by Baker to Jones, who seems to have at that time been merely one of Baker's trade customers. Baker had already determined not to patent his invention, and, so far as I can see, there was nothing to preclude Jones from using the invention in such manner as he pleased without again consulting Baker. Similarly it does not appear to me that either Adams & Co. or Reilly & Co., who had full opportunity of ascertaining the nature of Baker's invention, could have been prevented from making such use of it as they chose. Similarly with Carr Bros., who bought the Carr gun from Jones. When Jones got the actions or trigger parts of actions from Baker his workmen assembled the guns in the usual way. There is no evidence of any secrecy or confidence in the matter. It was apparently done in the ordinary course of trade.

The Jones gun was kept in Jones' warehouse; he showed it to anyone who desired to see it; he made no secret of it; he used it himself both in the field and for shooting clay pigeons; and he continued to do so without secrecy or concealment right up to the time when the plaintiff's provisional specification was filed. Under these circumstances I come to the conclusion that Baker's invention was so used prior to the plaintiff's provisional specification as to amount to a publication, and that the plaintiff's patent is void on this ground.

I may add that though I have no doubt that the plaintiff and Nobbs independently invented the same thing at or about the same time, there being no satisfactory evidence as to which of them was really the prior inventor, I am not at all surprised that the plaintiff, having regard to Nobbs' specification, was not readily convinced of this. Indeed, the only way to explain the possibility of any draughtsman drawing these specifications with Nobbs' invention before him is on the hypothesis which we know to have been the fact that such person was blind, and did not grasp the intricacies of the gun he was describing, and could not verify or correct the drawings, which are exceedingly inaccurate by reference to the original. This would have been very unfortunate for Nobbs if the plaintiff's patent were not void on other grounds. As it is, both the plaintiff and Nobbs suffer the like misfortune in having been anticipated by Baker. In the result, therefore, the action fails.

APPLICATIONS FOR PATENTS.

FEBRUARY 18—MARCH 16, 1907.

4,131.* Recoil Brakes for Field Artillery. Soc. Ame. John Cockerill (Date of application in Belgium, April 27, 1906).
4,226. Ordnance Ammunition Hoists. A. T. Dawson and J. Horne.
4,255.* Training Device for Shooting. C. von Kropff.
4,275. Bullets. L. B. Taylor.
4,349. Control of Guns. Sir P. Scott and A. T. Dawson.
4,396. Sighting Telescopes. A. König.
4,414. Rifle Practice Apparatus. F. Mitchell.
4,437.* Securing Percussion Caps in Cartridges. H. H. Lake.
4,439.* Explosives. M. A. G. Himalaya (Date of Application in U.S.A., February 24, 1906).
4,493 Target Signalling Apparatus. F. Swarbrick.
4,588. Ordnance Ammunition Hoists. A. T. Dawson and J. Horne.
4,631.* Recoil Apparatus. G. Bellati.
4,657. Optical Squares for Range Finders. H. D. Taylor.
4,688.* Guns E. L. Zalinski and I. L. Rice.
4,721. Maxim Quick-Firing Guns. J. Esler.
4,736.* Safety Device for Pivotted Breech-Block Firearms. C. Francotte.
4,747.* Cartridges. P. Selbach.
4,796. Eye-Pieces for Gun-Sight Telescopes. H. A. Cutmore.
4,823.* Firearms. P. Mauser.
4,824. Air-Guns. J. H. Cox.
4,890. Turret Gun Mountings. A. T. Dawson and J. Horne.
4,903. Supplying Ammunition to Ordnance. A. F. Petch and R. H. Carpmael.
4,904. Loading Guns. A. F. Petch and R. H. Carpmael.
4,923.* Small Arms. T. C. Johnson (Date of application in U.S.A., April 21, 1906).
4,974. Firearm for Slaughtering Cattle. G. L. Derriman.
5,010.* Sight Guard for Rifles. E. C. R. Marks.
5,048. Laying Mechanism for Guns. F. Wigley and W. F. Slade.
5,112. Ordnance Aiming Apparatus G Forbes.
5,132.* Apparatus for Teaching Gunnery. M. Calderara (Date of application in Italy, March 3, 1906).
5,134. Projectiles. S. O. Cowper-Coles.
5,193.* Firearms. J. Kirchhoff.
5,232.* Case Shot for Shot Guns. B. Camet (Date of application in France, March 21, 1906).
5,237.* Gun-Sights. H. M. Cremer (Date of application in U.S.A., March 5, 1906).
5,284.* Pistols. C. A. Allison.
5,289.* Ordnance. Fried. Krupp, A.-G. (Date of application in Germany, June 26, 1906).
5,311. Ammunition. A. Bray.
5,355. Aiming Device. E. J. D. Newitt.
5,477. Electric Air-Gun Target. F. J. Grey.
5,525.* Means for Retaining Small Arms in a vertical position. B. G. Wilmer.
5,628.* Fluid-Pressure Brakes for Ordnance. Fried. Krupp, A.-G. (Date of application in Germany, June 26, 1906).
5,637. Automatic Guns. A. T. Dawson and G. T. Buckham.
5,664. Rifle Carrier for Cycles. F. Hall.
5,666.* Automatic Firearms. K. A. Bräuning.
5,693. Targets. C. H. Ross.
5,716. Ordnance Sighting Apparatus. A. T. Dawson and J. Horne.
5,725. Projectiles. E. Harrison.
5,742. Range Finders. A. F. Petch.
5,775. Capped Projectiles. F. T. Webster.
5,883. Ammunition Supply for Ordnance. A. F. Petch and F. Duncan.
5,965.* Ordnance Sights. P. M. Justice.
5,970.* Mechanism for Indicating the relative position of guns. W. D. Kilroy and Evershed and Vignoles, Ld.
5,982. Ordnance Sights. A. T. Dawson and J. Horne.
5,983. Ordnance Sights. G. Forbes.
6,004.* Anchoring Gun Carriages to the Ground. J. A. Deport.
6,041. Ordnance Telescopic Sights. O. Forstmann.
6,066.* Ordnance Sighting Device. Fried. Krupp, A.-G. (Date of application in Germany, June 30, 1906).
6,077.* Anchor Projectile. E. S. Clough and W. Williamson.
6,125.* Sight Protectors and Muzzle Covers. J. Lauber.
6,162. Drop-Down Small Arms. W. Baker.
6,170. Air-Guns. J. H. Cox.
6,222.* Small Arms Extractor and Ejector Mechanism. H. W Holland and T. Woodward.
6,277.* Ordnance Training and Firing Mechanism. P. M. Justice.
6,296.* Burst Shell Extractors. V. A. Obregon and J. R. Ingraw.
6,312. Barbette Mounting. A. F. Petch, F. Duncan and O. King.
6,373. Air-Gun Target. J. Williams and E. Lawrence.

* These Applications were accompanied by complete Specifications

SPECIFICATIONS PUBLISHED.

FEBRUARY 28—MARCH 14, 1907.

COMPILED BY HENRY TARRANT.

3,094A (1906). **Elevating Apparatus for Ordnance.** A. T. Dawson and G. T. Buckham, London. The elevating mechanism dealt with is a modified form of that set out in Patent No. 23,532, 1902. The bevel wheel of this type of mechanism is actuated from a shaft carrying an operating hand wheel at one end and a bevel pinion at the other. The movements of the oscillating bracket carrying the telescopic screws of the gear are not interfered with. Accepted February 7, 1907.

3,100 (1906). **Breech Mechanism of Ordnance.** A. T. Dawson, and G. T. Buckham, London. In guns mounted low down the breech mechanism of the sliding type moving horizontally, is adapted to be operated by a lever situated above the breech chamber with its spindle vertically arranged at one side of the chamber. The spindle carries the crank for operating the block as well as the extractors which are of special design. The firing mechanism is of the slip-lock type. Accepted February 7, 1907.

3,336 (1906). **Firing Mechanism of Ordnance.** A. T. Dawson, and G. T. Buckham, London. The firing device of breech mechanism of the swinging breech block type described in Patent 22,078, 1903, is modified so that the gun may be fired from the same side as the pivot on which the swinging carrier works. In order to allow of this the cam shaft and firing lever are modified. Accepted February 7, 1907.

4,114 (1906). **Nitrate of Ammonia Explosives.** E. Steele, Germany. To overcome the disadvantage due to the hygroscopic nature of ammonium nitrate explosives the compound set out in Patent No. 11,000, 1904, was invented. This is modified, and to 75 % to 90 % of nitrate of ammonia is added 25 % to 10 % of nitrated or dinitrated resin or a trinitrated mixture of resin and cereal or starch meal. The

compound is granulated by exposing it to the effects of atomized alcohol. Accepted February 14, 1907.

4,776 (1906). **Back Sight for Rifles**. H. T. Ashton and J. J. Speed, Enfield Lock. (See Selected Patents.)

7,039 (1906). **Breech Mechanism of Ordnance**. Sir W. G. Armstrong, Whitworth & Co., Ld., and A. G. Hadcock, Newcastle-on-Tyne. By an arrangement of mechanism mainly consisting of an "end plate" the breech block of ordnance of the interrupted screw type is unlocked and partially withdrawn in the most direct and effective manner. The plate moves rearward faster than the breech block during unlocking, and works particularly well with a breech block having threads as set out in Patent No. 25,444, 1897. Accepted February 7, 1907.

7,040 (1906). **Firing Mechanism of Ordnance**. Sir W. G. Armstrong, Whitworth & Co., Ld., and A. G. Hadcock, Newcastle-on-Tyne. In the event of a misfire the patentees provide a carrier in the lock of ordnance breech mechanism to carry a spare primer. This is automically inserted in the vent after the other has been extracted. Accepted February 7, 1907.

8,169 (1906). **Cleaning Rod for Small Arms**. W. Haynes, Radcliffe-on-Trent and F. G. Heath, Redditch. The end of a small-arm cleaning rod is provided with an elongated sort of needle eye to contain the tow or rag. The eye is not quite complete as at the back end the metal is turned in to form a hook to prevent the rag being pulled out after it has been inserted through the open rear. Accepted February 14, 1907.

8,280 (1906). **Ordnance Mechanism**. A. F. Petch and R. Redpath, London. To proscribe the usual extended movement of the firing handle of guns which extend a long way back from the trunnions, the handle is arranged on part of the mounting not partaking in the movement of the gun. It is connected with the breech and firing lever by means of links. Accepted February 14, 1907.

8,902 (1906). **Signalling Apparatus for Ordnance**. A. T. Dawson and G. T. Buckham. The dynamo electric transmitting and receiving signalling apparatus described in Patents Nos 29,422, 1904, and 4,741, 1905, is modified in many respects. The apparatus is used for signalling aiming instructions from the coning tower to gun layers. Accepted February 14, 1907.

11,195 (1906). **Sighting Apparatus for Ordnance**. G. Holmstrom, London, E Middleton, Sheffield and A. E. Mascall, London. A method of mounting duplex sighting apparatus of ordnance is set out in this patent and the intention is to do away with back lash or lost motion between the two without the aid of springs or similar devices. The two sets are carried by a rigid frame. Accepted February 7, 1907.

11,201 (1906). **Discs for Spring Trap Shooting**. W. P. Jones, Birmingham and J. F. Wheat, Haughton. (See Selected Patents.)

13,645 (1906). **Rifle Sights**. W. K. Gregory, Catford. A clamping device is employed in conjunction with the tangent sight leaf of the Lee-Enfield rifle, and by means of a small projection fitting into a hole in the wind gauge slide the latter may be moved mechanically by screw adjustment. The wind gauge slide referred to is that which was permitted for use in competition at the Bisley meeting last year. Accepted February 21, 1907.

13,684 (1906). **Percussion Fuses.** Sir W. G. Armstrong, Whitworth & Co., Ld., and Dr. W. H. Sardeau, Newcastle-on-Tyne. A guard ring surrounds the heads of two blade springs which project into the path of the percussion pellet in the fuse. A safety pin holds the ring in place and takes the place of the ordinary shearing pins. The guard ring is set back when the projectile is discharged, leaving the pellet free to force the springs aside and so reach the firing pin. Accepted February 14, 1907.

13,716 (1906). **Air Guns**. E. Jones, Perry Barr, and Kynoch, Ld., Birmingham. (See Selected Patents.)

14,556 (1906). **Air Gun Targets**. N. Hall, Birmingham. An air gun target in which not only is a bell rung when a shot strikes the bull, but a system of spring-controlled levers is caused to hoist a signal above the target. The apparatus is reset by means of a lever. Accepted February 21, 1907.

16,813 (1906). **Aiming Apparatus**. P. M. Justice, London. (Agent for *The Sub-Target Gun Co., U.S.A.*). Coin controlled mechanism is described in this patent for providing aiming practice with a pistol or revolver. The position the shot would have struck when the trigger was pulled is automatically indicated on the target although no projectile issues from the arm. Accepted Feb. 14, 1907.

16,975 (1906). **Firing Mechanism of Ordnance**. P. M. Justice, London. (Agent for *The Bethlehem Steel Co., U.S.A.*). The firing mechanism of ordnance is improved with a view to rendering premature firing impossible. Only the final locking movement of the block seats the primer, whilst the striker is locked only when the block is home. Accepted February 21, 1907.

20,675 (1906). **Automatic Pistol Mechanism**. F. R. C. von Stechow. To reduce the length and weight of an automatic pistol the breech block is mounted on a breech box which is made rigid with the barrel. The barrel drops on a pivot to allow of access to the parts from the underside of the box. Accepted February 21, 1907.

20,692 (1906). **Sighting Apparatus for Ordnance**. Fried. Krupp, A.-G., Germany. To obtain more accurate indications of the elevation adjustment of ordnance than by the means set out in Patent No. 8,473/99, a second pointer guided on an "elevation bar" is added to the indicating pointer connected with the sighting device. Accepted February 7, 1907.

23,615 (1906). **Adapter for Rifles**. G. Horsmans, Belgium. A solid adapter, shaped like the cartridge for which the rifle is chambered, is constructed to hold a miniature cartridge tightly so that the combination may be used in the magazine. Accepted February 21, 1907.

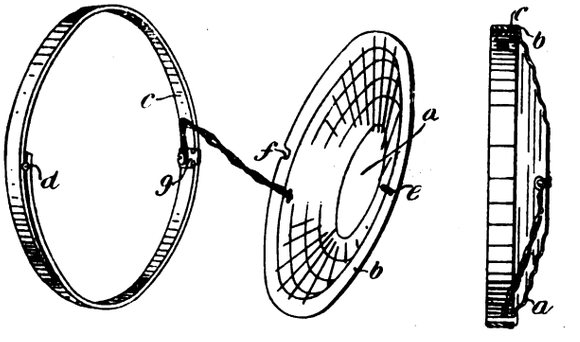
28,323 (1906). **Elevating Gear for Ordnance**. Fried. Krupp, A.-G., Germany. An arrangement for rapidly raising or lowering a gun consists of a toothed sector with an intermediate gear comprising a worm and worm wheel. The worm is provided with a second operating mechanism having an accelerated speed of transmission. Accepted February 14, 1907.

874 (1907). **Adapter Mechanism**. R. Wake, Wicklow. In Patent No. 9,293/03 is described an arranged to allow miniature rim-fire ammunition to be discharged from a tube inserted in the Service rifle. The present Patent deals with a spring extractor device adapted to withdraw the spent rim-fire cartridge from the breech adapter. Accepted February 21, 1907.

SELECTED PATENTS.

DISCS FOR SPRING TRAP SHOOTING.

11,201 (1906). W. P. Jones, Birmingham, and J. F. Wheat, Haughton near Stafford. Discs of the metallic kind used for spring trap shooting purposes are dealt with in this patent. An improved method is described of holding together the parts which separate when struck by shot and the force required to separate them may be adjusted.



The part *a* of the disc is formed of thin sheet metal of saucer shape and has an outside flange *b*, while the other part consists of the ring *c* made of spring metal of similar size to the flange *b*. The ring has overlapping ends between which is arranged the groove *d* to receive the peg *e* on the disc *a*. The pressure of the

spring ends on the peg when the parts are together may be increased or decreased by altering the distance between the ends by means of a screw set-pin. The opposite side of the disc is held in the ring by the engagement of the slot *f* on the periphery of the disc with the part *g* in the ring. The chain illustrated holds the two parts together when the device is struck.

The overlapping ends may, as is shown in the second illustration, be replaced by a solid ring and a supplementary spring attachment. Accepted February 14, 1907.

DROP-DOWN AIR-GUNS.

13,716 (1906). E. Jones, Perry Barr and Kynoch Ld., Witton. The invention described in this patent relates to air-guns of the break-down pattern, and its object is to provide means for sealing the joint between the air cylinder and the barrel when the gun is closed. A back sight of simple construction is also described.

At the breech end of the barrel *a* a conical projection *b* is formed and in the face of the cylinder *c* a recess is made to take the leather disc *d*. This disc is provided with an orifice through its centre for the passage of air and to prevent the pressure of the barrel causing the leather to spread, the orifice is lined with a flanged tube of thin metal, the flange being disposed at the rear of the disc. The forward end of the tube projects a short distance into the barrel and assists in making an air-tight joint when the gun is closed. The disc *d* as will be seen is provided with a conical recess in its face to take the conical protection on the end of the barrel.

Fig. 1

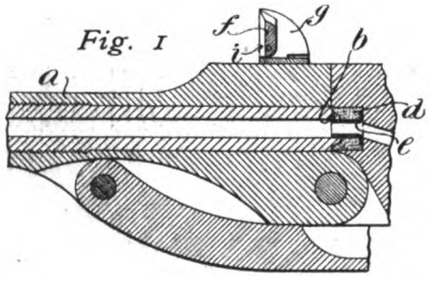


Fig. 3

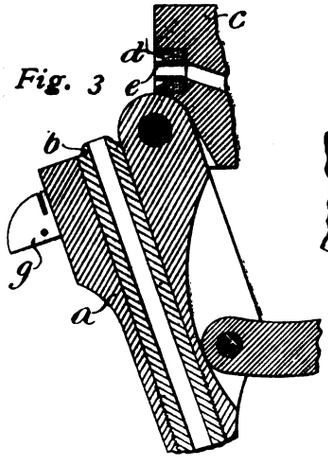
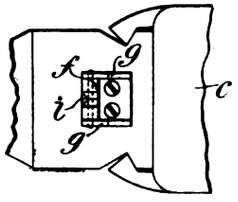


Fig. 2



The back sight consists of the metal leaf *f* which by means of a pivot is held friction tight between the two upright flange portions *g*. These flanges impose a spring-like pressure on the leaf *f* so that when moved on the pivot it may be held in any position between the vertical and the horizontal. The V notch *i* is provided on the top and is continued down the front of the leaf so that a clear sighting notch is exposed in any position of the sight leaf. Accepted February 21, 1907.

BACK SIGHT FOR RIFLES.

4,776 (1906). H. T. Ashton and J. J. Speed, Enfield Lock. In patent specification No. 6,743, 1903, granted to H. S. Watkin and J. J. Speed, is described a back sight for rifles such as is used on the short Lee-Enfield British Service Rifle. In the present patent a sight of similar description is dealt with, the main point of difference being that a fine and coarse elevation adjustment is provided, and, it is claimed, the modified sight is cheaper to manufacture.

Fig. 1

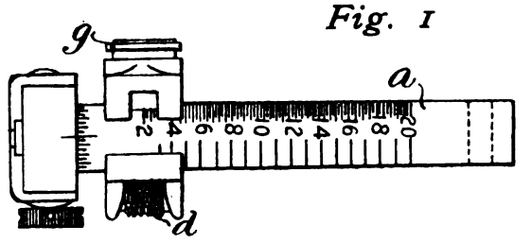


Fig. 2

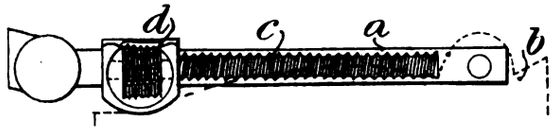
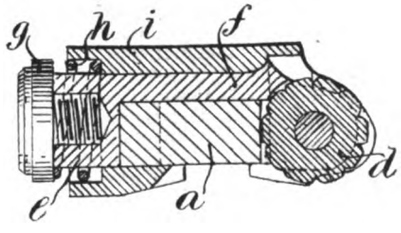


Fig. 3



In Fig. 1 a plan of the sight is illustrated, and from the side view (Fig. 2) the nut and toothed rack through which the fine elevation adjustment is obtained are clearly shown. The spring controlled part carrying the nut is illustrated in section in Fig. 3.

The leaf *a* of the sight is hinged to the bed *b*, and on one side of the leaf the toothed rack *c* is formed by cutting teeth in the side of its body. This rack it must be understood consists of a long threaded recess such as would be made by a screw if it were pressed against an impressionable material. The worm wheel *d* which is adapted to engage the threads of the rack is carried by the spring controlled part *e* and its shank *f*. The button *g* is screwed into the head *e* and the spring *h* having bearings on the body of the slide *i* and beneath the head *e* is so disposed that the carrier is caused to hold the worm wheel *d* normally in engagement with the rack. Pressure on the button *g* imparts lateral movement and the worm wheel is lifted out of its engagement with the rack so that the slide may be rapidly shifted along the leaf to make coarse adjustments. When the pressure on the button is removed the re-engagement of the rack and worm wheel may be used to make fine adjustments, the worm wheel being rotated by the finger. The worm wheel is provided with longitudinal cuts which, besides affording a hold for the finger, may be used to regulate finer adjustments than those of 25 yards marked on the side of the leaf opposite that containing the rack. Accepted February 21, 1907.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

As Others See Us.—Whilst the protectionist newspapers have belauded Artifex's and Opifex's pessimistic grumbling about the condition of the gun trade it is interesting to read what the official organ of the party in power has to say on the same subject. *The Tribune* credits the authors with having almost succeeded in imbuing their reader with the belief that the moral status of a civilised nation is to be measured by the facilities it offers for the sale of Birmingham guns. The alleged object of the book is stated to be to prove that the gun trade is a decaying industry, though apparently the authors believe that it might be made to flourish if rates and taxes were abolished, if duties were levied on foreign imports, if the laws relating to sanitation, factory inspection, employers' liability, and the indiscriminate sale of revolvers were repealed, and the regulation prohibiting the supply of arms to bellicose tribesmen and foreign revolutionaries abrogated. The authors are described as both truculent and dogmatic. There is every justification for giving prominence to the views of our very influential contemporary, in so far that they represent a point of view about the gunmaker's business which trade speeches and representations to official bodies are at times inclined to ignore. Gunmaking in many of its departments is not popular amongst the classes desiring the regeneration of the human race. Apart from the purely sporting trade, weapons are mostly made to kill human beings, and the foreign markets which our trade desires to supply are in many instances located amongst hostile races. A large part, therefore, of the existing trade can only be logically justified by the kind of argument which was used by the boy who objected on principle to robbing orchards, but joined in the proposed raid because the orchard would be robbed in any case, and he might as well have his own share of the plunder. It will be remembered that a prominent page in the Westley Richards catalogue, prior to the South African war, was a portrait gallery of the leading Boer Generals, who all used Westley Richards rifles. In a similar fashion when a lighter turned turtle in the Thames a cargo of rifles from Messrs. Greener to Morocco, was injured; and their sale as salvaged merchandise gave the public an insight into a typical gun trade transaction. Public and governing bodies are well acquainted with these and many other like circumstances, and it is not, therefore, likely that the gun trade demand for a free world market will be received on quite the same footing as if penknives and second-hand dress clothes were the objects it was sought to barter to native and other races. It is in fact only by appreciating the other side of the question that the gun trade can obtain official help in promoting those departments of business which do not offend the public conscience. The apple and orchard theory may be applied in practice, but it should not be too blatantly urged. In repressive rules and legislation the innocent suffer with the guilty, and public action taken on behalf of the trade at large should be directed towards preserving the trade with legitimate buyers, whilst leaving the more irregular channels of traffic to regulate themselves.

The Seizure of Cartridges.—One cannot help forming the opinion that an unnecessary amount of fuss has been made over the seizures in the North of a certain amount of ammunition which has been stored in an unauthorised fashion. The offence which has been committed has nothing to do with the moral aspects of the question of supplying cartridges for revolutionary purposes in Russia or elsewhere, but merely of

having stored explosives without those safeguards and precautions which have been framed for the protection of public safety in this country. The mislabelling of goods with the same evasive intention follows much the same rule. One may, therefore, regard the whole incident as a storm in a tea-cup. The persons concerned must have been sad bunglers at their work, since there is nothing illegal in keeping as many cartridges as one desires if a suitable place is chosen for their storage and the usual registration and notification formulæ are observed. It is no business of those responsible for seeing that explosives are properly stored to enquire into the market for which the goods are intended. There was in fact no need to commit the kind of illegality which has brought into prominence the circumstance that large quantities of ammunition are held in reserve for immoral use abroad. If the moral aspect of the case has any importance whatsoever it must equally include all trade which is done in the non-explosive, but equally important, counterpart of the cartridge, viz., the rifle which fires it. Trade in old rifles of one kind and another is freely carried on by all kinds of merchants and agents, and even if little informalities or finesse concerning questions of trans-shipment and so forth are necessary, these matters are attended to by experts whose first aim is to observe the written law. It is the foolish attempt to ignore the English law which has led to the calling of attention to a form of traffic which is likely to be carried on so long as human nature remains what it is, and nations exist in which the ruling classes do not receive the moral support of the general population.

Work at the Government Factories.—A good deal of anxiety has been caused in connection with the Government decision to cut down the manufacture of all war materials. The private firms have already been large sufferers by the lack of orders. These partly arise from the diminution of requirements since the South African war reduced demand to a peace footing, and partly from the fact that the present estimate of peace requirements is lower than anyone expected. Previous to the war, developments in smokeless powders had led to the building of many new factories whose aggregate output introduced serious risks of over-production. The various factories were well employed during the period of exceptional demand, but the slump which followed the diminished consumption was accentuated by price cutting of a very severe nature in the allied market for mining explosives as well as in regard to Government requirements for cordite. These cutting tactics are entirely hostile to the views of the War Office, which is nevertheless morally obliged to give a large share of business to the firm presenting the lowest tender. Public policy requires that private sources of supply shall be maintained in full working order during peace time so that they may respond to large calls in the event of an emergency. The War Office officials would cordially support any scheme by which the available business could be divided on equitable terms at fair rates. Hitherto it has been impossible to give effect to this policy. That the Government factory employees are suffering side by side with those engaged in private concerns is shown by the serious distress which has been introduced at Woolwich by the dismissal of a large proportion of the staff. Political agitation is necessarily in full swing; and yet it is impossible to see how the deliberately framed policy of cutting down manufacture can be harmonised with the making of work for those who have been thrown out of employment. The rifle business is not likely to suffer to so serious an extent. The sale of Sparkbrook factory to a private concern enables all available Government work to go to Enfield, and this factory, as well as the private ones, is employed on conversions for bringing the old model of rifle up to date, and also on a certain amount of new work. The private rifle factories have during recent years developed a capacity to help themselves by engaging in outside lines of trade. The chief trouble is thus confined to Woolwich and the private factories for producing ordnance ammunition and explosives. The latter have already cut down their staffs to a millennium footing, so that un-remunerative capital is their chief present anxiety.

Recent Patent Developments.—The patent columns of this journal usually provide an interesting record of the more up-to-date developments in the science of guns, powders, and ammunition generally. Ordnance patents we have always with us, but the other departments of invention have their fashions and their seasons. In the single-trigger age each month's issue showed how many minds had been at work evolving new combinations for dealing with this problem. The independent inventor of military rifle sights has at last learnt that when the War Office wants a new rifle sight Enfield will invent it. Consequently patents in this direction have no commercial value, and are now seldom encountered. The explanation is simplicity itself. So many sights have already been invented and abandoned, that the field is virtually quite open; and when a particular need arises that need can be satisfied by a competent mechanic advised by officers and others who have studied rifle shooting from the marksman's, as well as the theoretical standpoint. The modified form of sight for the short service rifle, which was described in last month's issue, provides a case in point. The same applies to the modified wind gauge sliding bar which is described in the present issue. Last year's wind gauge slide as applied to the service rifle proved virtually useless when tried at Bisley. In fact the changes of the wind are so rapid that last year's sight failed to keep pace with its movements. The obvious remedy was a screw system of traverse, which could be operated by touch alone, and this has been duly provided by the Enfield experts without presumably trenching on properly protected private ideas. Other items which are fashionable in the patent column at the present moment include the aftermath of detailed improvements which inevitably follow the introduction of a new pattern of rifle The War Office miniature arm has received the usual amount of attention in this connection. Double barrel shot-gun inventions are necessarily restricted in number by the finality in design which a long used model ultimately attains. From time to time new notions are worked out, and amongst these the Hill and Smith type of body seems to be worthy of very serious attention. If there is a weakness to which the ordinary shot gun is liable, that weakness is a constant tendency to come off the face. This may be due to ordinary wear of the breech mechanism, or it may arise from a slight bending of the body of the gun. If the second explanation covers anything like a considerable portion of the guns which are in the habit of giving way under use the Hill and Smith system of imparting greater rigidity seems to provide a practical remedy.

PRICE MAINTENANCE.

THE idea of doing the same turnover on an enhanced profit possesses an attraction for all those whose business is buying and selling. It is not, therefore, to be wondered at that vigorous efforts have lately been made to establish the trade in sporting cartridges on a basis of minimum selling prices. The idea seems at first sight feasible enough, in view of the success which has accompanied the efforts of a well-known ammunition firm to ensure that certain brands of cartridges are not sold below certain specified prices. As the wholesale supply of this commodity is in the hands of a few large and influential firms, it should not be difficult to organise a price maintenance arrangement to control the whole of the cartridges sold in this country. There is, however, an essential difference between the cartridges to which the arrangement has been applied in the past, and those to which it is proposed that the arrangement should be extended in the future. It is not in fact a very difficult matter to enforce a price maintenance contract on the distributors of proprietary articles. The essential distinction between proprietary goods and ordinary merchandise is that the former are sold on the guarantee of the manufacturer, and the latter on that of the retailer. The manufacturer of a proprietary article spends a large amount of money in informing the consumer that his branded goods are of the same quality from whomsoever they may be purchased. The public finds a certain amount of satisfaction in knowing the exact quality of the goods supplied, and the consequence has been that an immense trade has been built up throughout all branches of commerce in proprietary articles against the opposition of the retailer rather than with his collaboration. The moment, in fact, that any article or brand becomes well-known to the public a demand arises, and the retailer must satisfy that demand in order to retain his connection. A defensive policy is thus thrust upon the retailer, who stocks proprietary goods because he must, and fosters other lines in cultivating a living wage.

Price cutting in proprietary articles results from the public knowledge that they are of standard quality, and the buyer is not long in finding out where they can be purchased at the cheapest rate. Large retail firms, whose business is advertised by selling proprietary articles at a very low price, thus aim at attracting customers whose requirements include other goods bearing a generous profit. The prime idea is to secure the customer by means of price cutting in respect to goods of which he knows the value, and then to sell him something else assuming he will reason that a firm which is cheap in one thing must be cheap in all. The owner of the proprietary brand of goods has a consciencious objection to their being made a kind of stalking horse by means of which the innocent public may be brought into the range of the salesman's blandishments. The moment that the profit on a particular class of goods is cut down to the vanishing point, the retailer in self-defence uses his very large influence to substitute other goods. The manufacturer has accordingly found it necessary to lay down a minimum price at which his proprietary goods shall be sold. The retailer is thus reserved a living profit, and thereby become a consenting, if not a willing distributor of the goods concerned. The guaranteed profit is bound in any case to be small; consequently if the goods are of reasonably sound quality and are well advertised, a large turnover is assured. But the pushing and enterprising retailer is, however, hostile to all classes of price maintenance of goods, since he wants the large profits for himself. His methods of business are strictly competitive, and his hand is tied in respect to all goods where maintenance exists.

The gunmaker, whether in a large or small way, works on very much the same plan. He seeks in fact to introduce some of his own individuality into the goods he supplies, and he regards with horror the idea of reducing the cartridge trade to the Cockle's pills basis. While, therefore, the gunmaker regrets the continuous depreciation of profit in the cartridge trade, his position must be safeguarded before he can consider proposals for limiting his freedom of action. If sellers of cartridges were unanimous in the desire for minimum selling prices, it would be possible to barter against the exclusive handling of certain goods, the adoption of fixed minimum prices. That is to say the retailer would buy only the goods of the firms in the ring, and conversely the firms in the ring would stop supplies to any retailer who sold below minimum prices. In actual practice the minimum price itself introduces certain difficulties. What is a reasonable profit for a small firm trading with few expenses, or a large firm trading with a considerable turnover, would be quite inadequate to another firm doing a small high-class trade and making profits in proportion. Moreover, it does not at all follow that such an arrangement would go through unless everyone is dissatisfied with the present position. Someone takes the initiative in price cutting, and that someone is generally a pushing and enterprising firm determined to buy at favourable rates and to do an increasing turnover. In fact the moment an artificial standard of prices is set up in a free trade country an immense inducement immediately exists for opening the way to a foreign invasion. At the present moment the British industry of cartridge making is in a comparatively healthy condition as regards turnover. It holds its own against the keenest competition; and there are many firms who would think many times before they converted an honest desire to preserve the retailer's profits into definite action liable to produce undreamed of results for themselves. Just now the foreign competitor cannot feel quite sure what kind of opposition he would encounter when essaying to enter the English market; but his situation would be quite different if some of the outside dealers refused to be bound by a price maintenance agreement and were to offer large contracts abroad at a price rendered tempting by the self-imposed muzzling order which the home firms had adopted. The public undoubtedly buy their cartridges too cheap, and prices are too inelastic in face of the rising conditions of the metal market. The entire theory of price maintenance turns upon the question whether British cartridge cases and powders are so far proprietary articles that the public will insist on having them so long as the price charged is not exorbitant. The technical aspects of the question are all in favour of the home-made article. The English-made cartridge is positively superior under all tests practical and scientific to the foreign production, and the curious inter-relation of cap and powder is so complex that even if the foreigner produced something true to the English standard climatic differences might upset all his calculations. In this sense the British cartridge is a proprietary article to which price maintenance might be applied.

DEVELOPMENTS IN EXPRESS RIFLES.

IT is now some time since the very interesting subject of express rifles was reviewed in these columns. The latest article of any importance appeared in the issue of last September. Most of the items there forecasted have since been realised. Other developments not foreseen have also come to pass. There has in fact been a sudden and pronounced inclination towards the developments which were then described as constituting a new era in sporting rifles. The new era is now within sight of realisation; and it is interesting at this stage to consider the full bearing of the change which seems likely to come about. The War Office authorities are still hard at work with experiments to ascertain how far Spitzer conditions can be adapted to produce an enormous increase of flatness of trajectory, coupled with a degree of accuracy which will ensure satisfactory target results at a distance of say 1,000 yards. The German government is believed in well-informed quarters to be scrapping very large quantities of the 1898 model Mauser rifle; and no one seems quite sure of the calibre and general characteristics of the rifle which will take its place. It is generally understood that no less a velocity than 3,000 f.-s. is regarded as fully complying with the new system of ballistics. Gunmakers are of course faced with a much less complex problem to solve. Roughly speaking 300 yards is the greatest extent of the range they have to consider, and there is no particular need for the moment to aim at more than a 25 per cent. increase on the old 2,000 f.-s. velocity.

Hitherto the maker of express rifles has been satisfied to reproduce the velocity of the ·303 service rifle. This velocity is not always realised in practice, because the nominal ballistics assume a full 30 inches length of barrel and a military pattern of bullet, whereas the sporting length of barrel and the soft-point bullet both tend to lower velocity. Cartridges giving a much higher velocity have of course been well known for a long time past. Amongst military rifles the Mannlicher gives a very large increase over the round figure value of 2,000 f.-s. The effect has been that this rifle has retained a prominent position in the affections of sportsmen for all classes of shooting where the errors due to range misestimation are an important factor in the result of a day's sport. The Mannlicher rifle accordingly displaces on account of its flat trajectory many weapons shooting bullets which are highly effective from a stopping point of view when once they have touched the spot. It is, however, in the capacity of the Mannlicher to touch the spot that its precedence has been maintained. Large bore express rifles can be given a much higher velocity by building special cartridges with a large powder chamber, but the severe recoil experienced, and the very high power of these cartridges as a rule limits their use to large and dangerous game which are not frequently shot at distances where flat trajectory is of material importance. It is in fact for the class of rifle which is used on timid and wary horned game where great flatness of trajectory is required, coupled with a lowness of pressure and recoil which keeps the weight of rifle within reasonable bounds. By the use alone of low density bullets progress in the right direction seems likely to be achieved.

Recent ballistic experiments with cartridges carrying out the new principle provide some interesting material to work upon. Two new cordite rifles have been introduced with an excess size of calibre which enables them to escape the prohibition under the Indian Arms Act of the ·450 bore. The normal weight of a ·450 bullet of military density is 480 grains. The ·465, ·475 or whatever the larger calibre may happen to be, should have a bullet weighing about 500 grains if a full military density is desired. Mr. Holland has introduced a light bullet weighing 365 grains, and though the velocity imparted to it has not yet reached what may be termed full Spitzer conditions, the principle of exchanging diminished weight for enhanced velocity is fully exemplified. A stricter comparison can, however, be effected with reference to the new Lang rifle for which Kynoch's have produced two weights of bullet, viz., one of 500 grains and the other of 365 grains, both fired with the same charge of cordite, viz., 75 grains. The *Field* tests with the two cartridges display the following very interesting comparison:—

	500-grain Bullet	365-grain Bullet.
Actual Muzzle Velocity ...	2,111 f.-s.	2,250 f.-s.
Actual Muzzle Energy ...	4,943 ft.-lbs.	4,099 ft.-lbs.
Assumed Muzzle Velocity ...	—	2,470 f.-s.
Corresponding Energy ...	—	4,940 ft.-lbs.

The above figures show that the adoption of the same cordite charge for a lightened bullet gives only a portion of the benefit which should accrue from the change which has been effected. The natural assumption is of course that the granulation of rifle cordite produces a rate of burning which is only suitable for the ordinary military density of bullet. A lighter bullet with unchanged calibre fails to produce sufficient pressure to ensure the full rapidity of burning, whilst the higher velocity imparted to the bullet enables it to get out of the barrel before the cordite has been fully burnt. One may assume that the lightened bullet should have at least the same muzzle energy as the one of heavier weight. Pressure is, however, the only real limitation to the velocity produced, so that the limit might be further extended on the basis of equal chamber pressure.

The new era is, therefore, only in its infancy. Several calibres of bullet have already been tackled; and the sporting gunmaker is open to the competition of the military powers, a competition which in certain instances he is aiding by the submission of models and designs. On the score of accuracy some very interesting leading principles have been evolved. Messrs. Holland, Lang and Kynoch, representing three different experimental authorities have found that the light weight high velocity bullet, when properly designed and manufactured, gives a higher figure of merit for accuracy at sporting ranges than the old full density military type of bullet. In both the Holland and the Kynoch bullet this high standard of accuracy has been achieved by ignoring the Spitzer or pointed construction, and reverting to the principle which seems first to have become public property in connection with the Snider bullet. That is to say instead of reducing the length of the bullet in proportion to the diminished weight, a large part of the original length is retained by building the new bullet light forward.

THE KYNOCH'S PROSECUTION.

THE case against Kynoch's for adding an unauthorised ingredient to a certain mining explosive of their manufacture, which was heard in the Court of Summary Jurisdiction at Grays, Essex, came up for appeal at Quarter Sessions. The hearing occupied two days, viz., Saturday 20th and Wednesday the 24th ult., and in fact amounted to an entire re-trial of the whole case. The earlier proceedings were fully reported in our last issue, and it will be remembered that Kynoch's were fined £25 and costs for the alleged offence, and the explosive complained of, which had meanwhile been under seizure, was ordered to be forfeited.

Mr. Campbell appeared on behalf of the Public Prosecutor, instructed by the Treasury Solicitor, the respondent being H. M. Chief Inspector of Explosives.

It will be remembered that one of H. M. Inspectors of Explosives visited the Kynoch Thames Factory and placed under seizure 650 lbs. of blasting gelatine. A sample of this explosive was duly submitted to Dr. Dupré, the Home Office Expert on Explosives, who found that it contained mercury. The factory licence showed that the only explosives which could be stored in the magazine were those which the factory was licensed to manufacture, and the licence contained a provision stating that the explosives authorised to be manufactured should be exclusively as defined in the authorised list. The specification of blasting gelatine in that list contained no mention of mercury. Counsel desired to make it clear that the addition of mercury to an explosive itself constituted an offence under the Act. The evidence had shown that one part of mercury in 325,000 parts of explosive had the effect of masking the heat test, which latter determined the safety and stability of explosives.

Correspondence passed in November, 1906, between the Home Office and Messrs. Kynoch, in which Captain Lloyd suggested that in the explosive under seizure a masking agent had been used, and he called Messrs. Kynoch's attention to the fact that they had not answered this allegation. Mr. Cocking, in replying on behalf of Messrs. Kynoch's, wrote that the explosive was absolutely pure, and in a later communication he denied that a masking agent had been used. It was also affirmed that their Arklow guncotton was the purest that had ever been produced.

In the course of further correspondence, Captain Thomson wrote to Kynoch's specifically informing them that in the proceedings to be taken they would be charged with adding mercury with their explosive. Mr. Frank Huxham, secretary and manager, stated in his reply that the Inspector had already been informed that no unauthorised ingredient had been used, and that no breach of licence had been committed.

It was subsequently admitted by the defendants in the proceedings at Grays that the Company were in the habit of putting one part in 100,000 into their mining explosives. It was alleged that this was for the purpose of preventing fungoid growth, but the prosecution were unable to accept this suggestion as the material was added to an explosive which was known to be practically immune from the tendency to develop fungoid growth.

Captain Thomson, H. M. Chief Inspector of Explosives, after proving the conditions and terms of the Company's licence, referred to the heat test as the official test for explosives, and also as a test regularly used by manufacturers. He defined purity in an explosive as freedom from the acids of nitration and other injurious by-products. The effect of using in an explosive a masking agent was that an improperly purified sample might be enabled to pass the test. He was present when Mr. Gold, the manager of Kynoch's high explosives department, gave evidence, and he understood him to say that the Company put this material into all their explosives. This version of Mr. Gold's evidence was, however, disputed by the Counsel. Gelatine explosives in his experience were not subject to mildew. He had made experiments with samples of the explosive under seizure, and he had come to the conclusion that it was of moderately good quality, but he was not prepared to say that the use of silver foil made the heat test effective in the case of samples treated with mercury. His department did not propose to adopt the use of foil.

Captain Desborough proved the seizure of the explosive, and was present at the experiments when mercury was detected in the same.

Captain Lloyd held an enquiry into an accident which had happened at the Arklow Works. He told the manager he suspected them of using masking ingredients, and he took a sample of dry guncotton in a bag which had previously contained chalk, one of the ingredients of the blasting gelatine.

Mr. F. H. Dupré spoke as to the examination of the sample of explosive for the presence of mercury by the spectroscope test. In experiments made on March 30th, 1907, he had removed the vaporised mercury from the tube and had again made the test for mercury. Each time this was carried out the hundredth of a milligram came into vapour, and three such repetitions of the original test showed a continued brightness of the mercury spectrum from the original four gramme sample. He had found that one part in 325,000 made the difference between a bad explosive and a very good one so far as the heat test was concerned.

Dr. Dupré said he had seen thousands of samples of nitroglycerine explosives, and had never found any fungoid growth develop under any kind of exposure. Cross-examined: It may get mouldy when in contact with moist wood. Re-examined: He did not know any legitimate reason for using mercury in nitro-glycerine explosives, although he thought that one part in 100,000 would have antiseptic results. For 34 years he had used the heat test, and had never known it pass an explosive which had afterwards proved unstable under storage in this country.

Mr. P. V. Dupré spoke in support of his brother's evidence, and said that there was no doubt about the presence of mercury in the samples examined.

Sir Frederick Nathan said he had never heard of mercuric chloride being added to an explosive for increasing its stability. He had repeatedly tested mouldy guncotton which had come from abroad after long storage, and had always found that the presence of mould in no way affects stability. The Guttmann test was not in his opinion a reliable test either of nitroglycerine or guncotton explosives. He was not prepared to say that the addition of mercuric

chloride in the proportions mentioned in this case would promote instability in an explosive, since an extended series of climatic trials would be necessary before an opinion could be given. Guncotton which is intended to be dried is never treated to prevent fungoid growth.

Major Cooper-Key repeated his account of the jar he found marked bi-chloride. poison, with the first word erased.

Mr. Horace Avory for the defence pointed out that they were charged with keeping an explosive not of the kind authorised, viz., a blasting explosive which contained the unauthorised ingredient mercury. He averred that the prosecution had originally alleged that the old explosive would not stand the heat test. This was at once denied by Mr. Campbell, and Counsel for the defendant said he would be relieved from having to argue that the explosive was of a quality consistent with the ability to pass the heat test. The broad question to be decided was whether in fact an unauthorised explosive had been stored. The Company is bound by the Act of Parliament, and not by the rules which are framed in the office of the Inspectors of Explosives. He accordingly maintained that manufacturers were entitled to use any processes or materials in making their explosives which would render them more stable and better able to resist deterioration. Kynoch's thought that the addition of mercury would have a beneficial effect on the explosives to which it had been added, and Sir Frederick Nathan had admitted that the addition of one part in 100,000 does not affect the quality of an explosive as such. The notes on this point were turned up, and it was found that Sir F. Nathan qualified his remarks by pointing out the impossibility of expressing a definite opinion either way without exhaustive experiments. Counsel asked how it was possible that Kynoch's could be satisfied that the ingredients of their explosivss were pure and would stand the tests, and at the same time add a substance for the object of concealing defects.

George Fleckney, head tester at Arklow, produced the book containing the records obtained with the explosive under seizure, and showed that the nitro-cotton ingredient stood from 22 to 23 minutes, and the nitro-glycerine varied from 15 to 21 minutes. The temperature was 180°, instead of 160° as in the official heat test, which had the effect of making the test much more severe.

Mr. J. F. Udall, manager at Arklow, said he was present on the first day at the earlier proceedings, but was too ill to attend on the second day, and Mr. Gold, the manager of the selling department, gave evidence in his place. He confirmed Fleckney's figures of the tests of samples, and these tests showed that the nitro-glycerine and the nitro-cotton of which the blasting gelatine was made were absolutely pure. No objection had been taken by the authorities to the trace of sodium that remained in nitro-glycerine after washing. His Company had added one part in 100,000 since they began about three years ago to make their own guncotton. Previously they had used German guncotton which they knew to have been similarly treated. It acted not only as an antiseptic, but also as a stablizer. Their experiments had proved it. He believed it improved the quality of blasting gelatine when added. They inserted it in the finished explosive with the chalk. Cross-examined: He was an engineer, not a chemist. He had seen the correspondence between Birmingham and the Home Office. He knew that the effect of mercury was to increase the period of the Abel heat test. With silver foil one obtained the direct test. They relied upon the fact that the whole of the ingredients they put into their explosives are of the best, which is better than any test that can be put on the final product. The sample of blasting gelatine to which mercury had been added stood for 60 minutes. He believed that blasting gelatine was subject to micro-organisms. Why he preferred to add the mercuric chloride to the blasting gelatine rather than to the nitrocotton was that this material had a slight acid reaction. By delaying its addition till it could be put in at the same time as the chalk, the slightly alkaline reaction of the latter neutralised the acid of the former. They added the mercuric chlorate to the chalk, and the mercury must have permeated the bag in which Captain Lloyd took away his sample of nitro-cotton.

Mr. Horatio Ballantyne, consulting chemist, referred to the properties of bi-chloride of mercury as an antiseptic. In his opinion the presence of the mercury in the sample of nitro-cotton could be accounted for by it having been placed in a bag permeated with this substance. In his opinion if a substance present in an explosive is incapable of producing a chemical reaction such as takes place when detecting its presence, then *prima facie* it could not produce any deteriorating effect. He acknowledged that the addition of mercury made an obvious difference to the result of the heat test, and the amount of effect would not be known if the proportion of mercury used were also unknown. All blasting gelatine is infected with bacteria, and if one is minded to counteract these bacteria mercury is the substance for the purpose. He explained that any substance exposed to the air would necessarily be similarly infected with bacteria.

Mr. William Macnab said he had tested the sample explosive both with and without the addition of silver foil, and had found it to be of good quality. It was in his view a reasonable proposition that the addition of the quantity of mercuric chloride which had been spoken of might have a beneficial effect. He felt almost certain that a sample of pure guncotton would contain traces of mercury after being kept in a bag permeated with mercury. Cross-examined: If one did not know how much mercury had been added one would not know what effect on the heat test might be anticipated. In his opinion the addition of silver foil made the heat test reliable.

Mr. Horace Avory in summing up for the defence said it would be impossible to uphold the case before the Court unless the presence of this proportion of mercuric chloride is to be regarded as an unauthorised ingredient justifying the the seizure of the explosive. Mr. Campbell in replying said that the case must be decided on the question of fact whether the particular sample of explosive under consideration contained an unauthorised ingredient. The question was not that the substance had failed or would fail to pass the heat test, but the heat test had only been introduced into the case to show a motive for adding the unauthorised ingredient. This mercury which was deliberately put in to remain in the explosive occupied a different position from the sodium that was as far as possible removed. He asked the Court to decide that the mercury was present in an appreciable and a perceptible quantity. That it was perceivable was shown by its effect on the heat test as well as by the spectroscope. He maintained that it was put in with the knowledge that it would affect the heat test, and he submitted that it was put in with that object. Had it been put in as a valuable preservative why did not the defendants ask for their licence to be amended to that effect. If people were to be allowed to put masking substances into explosives it would be necessary for the Home Office to be ever alert to find a means of re-establishing the utility of the heat test. If it was put in as an antiseptic why did not the Company admit its presence when taxed by the Home Office with inserting it. Blasting gelatine was not subject to fungoid growth. Guncotton might be under certain conditions. Yet the defendants put it into the substance not so subject, and did not include it in the substance that might be liable to fungus growth.

After retiring to consider their decision the Chairman of the Court announced that the appeal would be dismissed with costs.

The Court further wished to express the following:—"According to our opinion a definite proportion of mercuric chloride was used as an ingredient in the blasting gelatine, which explosive was not in fact exclusively as defined in the list of authorized explosives. We express no opinion as to the purpose for which the mercuric chloride was added."

Mr. Avory asked that a case be stated for the High Court on the point of law as to whether one part in 100,000 constituted an explosive as unauthorized, and the Chairman announced, after consultation with his colleagues, that a case would be stated in rather different terms from those proposed, the chief alteration being the omission of the precise proportion of the added substance.

ROUND THE TRADE.

The will of the late Mr. Henry Eley has been proved at the gross value of £165,162. He was the surviving member of the brotherhood whose name is known wherever cartridges are mentioned.

Messrs. Cogswell & Harrison, Ld. have been forced to take the sudden resolution to rebuild their Strand premises, the foundations having been injured by building operations on the adjoining site. They have taken temporary premises at 210, Strand, at the corner of Essex Street, and it is understood that they hope to be back in a new building at the old address in something under record time.

The mining industry of Russia, as represented by the producers of iron, gold and platinum, have petitioned for a reduction of the duty on dynamite to the former rate of four roubles 50 copecks per pood (9s. per 36 lb.). It is alleged that the home production of dynamite is already sufficiently protected, and that the prosperity of the two or three factories concerned, which seems assured in any case, counts as little beside the much larger industrial question involved in the necessity for a cheap supply of explosives for the mines.

A very important scheme has lately been submitted to the shareholders of the New Explosives Co., Ld., who have shown their approval of the same by endorsing the recommendation of the directors that it should be adopted. Stated briefly it consists in the sale of a large block of shares at a substantial price to parties who it is understood are in a position to influence sufficient business to justify the step they have taken. Mr. L. G. Duff Grant has been responsible for carrying out in accordance with the views of the directors the details of the scheme; and he certainly deserves every congratulation for having provided a means for turning to account the first-rate manufacturing facilities which this old established and very up-to-date Company possesses.

Captain J. H. Thomson has issued his report concerning the accident that occurred at Nobel's Factory on the 5th February last. The accident arose from endeavouring to thaw a frozen gutter for conveying nitro-glycerine from one building to another by throwing buckets of hot water over the frozen part. It seems that a considerable quantity of nitro-glycerine and acids had been spilt on the ground where the explosion occurred. These acids, though they had performed their duty in nitrating the glycerine, are still in a concentrated condition, and have a very high affinity for water. In consequence of this affinity their combination with water evolves much heat. Witnesses testify that vapour was coming up from the ground where the water had fallen and one of the injured men is positive that this vapour contained red fumes. An attempt was made to arrest the decomposition by applying cold water, but an explosion occurred and extended along the gutter, but was not communicated to the 2,000 lb. charge in the building, to which the gutter led. The loss of three lives and injury to two other workers is attributed to the circumstance that when the decomposition was noticed the foreman, instead of withdrawing all the men from the spot, made a vain attempt to arrest the action. It is regarded as a grave error of judgment, but not a breach of rules to have thrown water on ground that was saturated with nitroglycerine and acids. Makers of nitroglycerine explosives should note the following extract from the report:—"The first question which arises is as to whether it is wise to carry on the operations of nitrating and separating in different buildings and whether any manufacturing advantage which is gained thereby is not more than counterbalanced by the extra danger involved in running down the acid nitro-glycerine from one building to the other. The combination of the two operations in one building is the more modern system, and some of the nitrating houses at this factory are worked in this way. We do not propose to press this question at present, though it is one which should, I consider, engage the earnest attention of all manufacturers of nitro-glycerine, who continue to nitrate and separate in different buildings.

The Morris Tube and Rifle Clubs Accessories Company of 11 Hart Street, Mark Lane, E.C., has been formed by Mr. Luff, Mr. West and Mr. Stentiford, to supply the class of goods which the late Morris Tube Co., Ltd., were in the habit of selling, previous to the absolute closing of the business by the receiver.

At the annual general meeting of Messrs. Webley & Scott, Ld., the chairman pointed out that during the fifteen months under review things have continued to move in the direction of increased cheapness in the sporting gun department. The profit of £9,677 was not very large, but compared with the previous nine months it showed an increase at the rate of something like 50 per cent. The heavy expenses of the reconstruction scheme and the fact that the directors sought to set £1,000 against their Company at Liége, were the two causes why they were unable to pay the full preference dividend. The chaos and unrest in Russia, with which a large portion of their trade from Liége was done, and the fact that a great deal of money was locked up in that country had made delivery to Russian customers unsafe, but this state of things was now improving. With regard to the automatic pistol, the last Government ordered ten of the .455 weapon, but no further order had been received. and the position was unchanged under the present Government. From Russia they had received very considerable orders for their .320 automatic pistol, but the Russian Government had prohibited the importation of all pistols into that country meantime. When the prohibition was withdrawn, however, many of the orders would stand good. They had also started the manufacture of a small baby pistol, which it had become the habit on the Continent to carry in the pocket. He added that within the next fortnight the Company would have a motor car on the road, which would be responsible for a little increase of their profits.

The report of the Schultze Gunpowder Co., Ld. explains that the unfavourable results on last year's working, as shown in the balance-sheet, have arisen from the expenses due to the withdrawal of a faulty batch of powder. The profit on the year, after charging all current expenses and providing for bad and doubtful debts, amounts to £704, which, added to the balance brought from the last account and supplemented by £2,000 taken from reserve, leaves £4,678 available. Preference dividends, amounting to £7,307, had been paid, leaving a debit balance of £2,629 to be carried forward. Lord Montagu, in his speech to the shareholders at the general meeting, explained that the Company had been obliged to treat the trade most liberally in connection with the issue of powder which was found to be defective, in order that the user should not be put to any loss. They had been blamed for not keeping entirely to bulk powder and for selling concentrated powder; but they had had to fall in line with public requirements and to do what their rivals did. They had had for some time a new concentrated powder "up their sleeves," and they looked forward to its being a great success from a sportsman's point of view. Everything was being done to put the affairs of the Company in a satisfactory state. He complained of the "cut-throat competition" that existed, and said that the Board were endeavouring to come to a friendly arrangement with some of the large manufacturers to put a stop to the loss so incurred. As to the question why the Board had paid a dividend on the preference shares in excess of the funds available and had decided on the suspension of the payment of further quarterly preference dividends, he explained that they had no idea until the month of September that any trouble had arisen as regarded the quality of the powder supplied. When, however, a large expected order did not come in they became anxious, and upon a trial balance-sheet being prepared they had to forgo further dividends. The Company had good cash reserves, but they must husband their resources as much as possible. Mr. Walter F. Smith seconded the motion before the meeting. In the course of the discussion that followed it was arranged that the Board should call in three independent shareholders to confer with them, with a view to issuing a statement.

THE NEW PATENT BILL.

IT would be difficult to over-estimate the important effects which the Bill to amend the law relating to patents and designs is likely to have if passed in its present form. No apology is accordingly necessary for paying close attention to its leading clauses even at this early stage. It should be understood that except when quotations are specifically indicated no attempt has been made to reproduce the exact wording of the Bill.

Clause **1.** deals with the grant of patents to two or more persons.

Clause **2.** which deals with chemical inventions, lays down that the claim for a patent shall, if required, be accompanied by specimens or samples. These will be analagous in purpose to the drawings which accompany a patent for construction.

Clause **3.** appears to grant immunity from payment of renewal fees in respect to "Patents of addition," but the term of such a patent shall not extend beyond that of the original patent to which the new patent makes additions or improvements.

Clause **4.** extends the scope of the comptroller's investigation as to the originality of a patent, to specifications published after the date of the patent under examination, but prior as regards date of application.

Clause **5.** When the examiner reports disconformity between the provisional and final specifications, the latter may take rank as a new application as regards date and substance.

Clause **6.** extends the grounds on which the grant of a patent may be opposed so as to cover the over-lapping of dates which may occur in respect to patents passing through the office at the same time, the earlier applications often taking the longer time to complete, and so anticipating later applications which have been quickly completed.

Clauses **7, 8,** and **9.** deal with questions of extensions of period and procedure concerning revocation of patent.

Clause **10.** is as follows:—

(1) At any time not less than three years after the grant of a patent any person interested may apply to the comptroller for the revocation of the patent on the ground that the patented article is manufactured exclusively or mainly outside the United Kingdom.

(2) The comptroller shall consider the application, and if after inquiry he is satisfied that the allegations contained therein are correct, then, subject to the provisions of this section, and unless the patentee proves that the patented article is manufactured to an adequate extent in the United Kingdom, or gives satisfactory reasons why the article is not so manufactured the comptroller may make an order revoking the patent either—(*a*) forthwith; or (*b*) after such reasonable interval as may be specified in the order, unless in the meantime it is shown to his satisfaction that the patented article is manufactured within the United Kingdom to an adequate extent:

Provided that no such order shall be made which is at variance with any treaty, convention; arrangement, or engagement with any foreign country or British possession.

(3) If within the time limited in the order the patented article is not manufactured within the United Kingdom to an adequate extent, but the patentee gives satisfactory reasons why it is not so manufactured, the comptroller may extend the period mentioned in the previous order for such period not exceeding twelve months as may be specified in the subsequent order.

(4) Any decision of the comptroller under this section shall be subject to appeal to the court.

Clause **11.** empowers applications for compulsory licence to be made to the Court instead of to the Privy Council. The "reasonable requirements of the Public" are set forth in detail.

Clauses **12, 13** and **14.** deal with sundry items of procedure.

Clause **15.** extends the "secret patents" system to the Admiralty.

Clause **16.** declares unlawful any conditions in an agreement of licence or sale which debar the licencee etc. from employing in his trade or industry articles acquired from other persons. This clause is understood to have special reference to conditions which exist in the boot trade.

Clause **17.** limits the power to appeal to a higher tribunal than the Court.

Clauses **18, 19** and **20.** relate to designs.

Clause **21.** is as follows:—

At any time not less than one year after the registration of a design any person interested may apply to the comptroller for the cancellation of the registration on the ground that the design is used for manufacture exclusively or mainly outside the United Kingdom, and where such an application is made the provisions of this Act with respect to the revocation of patents worked outside the United Kingdom shall apply with the necessary modifications, except that there shall be no appeal from the decision of the comptroller.

Clause **22.** relates to piracy of designs, and **23** renders certain patent procedure applicable to designs. *Clauses* **24** to **36** are headed "General," and the two following at least are of special importance.

Clause **29.** imposes a penalty for applying words which signify the existence of a copyright in a design when the same has expired.

Clause **30.** makes it quite clear that the grant of patent rights gives no power to use the Royal Arms, and the words in the principal Act forbidding their use are somewhat modified.

REVIEW.

Balistique Extérieure Ratonnelle problème balistique principal. By le Commandant P. Charbonnier. Published by Octave Doin, Paris. 500 pages with 76 figures. Price 5 fr.

This is a volume in the *Library of Applied Mechanics* forming part of the *Encyclopédie Scientifique* published under the editorship of Dr. Toulouse. The Encyclopedia covers the whole domain of science, and the thoroughness of the undertaking may be appreciated from the fact that the subdivision *Applied Mechanics* contains 67 volumes, of which 17 are on subjects connected with explosives, firearms and artillery. These latter works include the mechanism of explosives, exterior and interior ballistics, strength of guns, automatic firearms, field and naval artillery, and mines and fortifications. Each volume will be published at the same price, and be complete in itself. The one under notice appears to be the first publication of the series. It treats of the principles of exterior ballistics, and is necessarily highly mathematical, the theory being dealt with in a thorough and detailed manner. To students of exterior ballistics who wish to understand all there is to know about their subject, this book can be recommended. Two other volumes are promised, one dealing with secondary problems, and the other experimental results of exterior ballistics.

REPORT OF THE BOBBINITE COMMITTEE.

THE Departmental Committee, which was appointed a year ago to inquire into certain questions relating to coal-getting explosives, particularly with regard to Bobbinite, has issued a report which covers the whole question of explosives in relation to coal mines where special safety precautions are found to be necessary. When the Woolwich testing gallery was instituted it was not expected that any form of black powder explosive would succeed in passing the tests for establishing a comparative degree of immunity from the liability to cause explosions in fiery mines; but the skill and enterprise of Messrs. Curtis's & Harvey enabled them to produce a compressed cartridge of black powder which satisfied the tests laid down and thereby became permitted for use in fiery mines. Certain questions arose in connection with accidents which had occurred in the use of Bobbinite, and the present committee of eminent experts was appointed to consider the relative safety of Bobbinite and the other so-called safety explosives with reference to the measures taken under the Coal Mines Regulations Act for diminishing the explosives risks in mines.

The chief point in favour of Bobbinite is that, whilst satisfying the safety tests, it possesses, in common with black powder, the advantage of not requiring to be fired by a detonator. The report very carefully reviews the other points which are claimed in favour of Bobbinite, amongst them being that the majority of the working miners prefer Bobbinite. In drawing a comparison between the results obtained at the Woolwich testing station and in the actual use of mining explosives, the committee lay great stress on the influence which is exerted by the cross sectional area of the testing gallery. The smaller the size of the tube the more sensitive the test becomes, and, therefore, by inference fissures which contain dangerous gas will be far more sensitive than even the Woolwich gallery. Practical experience, however, upsets this view, because explosives of the Carbonite group have not been known to cause ignitions in this way. The committee express themselves unable to resist the conclusion that both the ignitions of gas which have occurred in practical working, and the results of experiments have distinctly indicated that Bobbinite and several other explosives when insufficiently confined are more likely to explode gas than those explosives which give a high "charge limite" when tested without stemming. The committee then go on to say:—

This leads us to consider what are the real dangers to be apprehended from fire-damp and coal-dust in a mine, having regard to the use of explosives. These dangers are of two orders: the first, small and local explosions of gas, and more rarely of dust, restricted in area and only affecting the men in the immediate vicinity; and the other, the great explosions spreading throughout the extent of the mine and producing disasters such as that which happened last year at Courrières.

If the only explosions to be apprehended in mine working were those of the former description, the case for altering the existing conditions would not be a strong one. As we have already pointed out, such explosions attributed to the use of Bobbinite were, during the years 1904 and 1905, responsible for the death of one man and injuries to fifteen others. This casualty roll would have been fairly counterbalanced by the accidents which would presumably have occurred in handling, had detonants been used instead of Bobbinite, a substitution which we estimate would have produced three additional deaths and injuries to four persons, the injuries, as a rule, being of a much more severe nature.

On the other hand, when we come to consider the possibility of an explosion of the second order, which may spread havoc through a whole mine and result in a death-roll of hundreds, the advantages of using an explosive which is much less likely to ignite gas or dust become of an overwhelming character, even in spite of the fact that from other causes that explosive may be rather less safe to handle.

We have arrived, therefore, at the conclusion that where a great explosion is to be feared, the existing standard for the admission of explosives to the Permitted List is not sufficiently high; but that where there is no risk of such a disaster the casualities due to small local gas explosions may be set off against the additional other risks attaching to the use of detonants previously referred to. We recognise, moreover, that as a coal-getting explosive, Bobbinite has certain advantages, and for this reason its elimination in cases where a widespread disaster is not to be feared appears to be undesirable.

A consideration of the details of all great modern explosions has shown us that no widespread explosion is at all likely to occur in a mine except by the agency of coal-dust. In modern times in this country the ventilation is too good to make the existence of an inflammable mixture of gas and air possible except locally, unless dust also is present; but it has, by assisting in spreading fine dust throughout the mine, and in rendering it drier than it would otherwise be, considerably increased the danger of a dust explosion. Gas in dangerous quantities may accumulate at spots at the face, or even over very small areas, but to imagine that a whole mine could become impregnated with a dangerous quantity of explosive mixture from end to end, without anybody perceiving it, seems almost incredible. But, on the other hand, we know that, especially in the roadways, whole mines become impregnated with dust, and when once this dust is ignited, an explosion flame is produced, which, with violent oscillations, rushes onward until either some obstacle or some space free from dust arrests its destructive progress. It is now universally recognised that a dust explosion may be originated by shot-firing in a dusty place without a trace of gas being present.

Our views, therefore, seem necessarily to involve us in a recommendation that permitted explosives be divided into two classes:—The first class being those which by both passing the existing test, and obtaining a high figure of merit in some further test or tests to be determined on after experiments, have shown themselves as safer under varying conditions; and the second class those which pass only the Woolwich test. We think it desirable that the explosives in the second class should be eliminated from use in road and stone work in every mine under the Explosives in Coal Mines Order, and entirely from all dusty mines in which a widespread explosion is to be feared.

The best known method of minimising or, indeed, of

neutralising the dangers of dust is watering. We forbear here to enter into a detailed account of the best method of watering mines which are not naturally wet, more especially as this intricate and difficult matter is already being made a subject of examination by the Royal Commission on Coal Mines. All we desire to say is that, if a mine is sufficiently wet or watered, either throughout or in zones, we think that in a case of that sort the dangers of explosives of the second class might be so minimised as to allow of these explosives being continued in use.

The object in retaining the use of these explosives is that the coal-getting qualities possessed by some of them are such that were they absolutely prohibited, substantial injury would be inflicted upon some mines in which the danger of a wide-spread dust explosion is not, in our opinion, so great as to warrant such injury.

Again, we think, in accordance with the views we have already expressed, that if blasting is only done between shifts, and by a very limited number of men, the advantages to general safety produced by the use of explosives of the second class may fairly be held to counterbalance the risk to which this limited number of men are exposed, and we are therefore of opinion that in mines where blasting between shifts only is used, and that by a limited number of men, explosives of the second class might still continue to be allowed.

Lastly, we wish to add a few words upon the character of the tests which should be employed in the formation of the two classes of explosives which we think should in future only be used in mines to which the orders under the Act of 1896 apply. It will be for the officers of the Explosives Department, who have done their work so well in the past, to arrange the details of these tests. Nevertheless, we think that we may indicate the general principles upon which they should be arranged. As we have already indicated, we think it would be desirable that the tests used by the Department should no longer consist of the single test, which we know as the Woolwich test, but should include a more severe test, possibly on the lines used on the Continent. Before the exact nature of such a test can be specified, it is in our opinion, necessary that thorough experiments should be carefully conducted. It may be necessary to build a large gallery similar to those in use in Germany and Belgium, and, as we believe, is about to be erected in France. It may also be necessary to try experiments, particularly on coal dust, in a disused mine. Differences of opinion exist as to whether natural gas or coal gas should be employed in tests. Coal gas seems to have succeeded well with the Woolwich test, and we are not prepared to say that it is essential that this more severe test should be carried out with natural gas rather than with artificial gas. At the same time we think that it would probably be very desirable to add to this testing station a testing station for testing coal dust and safety lamps. In this latter case the use of methane might be considered advisable, though even for this a substitute might possibly be found.

On the 14th March, says the *Novoe Vremya*, a fire broke out in the Putiloff Works, where the conical shrapnel shells are made for the 47 millimetre guns. The fire was overcome with great difficulty and not before £20,000 damage was done. Many finished shells and all the benches and machines in the workshop were destroyed.

APPLICATIONS FOR PATENTS.

MARCH 18—APRIL 13, 1907.

6,454. Ordnance and Projectiles. G. J. Stevens and W. E. Richards.
6,485. Ordnance Breech Mechanism. A. T. Dawson and G. T. Buckham.
6,539. Ordnance Sighting Apparatus. L. K. Scott.
6,585. Projectiles and Guns for same. L. Burley.
6,587.* Barrel Recoil Ordnance with Fluid Pressure Brake. Fried. Krupp, A.-G. (German application, July 25, 1906).
6,706. Sighting Mechanism for Naval Guns. L. J. Watson and A. E. Lester.
6,818. Quick-Firing Ordnance. A. T. Dawson and G. T. Buckham.
6,867. Windmill Target. E. S. Davis.
6,917. Ordnance Sighting Apparatus. A. T. Dawson and G. T. Buckham.
6,918.* Barrel Recoil Ordnance with Fluid Pressure Brake. Fried. Krupp, A.-G. (German application, July 25, 1906).
6,934. Small Arms Barrel Cover. J. W. Ottley.
6,949.* Feeding Quick-Firing Guns. G. Perino.
7,031.* Automatic Extractors for Breech Loading Guns. Aktiebolaget Bofors-Gullspang (Swedish application, Mar. 27, '06).
7,171.* Gas Guns. W. S. Franklin.
7,190. Running Target Apparatus. J. B. Lane.
7,237.* Recoil Loading Small Arms. B. Clarus.
7,244. Rifle Sights. H. Sefton-Jones.
7,322. Short Base Range Finders. H. D. Taylor.
7,414. Miniature Rifle Targets. J. S. Crowley and H. R. Sanders.
7,429. Directing the Firing of Naval Guns. T. Gilbert-Russell.
7,448. Windgauge Backsight Adjustment. R. A. Rogers and F. Cautels.
7,517. Ordnance Sighting Mechanism. A. F. Petch and F. Duncan.
7,625. Moving Targets. E. J. D. Newitt.
7,716. Targets for Gun Practice at Sea. W. F. Pamphlett.
7,797. Ammunition Hoists for Ordnance. A. T. Dawson and J. Horne.
7,837. Safety Explosive. N. Ceipek.
7,838. Safety Explosive. N. Ceipek.
8,034. Firearms. W. H. Jones and B. H. Jones.
8,038.* Firearms. S. Rogozea (Date of application in Belgium, April 9, 1906).
8,057.* Disappearing Gun Carriages. Fried. Krupp, A.-G. (Date of application in Germany, July 27, 1906).
8,102. Dummy Gun for Drill Purposes. A. E. Y. Trestrail.
8,156.* Explosives. Otto F. von Schroetter (Date of application in Germany, April 11, 1906).
8,157.* Detonating Wet Guncotton. Otto F. von Schroetter (Date of application in Germany, April 11, 1906).
8,258.* Sights for Firearms. G. H. Conrad.
8,390.* Bolt Guns. L. B. Taylor and E. H. Parsons.
8,537. Safety Explosives for Coal Mines. E. M. Hann and W. Greaves.
8,554. Single-Trigger Guns. H. W. Holland and T. Woodward.
8,575. Dummies for Military Practice. B. R. Dietz.
8,592.* Machines for Fixing Detonators to Fuses. Nobel's Explosives Co., Ld. and W. Muir.
8,644. Guns. T. Noble.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MARCH 21—APRIL 17, 1907.

COMPILED BY HENRY TARRANT.

4,937 (1906). **Ordnance Aiming Instructor.** A method of imparting aim instruction for heavy ordnance, consisting of an adjustable rifle arranged to be moved in an arc concentric with the arc of movement of the sighting apparatus of the big gun and through the same angular distance The rifle works in conjunction with an adjustable target. Accepted February 28, 1907.

5,315 (1906). **Bandolier Suspenders.** W. W. Twigg, Birmingham. Two shoulder straps are connected on the back of the wearer by a rigid horizontal connection from which a strap hangs its end holding the back of the ammunition belt. The

ends of the front portions of the shoulder straps also support the belt. Accepted March 5, 1907.

5,919 (1906). **Air-Gun Target.** C. Vesty, Birmingham. An air-gun target constructed so as to eliminate the possibility of dispute as to whether a bull has actually been scored. A disc of black paper is arranged between the face of the target and the bell, and this must be penetrated if the pellet has entered the bull. Accepted February 28, 1907.

6,580 (1906). **Bayonet Fastening.** A. Kruce. A simple clip fastening device is constructed to hold the bayonet firmly to the rifle. The system simplifies the attachment, and the elimination of a certain amount of metal heretofore used makes for lightness. Accepted March 19, 1907.

6,705c (1906). **Electric Ignition of Explosives.** W. Venier, Vienna. A portable electrical firing device for explosives the hinged lid of which carries an interrupter. The spark to ignite the compound in the distance is produced by forcing one contact of the interrupter of the front of the other so that the circuit is first closed and immediately afterwards is interrupted. Accepted March 20, 1907.

7,194 (1906). **Gun Carriage Wheels.** S. T. Richardson and R. Price, Birmingham. The two rims of a wheel for the carriages of heavy ordnance are trough shaped in section and carry pneumatic tyres. Each rim is provided with its own wooden spokes which are fixed to a common hub constructed of steel. Accepted March 21, 1907.

7,372 (1906). **Pedestal for Range Finders.** A. T. Dawson and G. T. Buckham, London. A pedestal for range finders is described in this patent. The pedestal is adapted to run on rollers, but the axes of the rollers may be shifted relatively so that the pedestal may be lowered until its weight rests firmly on the path on which the rollers work. Its weight otherwise is supported through the rollers. Accepted March 27, 1907.

7,571 (1906). **Enveloped Bullets for Small Arms.** King's Norton Metal Co., Ld., and T. A. Bayliss, London, and H. M. Smith, Abbey Wood. (See Selected Patents).

10,828 (1906). **Brakes for Ordnance.** Natalie and J. E. Schumacher, York. A brake for ordnance or ordinary vehicles which may be applied either by hand or automatically when the carriage commences to descend an incline. It may be instantly thrown into or out of action. Accepted February 28, 1907.

11,557 (1906). **Break-Down Air-Gun.** G. Hookham, Birmingham. In our last issue we dealt fully with a method of preventing escape of compressed air from the breech of break-down air-guns. This device is embodied in the gun described in the present patent, the novel features of which consist in the arrangement of the pivot on which the barrel breaks down so that the barrel end does not slide over the breech face when the gun is closed; two spring controlled clutches, one each side, which secure the barrel in the closed position; a spring controlled rod which locks the trigger until the gun is closed; and a method of pivoting the trigger block so that the stock may be turned upwards to allow of easy access to to the back of the cylinder. Accepted March 7, 1907.

13,030 (1906). **Double Single-Trigger Gun.** G. L. Rouy and R. L. Designe, Belgium. The outward appearance of the action described in this patent is that of an ordinary double-barrelled sporting gun with the usual two triggers. By an arrangement of two sliding parts dovetailed in the outsides of the triggers the two triggers are locked when one hammer is down but when both hammers are cocked the triggers act independently. This arrangement allows of the use of the gun as an ordinary double-trigger gun, of the use of the right-hand trigger to discharge both the barrels in the right and then left order, or of the use of the left-hand trigger to discharge them both in the left and then right order. Accepted February 28, 1907.

13,102 (1906). **Sighting Apparatus for Ordnance.** A. T. Dawson and G. T. Buckham, London. The velocity of projectiles decreases after a number of rounds have been fired from ordnance and it varies also with the temperature of the charge which is affected by the climate in different parts of the world. To compensate these differences a cam is adapted to act in conjunction with the range dial, described in Patent No. 16,767 (1904), so that through suitable compensating mechanism it transmits an angular movement to the range pointer. Accepted March 28, 1907.

13,126 (1906). **Manufacture of Cartride Cases.** S. O. Cowper-Coles, London. A mandrel the size of the interior of the cartridge case to be made is spun at a high speed in an electrolyte containing the metal it is desired to deposit to form the case. To compensate the lowering of the peripheral speed towards the centre of the base of the case the electrolyte is injected under pressure at this point, so as to produce a complete case of a uniform quality of copper. Accepted March 21, 1907.

13,283 (1906). **Safety Device for Percussion Fuses.** J. Y. Johnson, London. (Agent for *Société Francais des Munitions de Chasse, de Tir et de Guerre, Paris*). The mechanism of the type of percussion fuse which ignites the main charge an appreciable time after the shell has struck, is so arranged that the percussion pellet cannot be struck until the shell is rotated by the rifling at a speed sufficient to put two safety locking wings out of action by centrifugal force. Accepted March 7, 1907.

13,816 (1906). **Mountain Gun Mountings.** A. Bremberg, Glasgow. A method of overcoming the difficulty of allowing for a high elevation for mountain guns and at the same time maintaining the centre of gravity sufficiently low to ensure stability when the gun is travelling, consisting in providing two bearings for the straight axle. Normally the axle sits in the upper bearing but when the gun is to be fired the trail (and the gun) is raised so as to engage the axle and lower bearing. The necessity for a cranked axle is obviated. Accepted March 28, 1907.

14,811 (1906). **Sighting Apparatus for Ordnance.** A. F. Petch and F. W. H. Shepherd. A sight for ordnance having fixed trunnions is secured to one end of a shaft passing through a longitudinal hole in the trunnion. The other end of the shaft is locked to the cradle cheek or other part of the mounting which is elevated or depressed with the gun. Accepted March 7, 1907.

15,684 (1906). **Target Apparatus.** V. T. Murché, London. A curved vertical bar is fixed at the firing point, and a pulley at the end of a steel wire is adapted to be held at one end or other of the curve. The steel wire is raised or lowered to cause the several targets on the pulley carrier to run either to the butts or back to the firing point. Accepted March 28, 1907.

18,346 (1906). **Rifle Mechanism.** P. T. Godsall, Iscoyd Park, Near Whitchurch. In Patents Nos. 22,003 (1902) and 18,824, (1904), a bolt action military type of rifle was dealt with. The Patentee now describes modifications in the bolt stop, and cut off, and an alteration in the extractor head to allow of the elimination of the clip charger holder. The alterations aim at greater simplicity and thus reduced cost of manufacture. Accepted March 28, 1907.

18,391 (1906). **Telescopic Sights for Ordnance.** A. J. Boult, London. (Agent for *Neufeldt & Kuhne, Prussia*). Telescopic sighting apparatus for turret guns is usually corrected laterally to correspond with the shooting table in an automatic fashion during the elevation of the gun. As atmospheric influences and varying speeds of the target are factors for calculation the patentees arrange for a fine correction to be made by means of hand gear. Accepted March 21, 1907.

19,288 (1906). **Single Trigger Mechanism.** O. W. Brinizer, U.S.A. The single trigger blade of a double-barrelled gun carries a sliding piece having sear operating arms which are mechanically set to a position beneath either the right or left hand sear. The involuntary pull is rendered harmless by a pendulum like part which retards the rearward movement of the slide through the engagement of a set of teeth with teeth on the trigger blade. Accepted February 28, 1907.

20,382 (1906). **Combined Pistol and Sword.** A. Kühnen, Germany. The hilt of a sword is also the grip of an automatic pistol and contains the magazine. The short barrel of the pistol projects outwards so that the pistol may instantly be used by raising the sword. Under the Patents Act (1902), attention is drawn to Patents Nos. 5,552 (1891) and 8,761 (1899). Accepted March 28, 1907.

21,098 (1906). **Automatic Ordnance.** The Hotchkiss Ordnance Co., Ld., London (agent for *Société Anonyme des Anciens Establissements Hotchkiss & Co., Paris*). The firing mechanism of gas operated automatic ordnance is modified to enable the firer to discharge single shots with certainty. Heretofore this was a difficulty. The mechanism is arranged also to allow of the discharge of volleys. Accepted February 28, 1907.

23,751 (1906). **Improvement in Sighting Apparatus for Ordnance.** J. T. Dreyer, London. (*This Patent Specification is a Secret Document*)

28,188 (1906). **Action Body for Sporting Guns.** R. Hill and J. V. Smith, Birmingham. (See Selected Patents).

28,273 (1906). **Ejector Mechanism for Sporting Guns.** R. Hill and J. V. Smith, Birmingham. (See Selected Patents).

28,907 (1906). **Wind Gauge Back Sight for Rifles.** H. T. Ashton, Maj. W. B. Wallace, W. J. Robinson, Enfield Lock. (See Selected Patents).

29,161 (1906). **Bullets for Military Small Arms.** E. Polte, Germany. In view of the recent development of high velocities brought about by the lightening of bullets for military rifles and the change in the shape of the nose, the patentee describes a method of taking away some of the metal of the bullets previously in use, and by a series of pressing into successive dies altering the noses to the required shape. Waste of old material is avoided by this invention. Accepted March 21, 1907.

2,041 (1907). **Apparatus for Instruction in Gunnery.** A. S. Susmann and W. Vaughan. (*This Specification is a Secret Document*).

3,004 (1907). **Breech Chambers for Ordnance.** Col. H. C. L. Holden, R.A., Woolwich. To increase the air space in large ordnance the chamber has been bellied out to accommodate the charge, but this arrangement possesses a drawback in that it is difficult to load the projectile centrally into the bore. The Patentee therefore constructs the chambers with longitudinal grooves so that the charge sits on the "lands" and the projectile is in axial alignment with the bore. The arrangement allows the dimensions of the chamber to be varied easily to secure the best ballistic results. Accepted March 28, 1907.

SELECTED PATENTS.

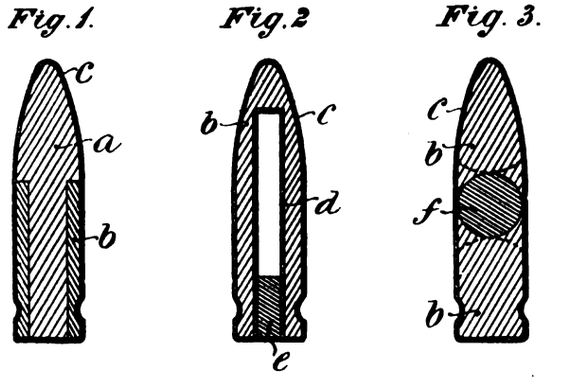
ENVELOPED BULLETS FOR SMALL-ARMS.

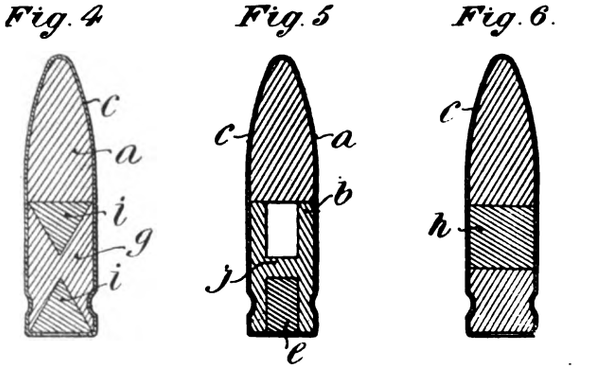
7,571 (1906). The King's Norton Metal Co., Ld., and T. A. Bayliss, London, and H. M. Smith, Abbey Wood. The modification in the construction of enveloped bullets described and illustrated in this patent is designed to secure more perfect obturation than heretofore, and to increase the rotary stability without materially increasing the weight of the bullet. The invention is the outcome of modern requirements which demand that the curve of trajectory shall be straighter than that which is secured with the bullet of the Service pattern at present in use. The weight of the bullet in proportion to its length and the shape of the bullet nose have therefore to be modified in order to secure the higher velocity which produces the longer curve; and the patentees point out that bullets already invented to fulfil these conditions are "underbalanced," the shifting of the centre of gravity having defeated the object for which they were designed. Such bullets are the cause of the "disclaimers" mentioned below.

The invention consists in so constructing and arranging the parts of solid enveloped bullets that while the length of the cylindrical part of the bullets is materially increased the weight of the said bullets is preserved about the same as that of an ordinary solid enveloped bullet, the improved bullet being of light weight in proportion to its length; and so that the bullets are balanced in order that increased stability in flight shall be insured. From experiments that have been made it has been found that bullets constructed according to this invention are or can be so nicely balanced that when placed in mercury they float approximately horizontal.

In carrying the said invention into effect the parts of the body of the bullet are made of different densities; they are so shaped and combined that the centre of gravity of the bullet is disposed to tend to preserve the axis of the bullet horizontal in flight. The parts of different densities may also be so shaped and arranged or combined that when enclosed in the outer case or envelope of the bullet the bullet is lighter axially than circumferentially, the lighter core of the bullet extending preferably from the base end to, or near to, the front end or nose.

The bullet, made up in various fashions to accord with the ideas of the patentees, is illustrated in the sectional drawings reproduced. The construction shown in Fig. 1 consists in the arrangement round the light metallic or non-metallic base or core *a* of the tube *b* made of denser metal such as lead, the whole being enclosed in the envelope *c* of cupro-nickel, brass or other metal or alloy. The shape of the component parts of the bullet may be varied within considerable limits, and may be modified as illustrated in Fig. 2, so that the interior of the bullet consists of a tube of lead *b*, or other dense metal, closed at its front end, the tube being left hollow or filled if necessary by a core of paper or other light substance. Again, the body of the bullet may be mainly of lead as in Fig. 3, a lighter or spherical part *f* being deposed between the front and base ends. Instead of a spheroidal construction the part *f* may be made cylindrical with concave ends as is indicated in dotted lines.





Or the enclosed body of the bullet may be constructed as is represented in Fig. 4, that is to say, it may consist of a conoidal nose or front end *a* of lead, two lighter conical parts *i* and a lead or other dense metal part *g* arranged between the two cones *i*. The two cones *i* are arranged with their axes in line and with their apexes presented to each other as is represented in Fig. 4.

The lead or other dense metal tube *b* of the cylindrical body of the bullet may again have a diaphragm *j* at its middle as is represented in Fig. 5, the tubular rear end being filled with a paper or other light filling material *e* as is represented. The bullet may also be made of a series of alternating light and heavy parts or discs as is illustrated in Fig. 6, the bullet consisting of two heavy end parts, preferably of lead, with a lighter middle part *h*, prefer-

ably of paper or paper pulp, between them; or the bullet may consist of several heavy metal parts alternating with several lighter metal or non-metallic parts or discs.

By the improvements in enveloped bullets described, the patentees claim that the cylindrical bodies of such bullets are made of greater proportionate length than is the case with ordinary enveloped bullets without materially increasing the weight, which results in a greater range and accuracy in the flight; and the centre of gravity is so disposed that the bullet is balanced in flight. Further, by making the core of the bullets of materials of different densities the breaking or setting up of the bullets on impact is ensured.

As mentioned above, the patentees state that they are aware that it has been proposed to make the body of an enveloped bullet for small-arms of two parts of different densities (for example of lead and aluminium) for the purpose of locating the centre of gravity in a different position from that of a bullet with a homogeneous body but that such parts have not been shaped and combined in such manner as to produce a perfect balance in the bullet in flight. They are also aware that non-enveloped bullets having an axial part or filling of less density than the external portion so as to be of greater length for a given weight than an ordinary solid bullet have been proposed and that non-enveloped bullets having such an axial filling and designed to be in equilibrium longitudinally have been proposed but that their invention really relates solely to enveloped bullets for small-arm ammunition the conditions governing the design of which bullets are widely different from those which govern the design of the old non-enveloped bullets.

As they are of interest we append the claims appearing in the specification.

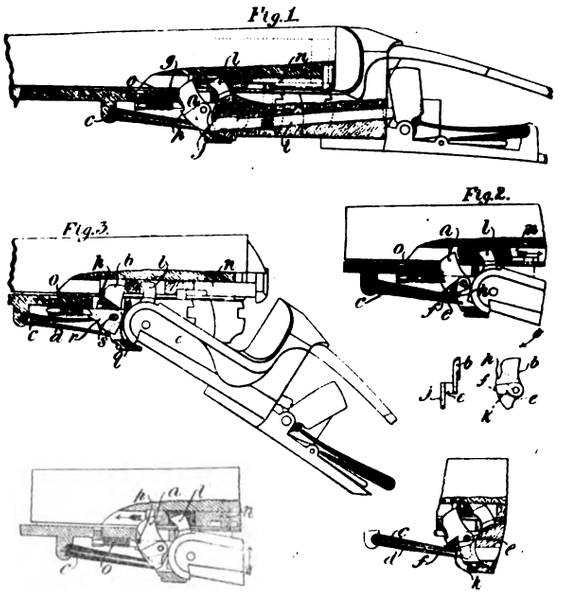
(1). The improvements in enveloped bullets for small arm ammunition hereinbefore described and represented in the accompanying drawing, the said improvements consisting in making the body of the bullet of two or more parts of different densities, the said parts being so shaped and combined that the bullet has a length in proportion to its weight greater than that of an ordinary solid enveloped bullet the centre of gravity of the bullet being so disposed that the bullet is nicely balanced and tends to preserve its axis horizontal in flight substantially as described and illustrated.

(2). The improvements in enveloped bullets hereinbefore described and represented in Figs. 1 and 2 of the accompanying drawing, the said improvements consisting in making the body of the bullet with a core of less density than the external portion of the said body substantially as and for the purposes described and illustrated. Accepted March 14, 1907.

EJECTOR MECHANISM FOR SPORTING GUNS.

28,273 (1906). R. Hill and J. V. Smith, Birmingham. The mechanism for ejecting the spent cartridges from the barrel or barrels of a break-down sporting gun of the well-known type is "selective," *i.e.*, if the gun be opened and one barrel has been fired the empty shell alone will be ejected, and the principal object of this invention is to provide means whereby the ejecting action of such mechanism is timed so that the ejector tumblers shall be permitted to "kick" only when the gun is almost fully opened. The following brief description shows how the "kickers" are held up almost until the moment of completed movement by an interceptor bolt which is then pushed away by a blade operated by a cam on the action body moving upward relatively with the downward movement of the barrels and fore-end.

The mechanism is illustrated as far as the space at our disposal will allow, and it will be seen that the gun carrying it is of the usual sporting pattern. It may be mentioned that the action illustrated is of the type dealt with in Patent No. 28,188, 1906, which is fully described in this issue, but the ejecting mechanism under review is apparently applicable to any type of break-down sporting gun action. The mechanism consists mainly of the pair of tumblers *a* and *b* which receive the sharp movement necessary to "kick" the extractors out and eject the shells from the barrels, from the spring *c*. The under legs *d* of these springs are secured much in the usual way to the fore-end knuckle whilst the ends of the upper legs of the springs are adapted to lie either on one flat or the other of the projections *e* on the sides of the tumblers When the spring end bears against the flat *f* (Fig. 1) the tumbler is pressed in such a manner that it is forced to bear against the stop *g* but when the trigger is pulled and the hammer *h* is dropped the cocking rod *i* is pushed forward so that when the gun is broken down the cam *j* on the rod *i* is caused to alter the position of the tumbler so that the spring end bears against the other flat *k* of the projection *e* on the tumbler side. In this position the spring tends to force the



tumbler forward to deal the sharp shell ejecting blow to the bottom *l* of the leg *n* of the extractor. The movement of the tumbler is stopped however, (Fig. 2), (until the time when the gun is almost completely broken down) by the spring operated rod *o* which bears into the notch *p* in the tumbler. Reference has to be made to Fig. 3 to discover how the nose of this rod *o* is displaced to allow the tumbler to drop. The ejector timing cam *q* on the action body operates to push the interceptor bolt clear through the medium of the blade *r* which works on the same pin on which the tumblers turn. The movement of this blade is limited by the slot *s*, and the cam *q* is not allowed to force the blade forward until the opening movement of the gun is practically completed. When the tumblers are released and are forced forward by their springs the extractor legs *n* receive a sharp tap on their ends and the empty shells are thus ejected.

If the cartridges have not been fired the hammers remain cocked and the cocking rods *i* are not pushed forward Consequently the initial shifting of the spring pressure from one surface of the lateral projection *e* on the ejector tumblers to the other does not occur and the tumblers do not drop when the gun is opened. In this case the cartridges are merely carried out slightly from the barrels by the usual action of the part *t* on the extractor legs.

The hammers of the locks are cocked by the operation of cams on the fore-end knuckle on the cocking rods after the initial displacement of the ejector tumblers and before the blade *r* is forced forward to displace the tumbler interceptor bolt; and the ejector

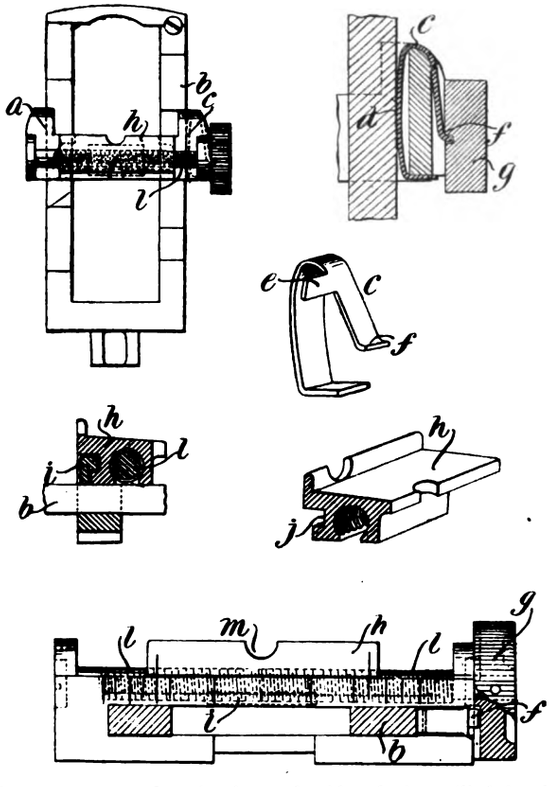
tumblers are re-cocked by the extractors legs during the closing of the gun.

The patentees state that they are aware of certain other ejecting devices in which a cam on the action body is arranged through a lever to move the ejector tumbler into the active influence of its spring at the commencement of the opening of the gun and they make no general claim to the use of ejector timing cams on the action body. Accepted March 14, 1907.

WIND GAUGE BAR FOR TANGENT LEAF SIGHTS.

28,907 (1906). H. T. Ashton, Major W. B. Wallace, and W. J. Robinson, Enfield Lock. The wind gauge sliding bar, adapted to be operated by a screw, is constructed for application to leaf sights such as that on the long Lee-Enfield rifle. A "gib" spring is arranged to act in two capacities, first as a gib between the slide and the leaf, and second as a rachet co-operating with the milled heel of the slide screw to indicate the distance through which the head is turned. To bring the sighting notch down close to the leaf, as much metal as possible is removed from the underside of the slide.

From the accompanying illustrations it will be understood that the slide *a* is mounted on the leaf *b* in the usual manner and to grip the two lightly together the gib spring *c* is fitted. Part of the spring *d* is arranged to belly out and press one end of the slide against the leaf. The tang *e* of the spring is secured in a recess in the end of the slide, and the upturned part *f* is adapted to act as a

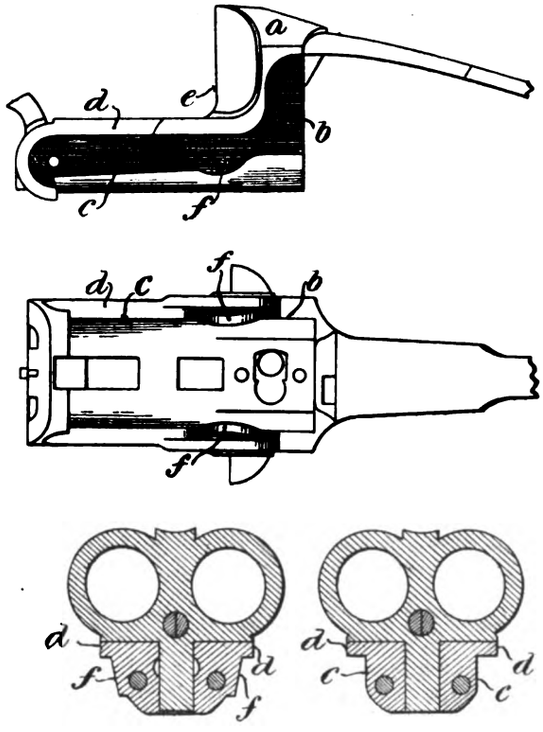


rachet to engage slots in the underside of the milled head *g*, through which the wind gauge screw is operated. The engagement of spring end and notches may be employed to indicate the distance through which the screw has been turned, and consequently the amount of travel imparted to the wind gauge slide.

The wind gauge slide *h* is retained in position by the engagement of the bar *i* of the main slide with the groove *j*. When the screw *l* is in position the slide is held against the bar *i*. The amount of metal beneath the screw *j* is immaterial and may either be cut away or left very thin. By this means the sighting notch is brought down low to adapt the bar for use on the existing leaf of such rifles as the long Lee-Enfield. Accepted March 21, 1907.

THE HILL AND SMITH GUN BODY.

28,188 (1906). R. Hill and J. V. Smith, Birmingham. The metal in the breech body of a sporting gun is so arranged, according to this invention, that the body is reinforced at the part where the fracture in light skeleton bodies usually takes place. The metal added to this particular part is taken from the exterior of the gun round the action, and the body although strengthened in this fashion weighs only as much or even a little less than those generally in use. The metal removed from the exterior of the action body is replaced by a forward extension of the wood of the



stock, so that the general outline of the gun is preserved or may even be improved, as the removal of the wood does not affect the strength of the action as would the removal of metal for this purpose from the ordinary type of action body.

The action body is illustrated in the drawings appended and it may be mentioned that an ejecting mechanism for this class of action is also dealt with fully in this issue. The outer sides of the body *a* are recessed or reduced in thickness at the rear and the lower parts *b* and *c*, leaving the upper and front boundary or edges *d* of the original thickness. Immediately adjacent and below the junction of the breech face *e* and the horizontal portion of the body where fracture is most likely to occur, the cheek parts *f* are left of greater thickness than the recessed portions *b* and *c*, but they do not stand out quite so far as edges *d*. The object of these cheeks is to leave such thickness of metal immediately below the angle of the action as will take up and distribute the bending strain imposed on the action flats by the shock of firing. The recessed portions *b* and *c* are rounded to remove as much metal as possible and the wood of the stock is extended forward so that the whole of the underside and recessed parts of the body are encased. The edges of the ridge parts *d* are undercut so that the wood is held down when in position. Accepted March 14, 1907.

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CONTENTS.

CURRENT TOPICS.

The Fate of the Morris Tube.—The announcement which appears in another column to the effect that the War Office has sanctioned the alteration of rifles of Government property fitted with Morris tubes, by fitting to them fresh barrels, bored either for the ·22 cartridge or the Morris tube cartridge, suggests that the tube method of obtaining miniature practice will shortly pass out of use. The only surprise is that this decision was not arrived at when the ·303 calibre was first introduced. A tube for reducing a ·450 Martini rifle to enable short range practice to be conducted was a sound enough idea. But when the calibre was attenuated down to ·303 bore the tube at once became so fragile as to throw a doubt on the possibility of attaining accurate results by its use. Coincidently with the use of the ·303 tube, the ·22 calibre rifle began to make its presence felt throughout the country, and shooters whose knowledge went further than mere drill-hall practice could show results with rim-fire cartridges at one-third the price which the more pretentious central-fire ·297—·230 Morris tube cartridge could not pretend to emulate. There is no doubt that the Morris tube cartridge could even now be improved so as to excel in competion with its inexpensive rival, but it is to be questioned whether the game is worth the candle, since cost is the essence of the problem in view of the remarkably high standard of performance to which the ·22 cartridge regularly attains. Funds are at the present time so tight in the War Office that no matter how important may be the results produceable by a given piece of expenditure, no money is available. The distinction which exists between issuing the new pattern of practice service rifle free to those using it, and allowing corps to make the alteration at their own expense, is but typical of the self-supporting basis upon which the rifle shooting movement must be carried on. The permission to adopt the ·22 calibre barrel in rifles refitted in accordance with the above order is of great importance because it enables the expensive and inefficient combination of the Morris tube and the Morris tube cartridge to be thrown out and replaced by an efficient firearm, firing an economical cartridge. It is true that tubes have of late years been chambered for ·22 cartridges, but in view of the inevitable adoption sooner or later of service rifles fitted with specially bored barrels, to progress in this half-hearted fashion is tantamount to taking two bites at a cherry. The ·22 service rifle is certain to become the recognised half-way house between the true miniature rifle and the service arm. Therefore the sooner effort can be concentrated on its cheap and efficient construction the sooner will rifle shooting practice extend on the right lines. The only pity is that so many rifle clubs have spent their initial funds on what must now be pronounced obsolete equipment. Barrels do not, however, last for ever, and the conversion process which has been sanctioned will at a small cost turn an old rifle into a new one.

Mid-Range Cartridges.—A good deal of discussion has taken place with reference to the rules issued by the National Rifle Association for the purpose of developing a mid-range cartridge suitable for target practice at medium distances. A general impression seems to have got abroad that the specification which has been issued leaves so much

margin as to make it doubtful whether cartridges loaded in accordance therewith, will offer sufficient margin of extra safety to permit ranges to be opened to its use which have been declared dangerous so far as the service cartridge is concerned. Safety is in any case a purely relative term, and as no one can deny the great reduction in muzzle and striking energy which the mid-range specification lays down some additional safety must exist, and it is merely a question of opinion whether it goes far enough. The same kind of objection is always brought forward against every kind of maximum limit. In the present instance it must be remembered that Bisley, and not the village green, is the place where the new cartridge load will be tried. The specification at least assures good shooting on the Bisley ranges with a very large extra margin of safety comparing it with the full service charge. The specification is in fact exactly suited to the conditions of the proposed competition. The extreme target distance is 500 yards, and it is doubtful whether passable results could be obtained at this distance with a lighter re-load bullet than is outlined in the specification. There are, however, those who maintain that ranges under suspicion of being unsafe for ordinary service rifle practice will never be re-opened or put into regular use without a definite guarantee, such as will make it impossible for the service cartridge ever to be used by the mistake, deliberate or otherwise of a shooter. So long, therefore, as the mid-range cartridge is merely a re-loaded edition of the service cartridge, being thereby fired from the service rifle, there will be no guarantee that service cartridges will not at some time or other be wrongly substituted. To meet this objection it would be necessary to design a new cartridge which could only be fired from a rifle specially chambered and bored for its use. This cartridge would present no difficulties of design or manufacture, but it would be impossible to produce it at short notice, and it would be a mistake to hurry in view of the importance of avoiding the unwise policy of introducing several mid-range cartridges, none of them occupying the position of an adopted model having the sanction of all concerned. If a special mid-range cartridge is required it should be designed at leisure with time to incorporate into its design the ideas and views of those who will be called upon to manufacture it, and the others who will look to provide the rifles. A re-load cartridge suitable for the coming Bisley Meeting may be regarded as a purely tentative production, viz., a means of adapting existing ammunition to fire with reduced charges in the existing service rifle, all with a view to showing whether a useful purpose can be served in the future by the production of a special mid-range cartridge with a special rifle, the counterpart of the service arm, to fire it.

The Kynoch Prosecution.—Notwithstanding the fact that the whole question involved in the prosecution of Messrs. Kynoch for adding an unauthorised ingredient to an explosive of their manufacture is *sub judice* by reason of the circumstance that a further hearing is pending before the High Court, the *Birmingham Daily Post* of the 24th ult. and certain Irish papers have published articles containing statements which hardly seem consistent with an attitude of suspended judgment. The articles in question are practically confined to what purports to be the report of an interview with Mr. Arthur Chamberlain, chairman of Kynochs, in which the Home Office inspectors are attacked for adopting an attitude of prejudice against Messrs. Kynoch. In the editorial opening it is alleged that Kynochs urged that the Home Office did not interfere with the use of mercury by their trade competitors in England. Our own report of the proceedings, which was compiled from notes taken at the time of the hearing, did not contain any reference to such a statement. Moreover the whole point of the above article seems to consist in an allegation that the Home Office are making a deliberate attack on an Irish industry, and that in consequence the Arklow factory must be shut down and another built elsewhere. It is impossible for the ordinary person to see what possible connection the recent proceedings can have with Ireland more than with any other part of the country. Yet it is seriously contended that the Irish factory ought to be placed under the superintendence of inspectors appointed by one of the Irish departments, and no longer under the superintendence of a hostile English department. It seems that the leader of the Irish party in the House of Commons has been asked to interest himself in the matter. Having ourselves been very careful not to allow any comments o appear taking one side or the other we must protest against any kind of attack on the fairness and good faith of Captain Thomson and his loyal and public-spirited co-inspectors. Their work is at all times exceedingly difficult, and requires the proverbial tact of the English gentleman to carry it through with the moral support of the trade, without whose co-operation the act could not be so successfully administered as at present. The Explosives Act applies to the whole of England, Scotland, Ireland, and Wales, and the recent action has been taken in respect to the whole area under His Majesty's Inspectors' control. The very vagueness of the suggestion that the Arklow factory must be removed elsewhere might mislead the reader into supposing that a site in any part of the United Kingdom outside Ireland would give freedom from the interference from which Arklow is said to suffer. As a matter of fact the recent prosecution was for an alleged offence committed in England. This is only indirectly an Irish question, and the word " elsewhere " must accordingly be interpreted to mean outside the United Kingdom, which would not be of much avail, because even if explosives were made in Timbuctoo the English market would still be closed to those which failed to comply with the authorized list. This is really, however, beside our present purpose which is to express most emphatic disapproval of the publication by a Birmingham contemporary of material which casts unworthy aspersions on the honour of H. M. Inspectors of Explosives, whose honour, fortunately, is not in need of being upheld by ourselves or anyone else. On the other hand the etiquette of our public departments makes it necessary to sit silent under attacks which might well be answered if an answer were allowed. It is, therefore solely with the idea of limiting the area of the attack which has been made that these words have been written,

THE NEW PATENT PROCEDURE.

WHAT with the legislation now before Parliament and the experience which has been obtained concerning the Patent Office search into the novelty of inventions, one cannot help concluding that a Government department which lived for so many years in a state of complacent happiness is waking up into usefulness. Those who have come into contact with the officials of this department have in very few instances been left in a state of doubt concerning the individual worth and merit of the experts who have received a life-time's training at this exacting work. The public comes more particularly into contact with the librarians. The obliging courtesy with which they will hunt up any unconsidered trifle of knowledge which a reader may require has always been a pleasing feature of visits to this library. It is probably the finest technical library in the world. The classification of books and periodicals is perfect, and it possesses the surpassing merit that the reader is allowed direct access to the bookshelves. There are many reasons for supposing that the interior work of the Patent Office, with which the public comes less into contact, is also administered on lines of orderly arrangement and well systematised information. However all these advantages counted for little or nothing so long as the patentee was allowed to re-invent whatsoever he pleased, including things in everyday use, and at times even the items in a museum of antiquities.

The revised Patent Office rules, which altered this state of affairs, and made arrangements for a systematic search into the novelty or otherwise of a patent, rendered available the vast stores of information which have been accumulated in such quantities since patents were issued at popular fees. Patent agents certainly made some sort of search, but the thorough hunt through all relevant specifications was an expensive matter, and even then open to the defect that unorganised individual efforts are unlikely to succeed in a task whose proper accomplishment could only be met out of the public purse. With an official search department each section of invention can be placed in the hands of a competent staff of trained experts who can readily turn up all that relates to the particular heading and sub-heading within which a given patent falls. The *bona fide* inventor is naturally disappointed if he finds that someone else has harvested the fruit which he thought his own, and he is still more disappointed if he knows that under his treatment the invention would succeed where previously the same idea has failed to produce commercial results. On the other hand it is not the personal feelings of the inventor which must guide the procedure of the Patent Office. If a specification covers old ground it is right that the inventor should be so informed at the earliest possible date. It may be that he has done some good and original work, and before the final draft of his patent is presented he has the opportunity so to circumscribe his claims as to strengthen his patent in those directions where new ideas are disclosed.

The new procedure will doubtless prove of great assistance in saving loss and disappointment to inexpert inventors who might spend money uselessly in pushing a patent which deals with a subject upon which he has no real expert knowledge. Such people are not denied the right to complete their patent, but they are forced to include in the specification a disclaimer of what has been done before. This interprets a specification for the benefit of those anxious to study its scope; and it at the same time serves to bring home to the inventor the fact that he is not conducting his researches in a virgin field. Probably no better example of the working of the new rules could be given than the following extract from a recent specification.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed we declare we are aware that it has been proposed to construct bullets for small arms in the following manner :—

First. Having an opening or hole extending longitudinally from rear or butt end of bullet to a point adjacent to its centre, having an opening or hole extending laterally through bullet, and having a broad recess or cavity on its outer surface :—

Second. Having finely cut parallel grooves in planes at right angles to the axis of the bullet and applying and compressing into said grooves a softer metal such as lead or tin to act as a lubricant.

Having fine grooves cut diagonally on body part of bullet, said grooves extending back to the rear or butt end of bullet.

Third. Having circular grooves formed on the body part of the bullet, the metal between these grooves being slightly tapered so as to form a bearing surface for the bore of the gun.

Fourth. Having projecting ribs on the body part of the bullet thereby forming shallow troughs on the casing, these troughs being discontinued a short distance from base of the bullet, and having a circular disc at the mouth of the casing of bullet and secured by the closing of said mouth; or the disc may be dispensed with and the mouth of casing be closed over the end of bullet.

Fifth. Having two series of shallow and closely adjacent depressed lines arranged in opposite spirals formed on the body part and extending to the rear or butt end of bullet.

Having slightly diagonal grooves cut in a knotted or knurling manner on the body part and extending to the rear or butt end of bullet.

Having small indentations formed on the body part and extending to the rear or butt end of bullet.

Sixth. Having a broad groove encircling the casing of the bullet.

In these arrangements of bullets for small arms the grooves, troughs and indentations are filled with a lubricating material.

We do not make any claim to any of these forms of bullets, but what we do claim is :—

First. In projectiles or shells used in heavy ordnance, the forming of a V shaped threaded and grooved surface on the body part of the projectile, said grooves being the same or of greater depth than the grooved rifled parts of the guns, so as to carry the lubricant and automatically lubricate the rifled parts of the guns, substantially as set forth.

Second. In bullets used in small arms, the forming of a V-shaped threaded and grooved surface on the body part of the bullet, said grooves being the same or of greater depth than the grooved rifled parts of the guns, so as to carry the lubricant and automatically lubricate the rifled parts of the guns, substantially as and for the purposes herein set forth and illustrated by Fig. 1 of the accompanying drawings.

Third. In bullets used in small arms, the forming longitudinally or diagonally, of finely cut grooves on the body part of the bullet, said grooves being discontinued a short distance from the base, so as to carry the lubricant and automatically lubricate the rifled parts of the guns and prevent the egress of the gases, substantially as and for the purposes herein set forth and illustrated by Figures 2 and 3 of the accompanying drawings.

Fourth. In bullets used in small arms, the forming of a number of narrow shallow V-shaped indentations on body part of the bullet so as to carry a lubricant substantially as and for the purposes herein set forth and illustrated by Figure 4 of the accompanying drawings.

LECTURES TO YOUNG GUNMAKERS.

XLIII.—CALCULATING THE THICKNESS OF FELT WADDING IN SPORTING CARTRIDGES.

HITHERTO all the instructions and particulars which relate to the loading of sporting cartridges have been based on purely practical experiments, and the amount of felt wadding has been fixed by the trial loading of a certain number of cartridges. The amount of space occupied by the column of shot in various bores of sporting cartridge has been well known for many years past. The figures for this measurement were first published in the lecture which appeared in this journal in the issue of December 1902, but a revised table was issued in Appendix I of Curtis's & Harvey's *Notes on Shooting*. The appropriate thickness of felt wadding to be employed is specified in cartridge loading instructions, and it is assumed that when the given thickness of felt is employed, the powder charge receives sufficient compression to give a tight well filled cartridge, but not one where the powder is unduly rammed. The specified particulars of a charge are as a rule fairly reliable for the better known calibres and loads, but instances occur where it is obvious that the thickness of felt has been defined without regard to the satisfactory nature of the result produced. In the present lecture an attempt will be made to explain a new method of tabulating the space occupied by the powder charge so that the whole contents of the cartridge can be expressed in a manner capable of affording useful instruction to any loader who is willing to work out simple arithmetical problems.

The new system of standardising cartridge loads is based upon a simple weighing and measuring test which, having once been made, clears the way for all future results. To ascertain the space occupied by a certain amount of powder in a certain gauge of cartridge it is necessary to weigh out that amount of powder, insert it in an empty cartridge case, and without ramming the charge measure the distance from the face of the powder to the mouth of the case. This distance deducted from the total length of the cartridge case *gives the distance from the base of the cartridge to the surface of the powder charge when in an uncompressed state.* As an example of this measuring process the following figures which were obtained with E.C. powder in a 12-bore cartridge case may be quoted :—

		Difference.
30 grains of E.C. occupy	·970 in.	·230
40 ,, ,, ,,	1·200 ,,	·230
50 ,, ,, ,,	1·430 ,,	·230
60 ,, ,, ,,	1·660 ,,	

With an increase in the length of the powder column of ·230 of an inch for every ten grains of additional powder the increase for a single grain of added charge is obviously one-tenth of this amount, viz. ·023 of an inch. By adding three times this amount to the measured length for 30 grains of E.C. powder the length of the 33-grain charge measuring from the base of the cartridge becomes ·970+·069 = 1·039. Exactly the same process of measurement was applied to Schultze powder and it was found that 42 grains of Schultze occupied 1·060 in. According to recognised practice 42 grains of Schultze and 33 grains of E.C. occupy exactly the same bulk and have the same propelling effect on a charge of shot. Actually every sample of powder differs from any other which may be taken. A specimen removed from the top of a tin gives a different density from the smaller grains which have collected at the bottom of the tin. Summarising general experience 33 grains of E.C. occupy rather less space than 42 grains of Schultze, and the experiments here shown indicate this fact, which suggests that the samples used in the experiments were fairly typical of the powders represented. One cannot, however, in a table of values take account of very small differences, and it was accordingly decided to select some midway length as the space occupied in a 12-bore cartridge by a three-dram charge, whether it be a 42-grain powder like Schultze or a 33-grain powder like E.C. that is used. The following shows how this adjustment was effected :—

42 grains of Schultze occupy	1·060 in.
from which deduct	·010 ,,
giving	**1·050** ,,
33 grains of E.C. occupy	1·039 in.
to which add	·011 ,,
giving	**1·050** ,,

The above shows that with the very slight alteration of the hundredth part of an inch the midway measurement of 1·050 can be adopted as the height from the base of the cartridge to the surface of the three-dram powder charge, uncompressed, and exactly as it is filled into the cartridge case. Whilst it was found that the height of this column of powder advanced with E.C., ·230 of an inch for every ten grains addition, with Schultze the increase was ·175 in. per ten grains. The following corrected table of values was thus obtained from this arithmetical treatment of the measuring and weighing experiments which have already been described :—

	Space Occupied.	
Charge.	Schultze.	E.C.
30 grains ..	— ..	·98 in.
40 ,, ..	1·02 in. ..	1·21 ,,
50 ,, ..	1·19 ,, ..	1·44 ,,
60 ,, ..	1·37 ,, ..	—

It will be seen from this last table that the unnecessary third place of decimals has been left out, and that three simple measurements have been evolved for each powder, such as show the relative space occupied by the two grades of density. Now that a series of figures has been evolved to express the height of the head of the powder in the cartridge it will be necessary to enquire what other measurements are needful for arriving at the total contents of the cartridge. Apart from the powder these are, first, the two twelfth-inch cards which lie on either side of the felt wad second, the felt wad itself, and third, the length of the shot column plus the over-shot card and the amount of case required for turnover. The two twelfth-inch cards on either side of the felt may be set down as measuring ·17 of

an inch, this being the nearest value to two places of decimals for their combined length. As these cards occur in every cartridge containing standard wadding, as recommended by the powder manufacturers, they form a constant item in the contents of the cartridge. They can, therefore, be added to the height of the powder, thereby producing the following table of powder values, which has been extended from the figures given in the last table :—

TABLE SHOWING THE DISTANCE FROM THE BASE OF A 12-BORE CARTRIDGE TO THE FACE OF THE POWDER CHARGE UNCOMPRESSED, PLUS TWO $\frac{1}{12}$-INCH CARD WADS.

	in.		in.
30 grs. of E.C. occupy	1·15	40 grs. Schultze occupy	1·19
31 ,, ,, ,,	1·17	41 ,, ,, ,,	1·20
32 ,, ,, ,,	1·20	42 ,, ,, ,,	1·22
33 ,, ,, ,,	1·22	43 ,, ,, ,,	1·24
34 ,, ,, ,,	1·24	44 ,, ,, ,,	1·26
35 ,, ,, ,,	1·27	45 ,, ,, ,,	1·27
36 ,, ,, ,,	1·29	46 ,, ,, ,,	1·29
37 ,, ,, ,,	1·31	47 ,, ,, ,,	1·31
38 ,, ,, ,,	1·34	48 ,, ,, ,,	1·33
39 ,, ,, ,,	1·36	49 ,, ,, ,,	1·34
40 ,, ,, ,,	1·38	50 ,, ,, ,,	1·36
41 ,, ,, ,,	1·40	51 ,, ,, ,,	1·37
42 ,, ,, ,,	1·43	52 ,, ,, ,,	1·40
43 ,, ,, ,,	1·45	53 ,, ,, ,,	1·41
44 ,, ,, ,,	1·47	54 ,, ,, ,,	1·43
45 ,, ,, ,,	1·50	55 ,, ,, ,,	1·45

The following very simple table shows the amount of space to be left for the accommodation of a series of shot charges :—

TABLE SHOWING THE AMOUNT OF SPACE TO BE ALLOWED IN A 12-BORE CARTRIDGE TO ACCOMMODATE THE FOLLOWING SHOT CHARGES, PLUS THE OVER-SHOT CARD WAD AND THE LENGTH OF TUBE REQUIRED FOR TURNOVER.

$\frac{7}{8}$ oz. requires	·90 in.	$1\frac{3}{8}$ oz. requires	1·20 in.
$\frac{15}{16}$,, ,,	·94 ,,	$1\frac{7}{16}$,, ,,	1·24 ,,
1 ,, ,,	·98 ,,	$1\frac{1}{2}$,, ,,	1·28 ,,
$1\frac{1}{16}$,, ,,	1·02 ,,	$1\frac{9}{16}$,, ,,	1·32 ,,
$1\frac{1}{8}$,, ,,	1·05 ,,	$1\frac{5}{8}$,, ,,	1·35 ,,
$1\frac{3}{16}$,, ,,	1·09 ,,	$1\frac{11}{16}$,, ,,	1·39 ,,
$1\frac{1}{4}$,, ,,	1·13 ,,	$1\frac{3}{4}$,, ,,	1·43 ,,
$1\frac{5}{16}$,, ,,	1·16 ,,		

The remaining item to be dealt with is the thickness of felt wadding. Fractional values do not convert exactly into decimals, but following the rule that no account need be taken of differences smaller than the hundredth part of an inch the following table of equivalents may be set down, viz :—

$\frac{1}{4}$	in. felt	= ·25 in.
$\frac{5}{16}$	,, ,,	= ·31 ,,
$\frac{3}{8}$	,, ,,	= ·37 ,,
$\frac{7}{16}$	,, ,,	= ·43 ,,
$\frac{1}{2}$	,, ,,	= ·50 ,,

The minimum chamber length for the nominal $2\frac{1}{2}$-inch cartridge is, according to the Gunmakers' Association sizes, 2·56 inch. Cartridge tubes are of course cut to something under this length, but as the margin of toleration is inconsiderable the standard decimal length of 2·56 can be adopted. In the same fashion 2·75 and 3·00 inches may be regarded as decimal lengths of the $2\frac{3}{4}$ and 3-inch cartridges respectively.

The material is now available for examining the better known standard cartridge charges with reference to the amount of felt wadding which will give an appropriate amount of compression on the powder charge. Dealing first of all with the standard charge of 42 grains of Schultze, $1\frac{1}{8}$oz. of shot and the usual $\frac{3}{8}$ inch felt wad the following calculation can be made :—

42 grs. Schultze plus two twelfth-inch cards occupy	1·22in.
$\frac{3}{8}$in. felt	·37 ,,
$1\frac{1}{8}$oz. shot, plus top wad and turnover	1·05 ,,
Total	2·64 ,,
Deduct length of $2\frac{1}{2}$ inch case	2·56 ,,

The difference is the amount of compression, viz. ·08 ,,

The same process may be applied to the well known combination of 33 grains of E.C. powder and one ounce of shot, with a $\frac{1}{2}$-inch felt wad, as follows :—

33 grs. E.C. plus two twelfth-inch cards occupy	1·22in.
$\frac{1}{2}$-inch felt	·50 ,,
1 oz. shot plus top wad and turnover	·98 ,,
Total	2·70 ,,
Deduct length of $2\frac{1}{2}$-inch case	2·56 ,,

The difference is the amount of compression, viz. ·14 ,,

The behaviour of the $1\frac{1}{16}$ oz. shot charge can be worked out with reference to the $\frac{7}{16}$-inch felt which is usually employed with this combination.

42 grs. Schultze or 33 grs. E.C. etc., occupy ..	1·22in.
$\frac{7}{16}$in. felt	·43 ,,
$1\frac{1}{16}$oz. shot plus top wad and turnover	1·02 ,,
Total	2·67 ,,
Deduct length of $2\frac{1}{2}$-inch case	2·56 ,,

The difference is the amount of compression, viz. ·11 ,,

The three standard combinations above dealt with show that the amount of compression put upon the powder even with recognised standard loads differs considerably. The $1\frac{1}{8}$oz. shot charge, when accompanied by the usual amount of powder and a $\frac{3}{8}$-inch felt, shows the small compression of ·08 of an inch, which is, however, two-hundredths more than the usual sixteenth-inch (·06) generally quoted by those powder makers who have given their views on the subject. When using the lighter charges of shot it is the rule, according to the *Field* system of loading, to add a sixteenth-of-an-inch to thickness of felt for every sixteenth-of-an-ounce taken from full $1\frac{1}{8}$oz. powder charge. By actual measurement each eighth-of-an-ounce of shot occupies the sixteenth-of-an-inch in the 12-bore cartridge tube. Therefore the compression goes up ·03 of an inch for each sixteenth exchange of shot for wadding. The assumption is that with the lighter charges of shot the lack of weight over the powder is balanced by the extra compression used, the powder being thereby aided in its work by the greater bottling up effect which enables a sufficient gas pressure to be developed in spite of the reduced mass to be set in motion. The object of quoting the above three standard charges being to obtain an average value for the compression of the charge in a sporting cartridge, this purpose is clearly attained by taking, of the three values shown, viz. ·08, ·11 and ·14, the approximate middle value of say, ·12in. the decimal equivalent for $\frac{1}{8}$-inch. The inadequacy of the ·08 inch of compression is frequently evidenced by the use by

powder manufacturers themselves of a $\frac{7}{16}$-inch felt wad in place of the $\frac{3}{8}$-inch thickness specified in their own instructions to trade loaders. In a similar fashion gunmakers themselves are very particular to obtain for ordinary loading a fairly hard quality of felt which will remain the full nominal length when loaded into the cartridge. A compression of about an eighth-of-an-inch, expressed in decimals as ·12, may, therefore, be accepted as a good mean size to use as a guide for fixing by calculation the felt thickness for any given combination of powder and shot. As the sixteenth-inch graduations by which felt wads differ in size are expressed by the decimal ·06, it follows that if ·12 compression is accepted as standard the actual compression using the nearest appropriate size of felt will show an extreme difference of ·03 on either size of this mean. The following shows the slightly different form which the arithmetic takes for finding the thickness of felt for a given combination of powder and shot.

Problem: *Find the appropriate thickness of felt for* 40 *grains of Schultze and one ounce of shot.*

40 grs. Schultze plus two twelfth-inch cards occupy	1·19 in
1 oz. shot plus top wad and turnover	·98 ,,
Total ..	2·17 ,,
Deduct ·12 compression	·12 ,,
Gross length of contents less the felt wad ..	2·05 ,,
Space available for felt	·51 ,,
Length of $2\frac{1}{2}$-inch case	2·56 ,,

Answer: *A half-inch wad measuring* ·50 *of an inch gives* ·11 *compression, viz. the same as with* 42 *grains and* $1\frac{1}{16}$*oz.*

Various other 12-bore charges can be worked out on the same system, and a series of specimen loads so treated is shown in the following table:—

Particulars of Charge.	Total Length Compressed ·12-in. less Felt.	Space for Felt.	Felt used.	Resulting Compression.
$2\frac{1}{2}$ in. Case.				
42 grs. Sch., $1\frac{3}{16}$ oz. ..	2·19	·37	$\frac{3}{8}$	·12 in.
*42 ,, ,, $1\frac{1}{8}$,, ..	2·15	·41	$\frac{7}{16}$	·14 ,,
*42 ,, ,, $1\frac{1}{16}$,, ..	2·12	·44	$\frac{7}{16}$	·11 ,,
*42 ,, ,, 1 ,, ..	2·08	·48	$\frac{1}{2}$	·14 ,,
40 ,, ,, $1\frac{1}{16}$,, ..	2·09	·48	$\frac{1}{2}$	·14 ,,
40 ,, ,, 1 ,, ..	2·05	·51	$\frac{1}{2}$	·11 ,,
36 ,, E.C., 1 ,, ..	2·15	·41	$\frac{7}{16}$	·14 ,,
30 ,, ,, 1 ,, ..	2·03	·53	$\frac{1}{4} + \frac{5}{16}$	·15 ,,
$2\frac{3}{4}$ in. Case.				
47 grs. Sch., $1\frac{1}{4}$ oz. ..	2·32	·43	$\frac{7}{16}$	·12 in.
47 ,, ,, $1\frac{3}{8}$,, ..	2·39	·36	$\frac{3}{8}$	·13 ,,
40 ,, E.C., $1\frac{1}{4}$,, ..	2·39	·36	$\frac{3}{8}$	·13 ,,
40 ,, ,, $1\frac{5}{16}$,, ..	2·42	·33	$\frac{5}{16}$	·10 ,,
3 in. Case.				
52 grs. Sch., $1\frac{1}{2}$ oz. ..	2·56	·44	$\frac{7}{16}$	·11 in.
44 ,, E.C., $1\frac{7}{16}$,, ..	2·59	·41	$\frac{7}{16}$	·14 ,,

* *These loads equally apply to 33 grs. of E.C. Powder.*

It must be understood that the object of the present lecture is rather to demonstrate a theory than to give comprehensive instructions on cartridge loading. The demonstration of the new system of examining loads has necessarily dealt only with one calibre of cartridge, and being the best known it is the one where there is obviously the least need for a check on the thicknesses of the felt wadding employed. On the other hand the very familiarity of the 12-bore loads provides a means for checking the application of the theory. A good deal of the efficiency of a cartridge depends on selecting the exact wad thickness to suit a specified charge. In $2\frac{1}{2}$-inch cases very few difficulties present themselves, and the above table is only interesting in this connection in that it shows how with one exception the wads ordinarily used comply with the theoretical amount of compression allowed in the calculations. The exception referred to is the usual three-dram charge of Schultze, E.C., or any other bulk powder in combination with $1\frac{1}{8}$oz. of shot. As tested by the amount of wadding used for all other loads the $\frac{3}{8}$-inch felt seems to be of inadequate thickness, whilst the $\frac{7}{16}$-inch wad gives a slight excess of compression, but not more than is commonly used with the one-ounce charge. It is not, however, the purpose of this article to do more than point out that the most standard of all cartridge loads is the most open to question.

As regards pigeon cartridges and the still larger three-inch 12-bores, some interesting results are presented. The ordinary pigeon charge with a powder of the Schultze style obviously requires a $\frac{7}{16}$-inch felt, notwithstanding that the Company's own loading instructions specify a $\frac{3}{8}$-inch felt. The corresponding powder charge for the 33-grain class using the same amount of shot takes up more space, so that the $\frac{3}{8}$-inch felt is the right one to use with E.C. powder. This calls attention to the interesting rule that though 33 and 42-grain powders are of equal strength, bulk for bulk, when the three-dram charge is considered, the same equality does not exist in the higher charges. With Schultze, 47 grains impart the correct velocity to $1\frac{1}{4}$oz. of shot. With E.C. 40 grains are required, and the latter charge occupies a good sixteenth-inch more space in the cartridge than the corresponding charge of the companion powder. The table of measurements advancing grain by grain shows that 40 grains of E.C. require an allowance of space of 1·38 inch, whilst 47 grains of Schultze require 1·31 inch, a difference of ·07 inch, practically the sixteenth of an inch already referred to. This curious relation introduces the apparent anomaly that there remains exactly the same space for felt wadding using 47 grains of Schultze and $1\frac{1}{8}$oz. of shot, as there is for 40 grains of E.C. and $1\frac{1}{4}$oz. of shot. The extra sixteenth-inch space which the E.C. charge occupies diminishes by $\frac{1}{8}$oz. the amount of shot which can be inserted into the $2\frac{3}{4}$ inch cartridge.

As has already been mentioned the present results deal only with a single calibre of cartridge. The principle can, however, be equally well applied to other calibres, and it will provide suitable subject matter for future lectures to publish appropriate tables of powder measurements and apply them to the fixing of felt thickness for a variety of charges. It should be clearly understood that the present system has no concern with the precise amount of powder and shot which constitutes a suitable load for a cartridge. When once the charge has been fixed, a simple sum in arithmetic will give the thickness of felt wadding with far more exactitude than the skilful loader can bring into play.

ROUND THE TRADE.

Considerable amusement was caused at the beginning of last month by an advertisment of the firm of Westley Richards & Co., Ld. in which 2165 f.s. was described as a record muzzle velocity.

A copy of the programme of a clay bird shooting meeting to be held at Antwerp on Saturday and Sunday, the 15th and 16th inst., has reached this office, and from the list of prizes, and the published conditions as a whole clay bird shooting seems to be doing well on the Continent.

A rather curious passage occurs in Mr. Cocking's specification for a chemical solvent for removing metallic fouling from rifle barrels. He refers to the metal which remains in the grooving or other places in the rifle, and thereby indicates that the fouling mostly collects in the grooves of the rifling, whereas in point of fact it lies on the surface of the lands.

At the annual general meeting of the Gunmakers' Association, held in Leighton House on Monday the 13th inst., Mr. H. Gilbert A. Thorn of 90 High Holborn and Norfolk House, Weybridge, was elected Honorary Solicitor to the Association, in the place of the late Mr. Reginald T. Woulfe. Mr. Thorn, who was articled to Mr. Woulfe, is the eldest son of Mr. Henry A. A. Thorn (Charles Lancaster) who has given so much time and assistance to matters connected with the Association.

The proof authorities have recently issued a varnished card showing the English, Belgian, German and French marks which are applied to firearms proved at the respective establishments in these countries. The whole thing is excellently got up, and the engravings of the different marks are exceedingly clear. Whether the copy which has reached this office has had an extra rough time in the post is difficult to say, but the corners are certainly so badly damaged as to make it seem desirable, either to adopt a more substantial system of packing, or to bind the edges of any future edition that may be required with cloth, instead of paper.

The Cogswell and Harrison Manufacturing Company is an off-shoot of the firm of gunmakers of corresponding name, which has been formed for the purpose of handling in a wholesale way, the powder and ammunition products which are manufactured at the firm's factories. It has been known for a long time past that Messrs. Cogswell and Harrison have themselves manufactured the bulk of their own requirements in the way of sporting cartridge cases. During the past season they have made their own smokeless powders, and samples of the same have been favourably reported upon in a recent issue of *The Field*. Their specialities in loaded cartridges are known as the "Victor," the "Excelsior" and the "Victoroid," and they are sold wholesale under a price maintenance arrangement.

The annual report of the King's Norton Metal Co., Ld. unfortunately reflects the adverse influence of the scarcity of Government orders which has been so marked a feature during the past year or so. The directors regret that, owing to this cause coupled with the dullness of the ammunition trade generally, and the unsatisfactory conditions which have prevailed in the general metal trades, a large portion of the Company's works has been standing idle. The accounts show a profit of £3,114, to which has to be added the balance of £4,493, brought forward from last year's account, and £2,500 taken by the directors from the special reserve for equalisation of dividends, making altogether a total of £10,107, of which amount the directors have appropriated £5,000 to depreciation. The directors recommend the payment of a dividend at the rate of seven per cent per annum on the preference share capital, which will absorb £4,200, and leave a balance of £907 to be carried forward.

A list of creditors in respect to the affairs of Messrs. Bonser, Hunter & Co., explosive agents of Leeds, has been published, from which it appears that the unsecured liabilities amount to £3,491, and the estimated net assets £1,465.

Major H. P. De la Bère, experimental officer at the School of Musketry, Hythe, has contributed an interesting article entitled "Modern Military Rifles" to the May number of the *United Service Magazine*.

Mr. C. Napier Hake, Chief Inspector of Explosives, Victoria, has been appointed a commissioner for the Federal Government for the purpose of making arrangements in connection with the proposed establishment of Service Explosive Factories in Australia and will arrive in London early in June. His address will be :—Commonwealth of Australia Offices, 72 Victoria Street, London, S. W.

The National Rifle Association has issued a notice to the effect that arrangements have been made for a team of British riflemen to visit Canada and Australia next autumn to take part in the "Palma" Trophy match. Major P. W. Richardson has been appointed shooting captain, and Captain L. Lloyd, D.S.O., adjutant. The team will leave England in August, and will take part in the meeting of the Dominion of Canada Rifle Association. It will afterwards proceed *via* Vancouver to Australia.

The net profit of the E.C. Powder Co., Ld. for last year is £10,940 against £9,970 for 1905. The sum left available after payment of the directors' fees, and adding the amount brought forward from the previous account, has enabled the directors to write £1,500 off freehold land, £1,000 off patents, and to add £1,000 to the reserve. The item of patents has now been reduced from the original £40,000 to £1,000. A dividend of four shillings per share, in addition to the interim dividend of two shillings already paid, and further a bonus of two shillings per share make a total of 13 per cent for the whole year, these transfers and payments leaving £3,897 to be carried forward. Mr. George Plater in presiding at the twenty-fourth annual meeting held on the 22nd ult. referred to the loss sustained by the Company through the death of Mr. H. Doughty Browne, who had been chairman since 1889. In the course of the chairman's speech some interesting particulars were given of the large sales during the year under review, which exceeded those of the previous year, notwithstanding that the supply of game was less plentiful.

The report of the Nobel-Dynamite Trust Co., Ld. for the year ended the 30th April last shows a net profit of £319,701, which, with the amount brought forward from the last account, gives a total available profit of £325,257. The five per cent preference dividend absorbs £25,000, and the balance will be appropriated as follows :—8 per cent dividend on the ordinary shares £182,832, 2 per cent bonus on the ordinary shares £45,708, transferred to reserve fund £60,000, carry forward to next account £11,717. The report states that the great wave of industrial activity which has swept over the world during the past year has had its effect on the Company's business. The demand for blasting explosives has increased to so marked an extent that the factories of the subsidiary and allied companies have been well employed. This increased production, coupled with improved methods of manufacture, has, in spite of the rise in raw material reduced the cost of production to such an extent as to enable the subsidiary companies to meet satisfactorily the reckless competion which has prevailed in nearly all markets, more particularly in the United Kingdom and in almost every branch of the industry. The demand for war material was well maintained. Notwithstanding the largely increased turnover the companies have not, thanks to the conservative policy pursued hitherto, required to raise funds in any way whatsoever during the period of dear money.

The directors of the Schultze Company have very wisely decided to increase the price of their powders, and a revised list has been issued in accordance with this determination. The discount arrangements have been modified so as to give greater advantages to those paying prompt cash, and the net result is that the amount of increase is materially less than the amount of reduction which was accorded some few years back. Powder, like so many other manufactured goods, has suffered from the tendency towards dearness of raw materials and greater cost of production.

We have received from the B. S. A. Company a copy of a catalogue to the trade only of steel tubes for shot guns, giving full particulars of the same in the rough-bored and fine-bored stages. Besides the ordinary patterns solid lump tubes and the special pigeon gun pattern of tube are specified. The dimensions and weight are given for each calibre and style of finish, and prices are stated for two qualities of steel in all but the rough-bored tube. It is very aptly pointed out by the Company that to produce high-grade shot tubes at the low prices quoted it has been necessary to standardise, and that specifications out of the ordinary must be charged accordingly.

The Gunmakers' Association, in sending a handsome sheet of the chamber sizes, announce that copies can be obtained from the Secretary, Mr. F. B. Bosworth, 167 Fleet Street, E. C. at the price of 2s. 6d. each post free. A particularly useful feature of the sheet is that besides the inch dimensions, which are given in black ink, the metric equivalents are shown in red lettering. The only criticism which can be advanced in reference to the sheet is that the short 2⅝-inch 10-bore cartridge is not included, and that the 4-bore dimensions, as originally adopted, are here confirmed, notwithstanding that complaints have been made in the trade that cartridges so chambered do not give satisfactory results with the ordinary 4-bore cartridges. The Sheet measures 30 ins. by 20 ins., and is mounted map-fashion, on varnished cloth. The bulk of the space is occupied by dimensioned drawings of the chambers, whilst the tabulated sizes are placed below.

The directors of the Hotchkiss Ordnance Co., Ld., in their report for last year, show that a profit of £26,449 has been made, which with the carry forward, gives £32,241 available for distribution. After providing £6,601 for interest upon debentures and debenture stock, £1,500 for the service of the first mortgage debenture stock sinking fund, and £3,111 expenses incurred in connection with the issue of second mortgage debenture stock, there remains an available balance of £21,029. From this sum a five per cent dividend has been declared on the preference shares, and three per cent on the ordinary. The sum of £1,500 has been written off in partial liquidation of discount upon the issue of the second mortgage debentures which was necessitated by the urgent need of the French company for additional capital to enable it to keep pace with the requirements of modern ordnance manufacture, a balance of £1,859 being carried forward. As the accounts indicate, business has been active during the year under review, but an unfortunate strike hampered production and caused a certain amount of disorganisation. The report mentions that £20,000 has been carried to reserve in the accounts of the French company.

The report of the British South African Explosives Co., Ld. for the year ended the 31st October last shows a net profit of £88,774, which has been arrived at after writing off £27,543 for depreciation and carrying £4,642 to a miscellaneous reserve fund. With the amount brought forward from the last account there is a total available profit of £128,752, out of which the directors recommend that £71,500 be applied in payment of a 6½ per cent dividend, leaving £57,252 to be carried forward. In adding £17,275 to the amount of undivided profit carried forward, besides writing off a large amount for factory depreciation, the directors have been guided in part by the fact that there has been some depreciation, estimated at about two per cent. in the market value of their investments, but chiefly by the need for making provision to keep the capital intact against the time when the factory may have lost its value as an asset, through diminished output of the Transvaal mines, or other causes depriving it of remunerative employment. The chairman mentioned at the annual meeting that the business being done during the present year promised to be quite as good as during the period reviewed by the report under notice.

We have received from Messrs. Bentley & Playfair, Ld. a copy of the 20th edition of their price list. A remarkable feature of this very handsome production is that the technical difficulties of reproducing guns by the half-tone block process have so far been overcome that the illustrations from one end of the book to the other are uniformly some of the finest it has ever been our pleasure to examine. The old woodcut and line blocks however perfect always failed to give the lifelike idea of the workmanship and contour of a gun which is so well expressed in Messrs. Bentley & Playfair's highly up-to-date production. The guns themselves display all styles and forms, whilst the rifles are also of the up-to-date kind which reflect credit on the manufacturer.

The *Irish Times* of the 10th ult. printed the following letter, which had been received by the Town Clerk of Arklow from Mr. Arthur Chamberlain, acknowledging some resolutions which had been passed at a public meeting in that town with reference to the attitude of the Home Office towards Kynoch Ld., in which he said :—" The position now is very difficult, the law has been strained against Kynoch, Ld. It is six months since their magazines have been seized and their business dislocated. Mr. Herbert Gladstone has refused arbitration, and has twice refused to see the Company's representatives. Kynoch, Ld., have lost so much money that it is impossible that the company should continue to risk anything more by carrying on business at Arklow under the shadow of men who have proved themselves to be so hostile and unjust. The only thing I can suggest is that the Arklow factory should be put under the control of the Irish Departments acting from Dublin, which would appoint their own inspector. This is a simple act of justice, which the Irish party in parliament ought to be able to secure, and if this were done I would press Kynoch, Ld., to make another effort to keep the industry going. Otherwise, when the present contracts run out the place must be dismantled."

The Birmingham Small Arms Co., Ld. ask us to mention that they have received permission from the Government to supply the *short* Lee-Enfield rifle with barrels specially chambered and bored for ·22 or ·297-·230 ammunition. A little booklet dealing with this departure has been issued, and all dealers who cater for rifle clubs, and other miniature rifle shooting organisations, should make a point of securing a supply of copies of the same. A still more interesting announcement is to the effect that permission has been given for fitting rifles, originally served out to volunteers for use with Morris tubes, with new barrels chambered and bored for the miniature types of ammunition mentioned above. The following further information is reproduced from a circular which has been issued by the Company :—" This permission is given on the understanding that the cost of conversion must be defrayed out of regimental funds, and that the arms are returned to store in serviceable condition if required. We can carry out this work at a charge of 28s. per rifle, including the modification of the bolt head and striker to adapt the arm for miniature ammunition. The advantages afforded by the use of the solid barrel are obvious, and attention may be drawn to the fact that ·22 ammunition is comparatively cheap and is very accurate. We have just re-barrelled 20 rifles for a leading Metropolitan regiment, and they are giving great satisfaction."

SOME RUSSIAN COMMENTS ON GUN EROSION.

AN article referring to the damage caused in the bores of guns by the erosion due to firing recently appeared in the *Gorny Journal*. Although this newspaper is primarily devoted to the mining industry its wide circulation amongst technical readers makes it about the only medium in Russia for the publication of scientific articles. The author of the paper under review is Major-General V. G. Ponomareff-Svider, and though his observations cover only to the year 1900 it is seldom that information of this character is published at all, let alone whilst it is still of interest. According to the writer of the article, observation shows that heat erosion in guns may be roughly divided into ordinary or chinky. The common form of erosion is seen as a roughness which with continuous firing develops into small and then larger flaws along the chamber and on the lead. These flaws gradually get larger and deeper, and ultimately join up and become one burnt piece of metal.

But whilst common erosion is known by such appearances, chinky erosion begins with a collection of furrows which in the course of firing grow in a lengthwise direction with the bore. Their separate parts join up, and they become a long line or groove of greater or less depth. The appearance of such longitudinal and extending furrows serves to indicate the initiation of a crack in the bore of the gun.

Chinky erosions more clearly than anything else were observed in the first examples of distant firing guns of the 1877 pattern of large calibre not excepting the Krupp factory guns. At that time the method of working steel was imperfectly known. Guns were made of relatively hard and unstable material, because the proportion of carbon varied widely, viz. between the limits of 0·40 and 0·75 per cent. The variableness of the chemical constitution of the steel and the as yet unperfected methods of working it were shown in a want of uniformity as regards strength. Several guns of equal calibre developed erosions as a result of firing at an unequal rate, and it seems reasonable to suppose that the difference was due to unequal quality of metal. It was found that metal with a crystalline formation suffered a rapid development of erosion, whilst steel properly worked and tempered in oil proved better able to resist the effects of firing.

According to the evidence of Vorontsoff, a mining engineer, the light guns of the Perm factory made from hard steel are subject to greater erosion than similar guns made of soft steel. Probably there are other causes which influence the power of a gun to resist erosion.

Unsatisfactory or rather unequal quality in the layers lying next the bore certainly encourages the development of erosion. But the improved methods of working steel help to enhance the resisting properties of the gun. It is obvious that better physical and mechanical properties can be imparted to a thin layer of metal than is possible in the working of a heavy barrel, and it was for this reason that lining tubes were employed in large guns, these being replaceable when worn out. This system gave effect to the belief that the wearing properties of a gun depend on the proper working of the metal. But as regards what was the best gun steel and under what conditions it would best resist erosion was not at once made clear. In spite of the experience which had been gained with the light guns made at the Perm factory, the heavy guns were for a time made of hard or medium hard steel for no reason than that of economy. It is more easily and quickly smelted, there is less waste and it requires less heat. It was only at the end of the eighties when the gun factory introduced apparatus on its own account for tempering the barrels and tubes, and finally introduced a special process for placing the tubes in the barrels and for removing them when worn out, in a word when all the smaller details had been worked out, that the Engineer Aphrossimoff, who had assumed the management of the Perm factory, began to use soft steel with a slight mixture of chrome. This steel smelted at a high temperature was capable of resisting high pressure, and after having been softened and tempered it retained a high degree of spring and ductility; its consistency was amorphous.

Trial 6-inch guns made of this steel, with inserted tubes, after having fired 300 rounds each, showed no signs of cracks due to heat of the gases. The Perm factory claims to have been the first to show that soft and well worked steel with a large margin of elasticity is the most suitable material for the manufacture of artillery guns. At the firing tests conducted at Kertch with a gun from the Krupp factory, after an insignificant number of shots had been fired, erosion marks in the form of rather large flaws were seen commencing in the chamber extending forward from the lead for about three feet along the bore. The surface of the chamber itself lying next the lead was covered with pitting and the surface had lost its high finish. At the eighty-ninth shot a full charge firing the gun was considered unreliable for distant ranging.

It was originally supposed that erosion was mainly the result of a mechanical action. The idea was that the powder gases forced themselves during the passage of the shot through the windage between the wall of the chamber and the shell, and moving with great velocity in the direction of the axis of the gun exercised great friction on the surface of the layer next the bore and so scored out pieces of metal. With equal pressure and using similar charges the erosions should vary in proportion to the calibre. Thus if an 11-inch gun of the 1888 pattern of the Krupp factory shows great erosion after a limited number of shots then a gun of 1877 pattern which had fired a relatively lighter charge should only be pitted around the lead after say fifty rounds.

Professor Tchernoff remarked how the furrow formation develops with the heating of the gun at the forges and rolling mills, the effect on the metal being similar to that which is produced on the surface layer of the bore by firing, and came to the following conclusion :—viz. that at the moment of firing, under the influence of the high pressure and the temporary high temperature, the outer surface of the metal heating up quickly, expands, and being unable to transfer all its heat to the shrunken inner layers, there is a radial expansion which causes the surface of the bore to thicken

and wrinkle. At the next shot the compression of the surface of the bore by the neighbouring layers of metal is diminished by the fact that they in their turn have become heated. The network of wrinkles should thus be obliterated but this becomes impossible because the raised parts of the metal are unlikely to return to their exact original position. As a consequence we get flaws and cracks in the metal, and the furrowed appearance which is produced by the incised cracks and wrinkles. With further firing the roughness increases. The formation of rents proceeds, and grooves ultimately develop through which the powder gases can freely pass. The passage of these gases at a high speed will naturally hasten the development of well-defined grooves. Thus the high temperature which is developed in guns of the latest type during the combustion of heavy charges under high pressure is one of the causes of the formation of erosions.

If this is recognised, then the tube made of softer and well worked steel should resist the effects of high temperature powder gases, because soft steel expands less from heat and is less brittle. It may be that the development of heat assists the thermo-chemical processes, but in such a case the steel weak in carbon will be more useful for guns of heavy calibre. With such steel the interior pressure is less developed and the less its tension the more difficult is the tearing away of the parts of the metal by the gases. In consequence, practice and theory reject the opinion previously prevailing that with increased calibre and pressure in the bore of the gun the percentage of carbon should be increased in the steel. On the contrary the fixed opinion now is that that steel best resists erosion when its melting point is high. Therefore as far as our present knowledge goes a 10-inch gun of the Obuchoff factory, made of very soft steel, sustains as many as three hundred shots without damage or loss of accuracy, whilst the useful life of an 11-inch gun used to be limited by 100 shots of a full fighting charge.

The preparation of such soft steel of ordinary amorphous consistency often presents serious difficulties. As shown above, very soft steel, even more with an addition of chrome, is very difficult to melt and requires a very high temperature in a Siemens gas furnace. In contrary case such steel easily oxidises and develops slag very badly; that is to say the slag formed through the oxidation does not float to the top of the metal, but gets mixed up with it and so gives rise to defects. Trouble with these defects led the Perm factory to abandon the idea of using soft steel, and a harder and more easily smelted steel was adopted for the production of gun tubes. Later on it was found that the whole trouble had resulted from the gas furnaces being out of order and requiring radical transformation.

Besides erosion there are other defects that may shorten the life of a gun, and special tests were made at the Perm factory in respect to the small sand flaws, ash flaws, small porosities, and "hair" faults; as the only arms not passed into the service were those with cracks. The barrel of an eleven-inch mortar was taken, on the chamber and lead of which ash flaws were grouped, these being found just where the shell with its copper rings tore into the bore. With the object of ascertaining whether the line of the tear goes through these ash flaws the barrel was burst. A charge of fifty pounds of large grain powder was placed so that the barrel should be broken into as many pieces as possible. This object having been attained it was found that the rupture had missed the ash flaw by about four inches from the largest flaw on the lead. The test showed that defects in high quality metal such as is used in the bore of an 11-inch gun do not weaken the arm, but they may help the development of erosion in firing. To test the latter assumption a second test was made with a 6-inch gun, which had a large number of ash and sand flaws in the bore. Many shots were fired from it. After each round the gun was carefully inspected, and the bore measured. After 500 shots had been fired no erosion was visible. Thus it was proved that well worked soft steel of which these two guns were made resists erosion excellently, and that flaws such as those mentioned do not tend to enlarge these erosions.

THE GAME LAWS OF AFRICA.—Though it is the custom amongst newspapers to ignore an item of information, rather than publish it when out of date, an exception seems desirable in the case of a large blue book which has now been out for some months. We refer to the work entitled "Correspondence relating to the Preservation of Wild Animals in Africa," of which the published price is four shillings. The whole of this very bulky volume is devoted to reports from officials situated in various parts of Africa concerning the game found within the area under their control, the conditions under which it may be shot, and the prospects of the future supply of game. The geography of Africa is necessarily complex, but in the blue book under notice the gunmaker will find the very kind of information which is calculated to supplement his own extensive knowledge. The sportsman as a rule keeps in close touch with his gunmaker, and many valuable hints and observations are to be found in the reports which come to hand in the course of post. The blue book under notice is probably better adapted than any other volume for giving the careful reader details of the game encountered in each of the British possessions in Africa.

THE PROOF HOUSE RETURNS.

THE accompanying digest shews the number and classification of the proofs which were made in Birmingham during last year. The headings adopted, whilst doubtless appropriate from a proof point of view, do not possess the statistical value which such returns would possess did they express more clearly the movements in trade of the different classes of arm as they are known to the dealer and consumer. An example is provided by the Chairman's reference to the proofs of small-bore American rifles at the annual meeting of the trade on the 8th ult. Mr. W. L. Powell referred to the increased number of proofs of these rifles during the year under review; but it is certain that he spoke from inside knowledge of proof-house matters, and that he could not have differentiated one class of arm from another in the way he did, had his information been limited to that given in the

official list of proofs. The following table summarises the proofs recorded in the report, and the figures for the two previous years are put in for comparison :—

	1904.	1905.	1906.
Provisional Proofs	63,549	55,380	80,522
Definitive Proofs—			
Muzzle Loaders	34,122	31,181	30,307
African Barrels	69,661	110,615	62,632
Breech Loading Arms ..	71,347	57,658	74,273
Nitro Proof of Rifle Barrels	2,270	1,492	2,031
Express Rifle Barrels ..	557	637	520
Military Rifle Barrels ..	8,177	7,094	16,964
Chambers of Revolvers ..	31,794	48,200	55,479
Pistols	160	530	14,241
Sundries	824	448	1,009
Supplementary Proofs—			
Nitro Proof	21,819	23,803	32,190
Proved with Nitros ..	689	419	360
	304,969	337,457	370,528

In most of the items of the above list which reflect trade activity, the figures show a welcome increase on previous years. When a similar list of proofs was analysed a year ago it was obvious that whilst the 1905 proofs showed a total increase on those of the previous year, the items which were of most account showed a backward tendency. The gross increase was then confined to African barrels and other unimportant trifles. In the present record a different tale is told. The total number of proofs is materially in advance of those of the previous year, which in turn were greater than for the year before that. Muzzle loaders, other than African barrels, still maintain a fairly stationary level, but African barrels show a material decrease. Barrels for breech loading arms, which is a highly miscellaneous heading, really comprise the bulk of the proofs affording an index to trade activity. On the other hand so many foreign proofs are comprised under this heading that the indication of greater prosperity can only be taken in a relative sense. The total number of proofs of barrels for breech loading arms is well ahead of the record for 1905, and slightly in excess of 1904, but the total is still but three-quarters of that attained in the year 1903 when an exceptional record running into six figures was experienced. The nitro proofs of rifle barrels are only satisfactory in that last year's drop has nearly been recovered. Express rifle proofs, which one would hope to see an expanding item as it relates to a profitable class of arm, show a decrease of about one-sixth on the previous year. This, however, is not remarkable in view of the suitability of the modern military rifle for most classes of game shooting. At any rate the useful properties of the express rifle are to an extent marred by the lack of a standard express cartridge so widely used as to be obtainable even in those districts where the sporting ammunition used is mostly service cartridges drawn from Government stores.

The large increase of military rifle barrel proofs bespeaks the existence of contracts for private customers of the kind which have been so scarce since the present British service rifle was introduced. The revolver trade, as judged by the total proofs conducted, shows a further satisfactory increase. It is, however, in the item of pistol proofs that the present statistics are most satisfactory. A jump from odd hundreds to fourteen thousand looks very well, and as practically the whole rise is due to automatic pistols not of foreign make, this item in the report shows welcome evidence of manufacturing enterprise. The large relative increase of sundries is almost entirely due to a sudden demand for toy cannons, The list of supplementary proofs again affords a certain amount of evidence of increased activity in genuine manufacturing work. This class of proof relates essentially to shot guns, and as the item was practically stationary for the preceding year or two years, the sudden increase must be ascribed rather to additional trade than to the more general adoption of the safeguard afforded by the extra test for nitro powders.

In a year showing a good all-round increase of proofs of the better class the financial transactions of The Proof House are likely to show an improvement. The actual result is that instead of a deficit, as in the previous year, a substantial surplus has been carried to the revenue account.

APPLICATIONS FOR PATENTS.

APRIL 15—MAY 18, 1907.

8,721. Elevating Mechanism for Gun Mountings. A. T. Dawson and G. T. Buckham.
8,958. Gun Mountings. L. W. de Grave.
9,045.* Loading Guns of Large Calibre. E. C. L. Marzari.
9,160. Explosive Shells. F. M. Hale.
9,170.* Explosives. G. Cornaro (Italian application, April 21, 1906.)
9,175.* Magazine Rifles. E. E. Redfield.
9,195. Targets. D. W. Holt.
9,283. Projectile Fuses. H. V. Cuthbert-Keeson.
9,607. Moving Target. Maxwell, Son & Co., and J. Lockhart.
9,676.* Mechanical Targets. E. Habersbruner and J. Stöcker.
9,770.* Miniature Rifle Ranges. H. Phillips.
9,777.* Ordnance Sights. P. M. Justice.
9,778.* Rifle Target Practice Apparatus. H. H. Cummings (U. S. A. application, October 20, 1906).
9,779.* Rifle Target Practice Apparatus. A. A. Adams (U. S. A application, Jan. 26, 1907).
9,780.* Rifle Target Practice Apparatus. H. A. Stebbins and A. A. Stebbins (U. S. A. application, May 23, 1906).
9,820.* Ordnance. Fried Krupp, A.-G. (German application, August 9, 1906).
9,858. Blank Cartridges. H. J. Blanch and C. W. Andrews.
9,869.* Firearms. U. Marga.
9,870.* Cartridges. U. Marga.
9,876. Enveloped Bullets. King's Norton Metal Co., Ld. T. A. Bayliss and H. Melville Smith.
9,929. Sighting and Aiming of Ordnance. A. F. Petch and F. Duncan.
10,002. Sights. C. W. Robbins.
10,014.* Cartridge Deflectors. H. W. Lake.
10,023.* Cartridge Deflectors. H. W. Lake.
10,043.* Rifle Target Practice Apparatus. P. M. Justice.
10,098. Sights. T. Gilbert-Russell.
10,104.* Automatic Pistol Safety Mechanism. J. Carter and F. T. Murray.
10,149.* Automatic Guns. Hotchkiss Ordnance Co., Ld.
10,158. Targets. J. Paterson and The Miniature Target Apparatus Co., Ld.
10,276. Rifle Attachment. T. W. F. Rowney.
10,298. Miniature Shooting Range, T. Edwards.
10,311. Projectiles. E. W. Wetherell.
10,377. Lock Mechanism of Drop-down Guns. W. J. Whiting.
10,429.* Automatic Rolling Gear for Gun Barrels. P. Hesse.
10,430.* Gun Barrels. P. Hesse.
10,510. Explosives. B. E. D. Kilburn.
10,526. Nitrate Explosives. A. Ermel.

10,567. Detachable Lock Plate Mechanism for Drop-Down Breech-Loading Guns. J. Deeley and L. B. Taylor.
10,622.* Cartridge Feeds. A. B. Cary.
10,637. Breech Closures for Drop-Down Firearms. A. Brauneis.
10,681.* Machines for Rifling Gunbarrels. E. Jones and Kynoch Ld.
10,706.* Cooling Apparatus for Powder Magazines. A. W. Stewart.
10,739.* Gun Mountings. A. F. Petch, R. Redpath and T. A. Petrie.
10,779.* Drop-Down Barrel Firearms. F. Stendebach.
10,787. Rifle Practice Apparatus. F. Mitchell.
10,947. Expanding and Diminishing Peep Sight. W. L. O'Brien, G. Tomlinson and A. H. O'Brien.
10,964.* Targets. G. Buxton.
11,038. Mechanical Machine Gun. H. C. Heide.
11,042. Setting Time Fuses for Projectiles. Sir W. G. Armstrong, Whitworth & Co., Ld. and A. G. Hadcock.
11,046. Ordnance Breech Mechanism. Sir W. G. Armstrong, Whitworth & Co., Ld. and C. H. Murray.
11,053.* Case Fuses for Projectiles. Sir H. W. W. Barlow, Bart. and W. Charlesworth.
11,157. Sub Targets. F. W. Moffit.
11,369. Fuses for Projectiles. Electric Ordnance and Accessories Co., Ld. and R. F. Hall.
11,370. Cartridge Belts. M. C. Maunsell.
11,578. Bullet-Proof Shields. S. C. N. Macklin.
11,601. Apparatus for Controlling Firing of Ordnance. F. Wray.
11,607. Gun Sighting Apparatus. A. T. Dawson and G. T. Buckham.
11,612. Howitzer Sighting Apparatus. A. T. Dawson and G. T. Buckham.
11,704. Apparatus for Recording Gunnery Practice Results. A. T. Dawson and G. T. Buckham.

SPECIFICATIONS PUBLISHED.

APRIL 25—MAY 23, 1907.

COMPILED BY HENRY TARRANT.

7,967 (1906). **Automatic Rifle Mechanism.** M. G. Farquhar, Aboyne, and A. H. Hill, Birmingham. The energy of recoil is utilised to open and close the breech, eject the spent cartridge and insert a fresh one in the barrel. The novel feature consists in the storing of the energy in a ribbon spring working in a drum, the object being to conserve the energy until pressure on the barrel is relieved and the breech may safely be unlocked. Accepted April 3, 1907.

8,281 (1906). **Ordnance Mounting.** A. F. Petch (of the Coventry Ordnance Works, Ld.), London. The cradle on which the gun is held during the sliding recoil movement is composed of a series of supporting stirrups shrunk on to the cylinder containing the hydraulic buffer or running out springs. The cylinder is made of sufficient girder strength to support the weight of the gun. Accepted April 5, 1907.

9,791 (1906). **Explosive Compound.** Dr. V. Vender, Italy. What is claimed to be practically an unfreezable explosive is produced by incorporating with pulverulent substances the nitration products of basic formin and acetin mixed if desired with nitroglycerine. Such products may be gelatinised with nitroglycerine, and in either case an explosive of plastic horny constituency results. Accepted April 25, 1907.

10,039 (1906). **Single Observer Range Finders.** Prof. A. Burr, Glasgow, and Prof. W. Stroud, Leeds. This invention concerns single observer range finders working on the coincidence principle the object being to eliminate a difficulty connected with the use of a small angle reflecting prism such as that in the system dealt with in Patent No. 9,520, 1888. Accepted April 30, 1907.

11,111 (1906). **Firing Mechanism for Ordnance.** C. Holmstrom, London, J. Brown & Co., Ld., Sheffield, and A. E. Mascall, London. This improved system of firing mechanism relates to that described in Patent No. 15,364, 1901. It is adapted either for electric or percussion firing and the principal improvement allows the gun to be firing only when the breech is properly locked. Accepted April 30, 1907.

12,313 (1906). **Quick-Firing Ordnance Mountings and Sights.** Lieut. A. T. Dawson and G. T. Buckham, London. To reduce the stress of recoil on the base of quick-firing gun mountings the height of the axis of the trunnion is reduced. This necessitates a rearrangement of the sight mounting to allow of the sight remaining at the same height as heretofore. The method of rearranging the sight is dealt with fully in the specification. Accepted April 18, 1907.

14,224 (1906). **Eye Protector for Telescopic Sights.** The Telaupad Syn., Ld., London, and H. A. Cutmore, Blackheath. The ordinary eye protector for telescopic sights is claimed not to give efficient protection. The rubber shield dealt with in this specification consists of two portions built on the "compartment" principle so that air chambers are formed between them. Accepted April 11, 1907.

15,081 (1906). **Solvent for Cupro Nickel.** A. T. Cocking and Kynoch Ld., Birmingham. Claim No. 2 of three short ones reads "A solvent which will remove the metallic fouling from the barrel of a gun or rifle without injury to the barrel substantially as described." The object of the invention is to obtain such a mixture of potassium bichromate and chromic anhydride as to give the maximum solvent action upon cupro-nickel, nickel and copper without being a solvent for steel. The solvent is made therefore to consist of 54% of potassium bichromate and and 46% chromic anhydride. If the proportion of the latter is increased the solution has a tendency to attack the steel. Six grammes of the mixture dissolved in about 40 cubic centimetres of water is a convenient amount for cleaning a barrel. Accepted April 11, 1907.

15,185 (1906). **Lubricating Projectiles and Bullets.** J. Donaldson and T. Ansboro, Glasgow. The patentees state that they are aware of the six methods they specify of lubricating projectiles, but their method consists in forming a V-shaped threaded and grooved surface on the body part of the projectile the grooves being adapted to carry the lubricant. Accepted April 11, 1907.

15,769 (1906). **Adjustable Foresight for Rifles.** J. Betteridge, Birmingham. (*See Selected Patents*).

16,186 (1906). **Safety Device for Projectile Fuses.** Sir W. G. Armstrong, Whitworth & Co., Ld. and Dr. W. H. Sodeau, Newcastle-on-Tyne. A vaned member is embodied in a projectile fuse and is adapted to actuate a screwed spindle during flight to free the percussion pellet, or in the case of a time fuse to remove a valve and so open the duct between the time pellet and the main charge. The fuses are perfectly safed by this device until actual discharge. Accepted May 2, 1907.

16,882 (1906). **Plastic Trinitrotoluol Explosive.** C. E. Bichel, Germany. Trinitrotoluol explosives have hitherto been produced only in crystalline or molten forms and objections exist to loading either form into a certain class of shell. These difficulties are overcome by the production of a plastic compound made up by adding to trinitrotoluol, solid or liquid resins in solution either with or without binitrotoluol. The addition of resin allows the crystals to be worked into a plastic explosive that is claimed to detonate well. Accepted April 18, 1907.

18,087 (1906). **Practice Projectiles.** B. A. Frith, Norton, and A. Anderson, Dore. A projectile of iron is closed at the base by a screw plug, and at the nose by soft lead. The interior is filled with water so that when the projectile strikes, the soft lead is forced rearwards and the shell is broken up by hydraulic pressure. The armour plate is not injured. Accepted April 25, 1907.

18,825 (1906). **Chain Rammers for Ordnance.** Sir W. G. Armstrong, Whitworth & Co., Ld., and C. H. Murray, Newcastle-on-Tyne. Modification in chain rammers consists in utilizing the same means for running out the chain and for returning it to a casing adapted to coil it spirally, and in an improved friction buffer device. Accepted April 4, 1907.

19,707 (1906). **Elevating Gear for Ordnance.** A. F. Petch and R. Redpath, London. To facilitate the laying of a gun provided with elevating gear such as is described in Patent No. 18,898, 1904, a breast piece is provided against which the gunner may lean and be supported. Accepted April 18, 1907.

20,744 (1906). **Fixed Barrel Air Rifles.** L. Jefferies and G. F. Urry, Birmingham. The rotary loading plug of fixed barrel air rifles is retained in its seating by the end of a spring device pivotally mounted on the body of the rifle. The spring is turned away to remove its pressure so that the plug may be taken from its socket. Accepted April 25, 1907.

22,565 (1906). **Wind Gauge Slide for Back Sights.** The King's Norton Metal Co., Ld., T. A. Bayliss, London, E. Whitworth, King's Norton, C. H. Watson, and F. W. W. Baker, London. (*See Selected Patents*).

24,882 (1906). **Wind Gauge for Rifle Sight.** R. A. Rogers and F. Cantelo, Sandown, Isle of Wight. An ordinary bar of the usual tangent leaf back sight for rifles is provided with a groove in which a slideable bar carrying the V notch is arranged to work. It has no screw adjustment. Accepted May 2, 1907.

26,426 (1906). **Naval Gun Mountings.** Société Anonyme des Anciens Establissements Hotchkiss & Co., France. The connection between the collar sliding in the trunnion cradle and the piston of the hydraulic brake is made through the spherical washers so arranged that wedging in any direction through defective parallelism between gun and piston rod is avoided. Accepted April 4, 1907.

29,467 (1906). **Fluid Pressure Brakes for Ordnance.** Fried. Krupp, A.-G., Germany. Improvements are dealt with in this specification in that type of fluid pressure brakes fitted with a hollow piston rod and a running out rod which discharges the brake fluid from the hollow piston when the gun is running out. Accepted May 2, 1907.

1,376 (1907). **Elevating and Sighting Gear for Ordnance.** A. F. Petch and R. Redpath, both of Coventry Ordnance Works, Ld., London. The patentees describe a simplified construction of the elevation and sighting gear of the guns that are provided with laying and ranging carriages independent of the main carriage and which are fitted with sights capable of movement either with or independently of the gun. Accepted April 11, 1907.

1,422 (1907). **Adapting Central-Fire Rifles for Rim-Fire Ammunition.** F. Greener, Birmingham. (*See Selected Patents*).

2,094 (1907). **Ammunition Wagons.** Fried. Krupp, A.-G., Germany. A tilting ammunition wagon for transporting divided ammunition is dealt with in this patent. The box receives the cartridges near the axle and the projectiles in its outside parts. When tilted into the firing position the fuses are turned away from the firing front. Other novel details of construction are also set out. Accepted April 25, 1907.

2,321 (1907). **Sighting Apparatus of Ordnance.** Fried. Krupp, A.-G., Germany. The sight carrier forms one limb of a parallel link system so that no matter what position the rocking barrel gun carrier assumes, the sighting line remains parallel to its original position. Accepted April 11, 1907.

3,309 (1907). **Shield for Light Ordnance.** Société Automobiles Charron, Girardot and Voigt, France. A shield or cupola for machine guns is constructed so that it may turn on a central pivot. A circular ring of compressible substance such as leather prevents rotary movement when in the correct position, and the structure has to be raised by mechanical means to disengage this ring and so to allow the gun to be turned to another position. Accepted April 18, 1907.

4,736 (1907). **Safety Device for Falling Block Rifles.** C. Francotte, Belgium. (*See Selected Patents*).

5,232 (1907). **Case Shot for Sporting Guns.** B. Camet, France. A smooth cylindrical hollow body with a closed front is adapted to contain the shot charge of an ordinary sporting cartridge. The object of the cylinder is to carry the shot a certain distance before air resistance and gravity combine to overturn it, thus allowing the shot to be dispersed from its open rear end. The nose of the cylinder is formed after the fashion of a bullet nose and is roughened so that the progress of the charge piles up a column of air over which gravity eventually causes the cylinder to trip. Accepted April 18, 1907.

5,237 (1907). **Pendulum Sight for Rifles.** H. M. Cremer, U.S.A. The patentee describes a tangent pendulum sight for rifles adapted to allow of quick aiming and precision in angular position. It is constructed also to admit of very easy detachment of the sight from the rifle. Patent No. 2,619, 1861, and several U.S.A. patents are mentioned as having dealt with this branch of invention. Accepted 25, 1907.

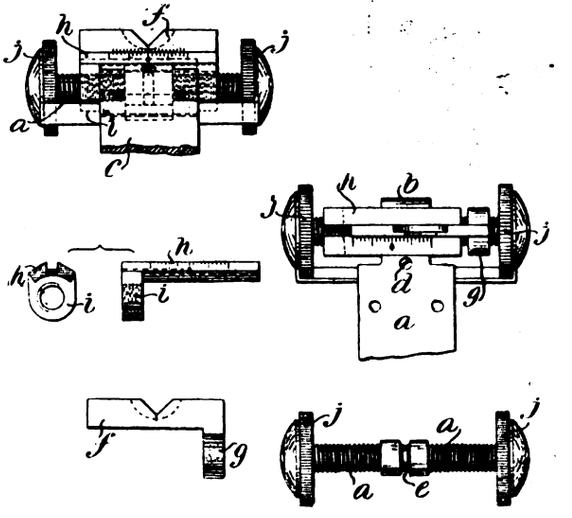
5,525 (1907). **Rifle Rack.** B. G. Wilmer, London. A unit of a rifle rack adapted to be built into a brick wall consists of a metal portion the legs of which are hooked so that it cannot easily be pulled out of the wall. The projecting hook part intended to hold the barrel of the rifle is lined with wood. Accepted May 2, 1907.

SELECTED PATENTS.

WIND GAUGE SLIDE FOR BACK SIGHTS.

22,565 (1906). The King's Norton Metal Co., Ld., and T. A. Bayliss, London, E. Whitworth, King's Norton, C. H. Watson, and F. W. W. Baker, London. The wind-guage slide dealt with in this patent consists of two separate parts. One carries the V notch and works on a right hand threaded portion of a rotatable spindle, and the other carries the scale and works on a left hand threaded part of the same spindle. Thus when the spindle is turned, the parts are moved either towards or away from each other, and each unit of motion of the V notch bar is measured on the scale carrying portion by a graduation double the length of the movement of either bar in respect to the leaf of the sight.

The bar is illustrated in the drawings reproduced. The spindle *a* is, as will be seen, threaded half its length one way and the other half in the opposite way. The spindle works in a bearing *b* in the end of the leaf *c* and endwise movement is prevented by the



pin *d* which engages the annular groove *e* on the centre of the spindle. The V notch carrying bar *f* is fitted with the screwed collar *g* working on the right hand threaded part of the spindle, and the scale part *h* carries the collar *i* working on the left hand threaded part of the spindle. It will be understood that the relation of these parts with each other and with the spindle, is such that

when the spindle is turned by means of either of its milled heads *j* the bars *f* and *h* will be caused to move either towards or away from each other, the reading of the scale is by this double movement being much facilitated. If necessary a vernier scale may be provided on the V notch bar *f* to work in combination with the scale on the bar *h*. Accepted April 4, 1907.

SAFETY DEVICE FOR MARTINI RIFLES.

4,736 (1907). C. Francotte, Liége. A safety device for rifles of the Martini type is arranged to engage automatically with the tumbler when the breech block is turned down by the under lever to cock the parts. It is released by means of a trigger-like part

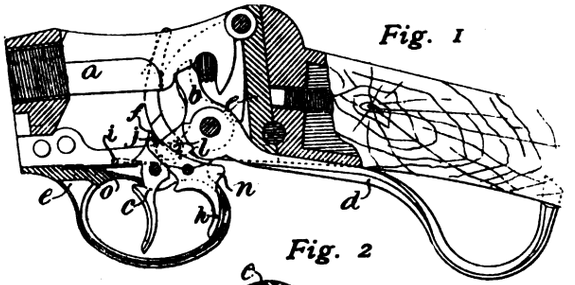


Fig. 1

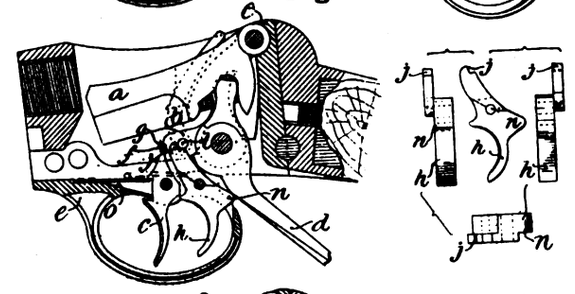


Fig. 2

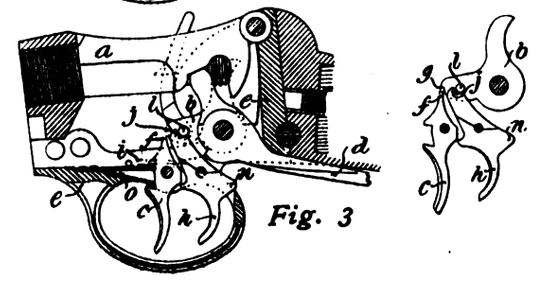


Fig. 3

situated at the back of the main trigger and its presence allows of the lightening of the trigger pull which without such a safety device must be fairly heavy to prevent jarring off should the rifle be dropped or the breech closed violently.

In Fig. 1 the mechanism is shown after firing, in Fig. 2 the parts are illustrated after being cocked, and in Fig. 3 the action is closed ready for firing. The mechanism consists of the usual pivoted breech shoe *a* the tumbler *b*, the trigger *c* and the cocking lever *d*, all these parts being carried by the trigger guard *e*. The tumbler *b* is held in the cocked position by the nose *f* of the trigger which takes into the bent *g*.

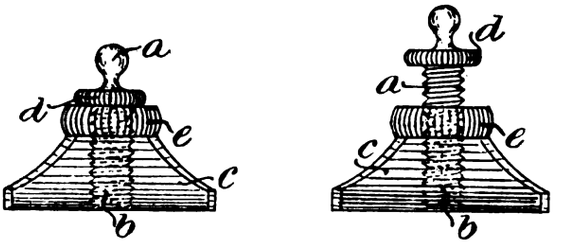
The safety mechanism, forming the subject of this patent, consists of the second trigger-like part *h* called the safety sear. It is arranged at the rear of the ordinary trigger and is constantly pressed backwards by the spring *i*. The notch *j* in the beak of the safety sear *h* is forced beneath the lateral projection *l* on the tumbler *b* by the pressure of the breech end of the lever *d* on the part *n* of the sear which projects through an opening in the back of the trigger guard, (Fig. 2). This takes place when the lever *d* is pressed downwards to cock the mechanism and eject the spent cartridge.

When the lever *d* is returned to the closed position (Fig.3) the tumbler projection *l* engages with the notch *j*, and the tumbler is held sufficiently raised to leave the trigger *c* free and not in contact with the bent *g*. In this position the parts are safely locked.

To release the safety sear it is necessary to press its lower portion *h* backwards so that the tumbler is allowed to drop and engage its bent *g* with the beak *f* of the trigger. If the spring *o* of the trigger were broken and the trigger rendered inoperative the rifle could still be fired by using the safety sear as a supplementary trigger. Accepted April 25, 1907.

ADJUSTABLE FORESIGHT FOR RIFLES.

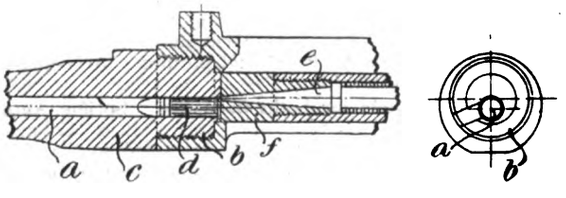
15,769 (1906). J. Betteridge, Birmingham. The foresight described in this specification is intended principally for air rifles and other small weapons of this description. The foresight *a*



consists of a bead carring a threaded pin working in the screwed hole *b* in the block *c*. The block is dovetailed into the barrel in the usual way. The sight is moved up or down to accord with various ranges by means of the milled collar *d* and it is locked in position by screwing the lock-nut *e* tight down on to the base *c*. Accepted April 11, 1907.

RIFLES FOR RIM FIRE CARTRIDGES.

1,422 (1907). F. Greener, London. The patentee overcomes the difficulty of adapting the breech mechanism of central fire rifles to discharge rim fire ammunition by throwing the barrel out of centre so that the rim of the case is brought opposite the striker. The invention applies particularly to cases where barrels bored and chambered for miniature rim fire ammunition have to be fitted to rifles of the present service or Martini falling-block type. To convert existing central fire rifles to the rim fire system the patentee proposes therefore to fit a barrel turned and screwed at the breech end eccentric to the bore. Alteration to the breech or striker is rendered unnecessary.



The invention is illustrated in the small drawing reproduced and it will be seen that the bore *a* is thrown out of truth with the screwed portion *d* of the barrel *c*. The rim fire cartridge *d* is shown in the chamber. The striker *e* is central in the breech bolt head *f* but its nose lies opposite the rim of the cartridge *d* by reason of the position of the bore in relation with the screwed end *d*. The screwed end is, of course, out of truth to the extent of half the diameter of the rim fire cartridge. Accepted April 11, 1907.

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CONTENTS.

CURRENT TOPICS.

Mr. Haldane's Walking Stick.—During a time when the operations of the Explosives Department of the Home Office have been made the subject of Parliamentary discussion, it is particularly unfortunate that the Secretary of State for War should have announced himself a culprit of the deepest dye. With the Home Secretary assuring the House that the Explosives Act is administered without fear or favour, and that its provisions will be put in operation against all who infringe its clauses, Mr. Haldane's makes an interesting little speech about the properties of explosives, in which he calmly announces that some time back he was in the habit of carrying about with him a walking stick made of cordite, and that he frequently deposited it in the cloak room of the House of Commons. Such a confession from such a quarter is not likely to strengthen the hands of the Home Office in its war against the improper treatment of explosives. An entire walking stick made of cordite represents an amount of explosive which would subject all who came within reach of it to an unreasonable amount of danger. The risk of fire from accidental contact with a match or lighted cigar end is amongst the possible consequences of the stupid freak which possessed Mr. Haldane, when a member of the Explosives Committee, to convert a sample of the service explosive to an improper use. The practice is hardly likely to become general, because if everyone handled a stick of cordite with the intimacy commonly accorded to a walking cane, sufficient nitroglycerine would be absorbed into the system to cause a succession of bad headaches such as would make life a torture until one had become sufficiently acclimatised to the drug. The Secretary of State for War would form an excellent subject for prosecution under the Act, and he could show in his own person that Mr. Gladstone's assurance that the law is administered without consideration for individuals is justified.

An Index to Explosive Literature.—The high standard of literary excellence which characterises the reports, annual and special, of H.M. Inspectors of Explosives certainly justifies the title adopted for this note. Notwithstanding the many pre-occupations of the recent mercury controversy H.M. Inspectors of Explosives have found time for the preparation of two documents which will be of lasting value to all concerned in the manufacturing and handling of explosives. The first is an alphabetical index covering the contents of the annual reports of explosives from the year 1876 down to 1905. It would of course be impossible to aggregate into a single volume, at anything approaching a reasonable cost the full index of each successive yearly report. The present index, which covers a matter of only ten pages, therefore represents the result of the more laborious task of selecting the salient items of each annual report, and indexing them under the kind of subject matter heading which would suggest itself to anyone making a search. The identification of each item by the year of the annual report in which it is dealt with, together with the page, gives a most useful general indication of the dates of important events. For instance, under the heading of "Big Blasts" there is a list of fifteen in different parts of the country, and the explosives used. The idea has, however, been

to give each item a specific heading, rather than mass a number of items under some general heading. The whole ten pages are of considerable interest, and they constitute a direct invitation to turn up in the annual reports some of the articles and notes which have been forgotten. One cannot, for instance, look over the pages without noticing an entry concerning the explosion of an ostrich egg. Such a curious occurrence naturally attracts the attention, and one instinctively desires to investigate whether all eggs have this alarming tendency to develop gas under pressure and so add a new danger to domestic life. The second of the two documents is the natural corollary of the first, being a similarly compiled index to the special reports issued by the inspectors during the same term of years. The same system of indexing has been adopted; but the technical value of the material dealt with is of course far greater than is the case with the matter in the annual reports, because each special report arose from an enquiry into some important event, and the inspector who specially studied the surrounding circumstances has recorded his observations in the form of a special report. The inspectors have certainly earned thanks and congratulations in regard to this latest proof of their industry.

Defective Service Ammunition.—A mild form of newspaper scare has recently resulted from the bursting of a number of ·303 cases in the course of use. More or less reassuring replies on the subject have been given in the House of Commons, but to the technical man the evil is of deeper foundation than the accidental occurrence of a few badly drawn cases. The service cartridge, as has been frequently pointed out in these columns, is defectively designed in directions which could be modified without altering the external shape. The head of the cartridge is seriously weakened by two doubtful elements of design. The first is the needlessly large cap which unduly diminishes the amount of brass in the head of the cartridge, and the other is the occurrence of a square shoulder in the interior of the case at the junction of the base and the cartridge wall or tube. The weak head due to the large cap is especially productive of "blow-backs," the head expanding under pressure and releasing the cap from its frictional holding, whilst the large diameter of the cap itself gives a proportionately large area for the gases to act upon. The square interior shoulder promotes two serious tendencies. The first is that with solid drawn ammunition the presence of a square flange or shoulder necessitates a good deal of working of the metal at that point, with the result that the cartridge is likely to become brittle. The other disadvantage is purely mechanical, and arises from the fact that the cartridge tube expands under firing, whilst the cartridge head remains more or less rigid. The sharp line of demarkation which separates the rigid from the flexible produces undue distress at the point of junction between the base and the tube. If the base were gradually merged into the tube by a gentle slope, cartridges would be much less likely to go wrong, but under present conditions the very worst form of construction exists, and the evil is not lessened by the constant distribution for target use of ammunition which has travelled round the world. After a prolonged cooking in the tropics the cartridges are considered too bad for use abroad, and they are sent home to be used up for rifle practice. There is no knowing to what extent the prolonged storage and general rough and tumble which the cartridges receive, will affect their stability and endurance. The nitroglycerine may evaporate from the cordite and be re-deposited in the cap chamber and around the cap. Then again the mercury from the cap may become detached, and the contact of ever so small a portion with brass produces a rapid deterioration of the metal. One can see that the service cartridge is none too well designed in the first place, and that it receives an exceptional amount of ill-treatment under storage in the many climates where the British forces are in the habit of operating. It is not, therefore, surprising that gas which is intended for propelling the shot should at times escape into the breech.

The Cordite Enquiry.—The appointment of a special committee to enquire into the presence of unauthorised ingredients in cordite represents a very wise method of dealing with an exceedingly difficult situation. When Kynoch's were prosecuted for the addition of mercuric chloride to explosives, certain War Office experts gave evidence on behalf of the prosecution, and one would naturally expect in such circumstances a fairly strong statement of the case against the defendants. Sir Frederick Nathan and Dr. Farmer were both fairly emphatic at the first hearing as to the probability of mercury exercising an unfavourable effect on the stability of an explosive. The silver-foil test was first mentioned during the cross-examination of one of the witnesses in a way which suggested that its existence was well-known, whereas in point of fact it had not been generally realized previous to the first hearing that a means existed for neutralising the effect of the masking ingredient. During the interval between the successive trials a number of tests were conducted under the new conditions, and opinions were so far modified that mercury was no longer condemned as a deleterious ingredient, but merely as one that had no proper place in a gelatinised explosive. Mr. Haldane, in the House of Commons debate, was necessarily obliged to deprecate any tendency to create a scare; and he may accordingly be assumed to have adopted the most favourable possible attitude towards service explosives containing mercury. The committee, which has been appointed, must necessarily act with entire detachment from preconceived notions and previous happenings. With the high scientific ability at its command all doubt should in due course be set at rest concerning the advisability of using or not using the cordite which now lies under suspicion. The enquiry will be entirely disassociated from the question why the mercury was added. The business of the committee will be to decide whether having got there, say by accident, its presence will detract from the capacity of the explosive to stand storage, and whether its condition can be noted by a suitable modification of the heat test.

THE BISLEY PROGRAMME.

THE coming Bisley rifle meeting seems likely to have in store some surprises for those who regard the pointed bullet idea as still in the experimental stage. Other countries are known to have achieved very high velocity with pointed bullets of comparatively low weight, and the early doubts as to their alleged behaviour have been dissipated by the knowledge that the pointed formation gives an undreamed of reduction in the air resistance encountered. Responsible opinion has acknowledged the military usefulness of a bullet which materially enhances the distance for which a fixed sighting may be employed; but it is quite another question whether the best military bullet necessarily conforms to the standard of accuracy demanded by the target shooting enthusiast. The indirect advantage in a military rifle and cartridge of great consistency of shooting is that target practice assumes a high level as a sport, and, therefore, encourages the kind of practice which enhances the efficiency of the individual soldier. It is not of course the volunteer marksman who experiments with new forms of bullet and cartridge. This work is the speciality of the small body of scientific marksmen who practice at long ranges with rifles fitted with match sights. For particular conditions of their sport they require a cartridge which shall place a series of shots in a horizontal band not exceeding two feet in height at 1,000 yards, and they further require that the cartridges used shall not be unduly influenced by wind. The harmonising of these two requirements in a style of bullet and cartridge which has only been under consideration for little more than a year presents many difficulties; but there is reason for assuming that the coming meeting will show in general use amongst the competitors pointed bullets of one kind and another, whose adoption by the match rifleman implies a definite advantage over the older designs.

Few of the other aspects of the Bisley programme present any particular features of interest. The various competitions devoted to special rifles include, as before, the "Esser-Barratt," the "Greener," the "Savage," "Sporting Telescope," and the "Stevens." The "Winchester" is, however, a new competition of great interest, in that the Company have presented a challenge cup, which will be awarded yearly to the shooter whose two best shots fired at 200 yards under a time limit of one minute show the highest score. The conditions allow repeating and automatic rifles to be used, but the weight must not exceed ten pounds, and they must be fired from the shoulder, which of course excludes the use of a rest. The miniature rifle contests display no special novelty, either in regard to the conditions or weapons to be used. The "mid-range" event on the other hand will give an opportunity of witnessing the results obtained by a mid-range cartridge complying with the specification which was published some time back. The "Two-twenty" competition is at 100 and 200 yards, in which ·22 ammunition with an energy equivalent not exceeding 1,300 ft.-lbs. is to be used. Curiously enough, this is about ten times the energy of the ordinary ·22 cartridge.

THE NEW PATENT BILL.

It is exceedingly cheering to notice that amongst the large mass of proposed legislation which has been thrown overboard by the Government the Patents and Designs Bill is not included. This piece of legislation has now passed triumphantly through the hands of the Standing Committee without apparently having lost a single material feature of the original draft. The number of clauses has increased from 36 to 48, and every item of added matter, whether in the form of new clauses or new sections and sub-sections, emphasises the objects originally in view. One slight concession has, however, been granted to the foreign patentee. It was originally proposed that he should have three years clear run before being required to show that the patented article or process is exclusively or mainly carried on in the United Kingdom. This period of grace has now been extended to four years, and no doubt sound reasons were advanced for allowing the foreign patentee a greater margin of time for what must in many instances amount to the establishment of manufacturing facilities in this country. If at the end of the period noted the invention is worked exclusively or mainly outside the United Kingdom, it is open to any person to apply for the revocation of the patent, and the comptroller has power to make the necessary order, subject to one appeal only, viz., to a judge of the High Court, specially selected to deal with patent questions. The amended draft of the new bill emphasises very strongly the intention to prevent the ownership of a patent from being made an instrument for enforcing restrictive conditions which limit the freedom of the licensee on matters lying outside the actual area covered by the patent. The licencee cannot be forced by contract to abstain from using certain goods, nor can he be required to use goods or articles in which the licensor is interested, but this condition does not affect the power of a patentee to lay down in the terms of a licence that only the goods of a certain person shall be sold. Two whole pages of the Bill in its amended form are devoted to this important clause restricting the owner of a patent from using this ownership as a handle to extort conditions outside the legitimate sphere of a licence agreement. In the original Bill the same subject was treated in nine lines. A new clause which enjoins on a patentee the obligation to disclose, upon request, the number and date of any of his patents is of great importance to the community at large. Instances frequently arise in which a patentee refuses information which would show, either that his device is no longer protected, or else that the term of the patent is drawing to a close. In fact the whole structure of the Bill now before Parliament tends to reduce to a strictly business level the contract which exists between the department which grants patents and the public who take them out. It also introduces several much needed reforms into the relations which exist between one patentee and another, and between the patentee and those who use or work his invention. The predominant feature of the whole Bill rests, however, in the circumstance that the foreign patentee will no longer be allowed to use the British patent laws as a means of hampering British trade.

BENJAMIN ROBINS, 1707–1751—AND AFTER.

BY CAPTAIN J. H. HARDCASTLE.

"This excellent person was born at Bath in 1707" writes his friend and biographer Dr. James Wilson, and the precocity of his genius is shown by the fact that amongst his earliest papers, one was "a demonstration of the last proposition of Sir Isaac Newton's Treatise on Quadratures, which was thought not undeserving a place in the Philosophical Transactions" (for 1727, No. 397). He died when Engineer General to the Honorable the East India Company "at Fort St. David, the 29th July 1751, with his pen in his hand, as he was drawing up for the Company an account of the posture of their affairs."

The chief interest to our readers in the life and labours of this extraordinary man, "withal a most sprightly and agreeable companion." will lie in his published works on gunnery and ballistics. His *New Principles of Gunnery*, first printed in 1742, shows a grasp of the subject so sure and so much in advance of his times that for a hundred years and more his conclusions constitute an unexhausted mine of information on the science of weapons of war. Even now in this year, two hundred years after his birth, students of the subject can do worse than use his writings as their text book, and certainly the beauty of his style, and the amazing clearness of his thought might well be imported into many modern treatises with advantage. Three of the subjects on which he experimented and wrote were the determination of the force of gunpowder, the resisting power of the air and the nature and advantage of rifled barrel pieces.

When Sir Andrew Noble commenced his labours on the force of fired gunpowder, when Bashforth began his labours on the resistance of the air, and when Whitworth undertook to investigate the effect of rifling, Robins had been dead for an hundred years. For the whole of that time the science of ballistics remained where he left it. Many of his discoveries had been forgotten. There can be little doubt that if he had lived to the natural span of years rifled cannons would have been used at Waterloo, and England would have been the country to have profited by his prediction :—

"I shall, therefore close this paper with predicting, that whatever State shall thoroughly comprehend the nature and advantages of rifled barrel pieces, and have facilitated and compleated their construction, shall introduce into their armies their general use with a dexterity in the management of them; they will by this means acquire a superiority, which will almost equal anything, that has been done at any time by the particular excellence of any one kind of arms; and will perhaps fall but little short of the wonderful effects, which histories relate to have been formerly produced by the first inventors of fire-arms."

Concerning the force of fired gunpowder there is little in our author's writings of practical interest at the present day when black powder is no longer used for propulsion; but there is much that can be read with advantage even by those who have studied the subject. The very simplicity of the experiments and apparatus employed by him to establish his fundamental proposition on a sound basis should encourage the young student to experiment for himself, if only with a toy cannon in his own backyard. The science of interior ballistics would then cease to be associated in his mind with such abstract things as x and y. Such depressing things as pen and ink and confinement in a schoolroom would be exchanged for all the pleasurable sensations associated with original discovery and actual demonstration of physical laws, notwithstanding the fact that many or all of the discoveries and demonstrations were known to others beforehand. They would be new to the student and would be impressed indelibly on his mind by their very newness and actuality. Robins' apparatus were a gun, a few ounces of powder, some bullets, 12 to the pound, a pair of scales and a ballistic pendulum, and it is worth noting that within the last few years some of the best experiments with small arms have been carried to success with the same modest conveniences.

Of the nature and advantages of rifled barrel pieces every word of Robins in worth reading. His original paper was read before the Royal Society on the 2nd of July, 1747, just 160 years to the day before these lines are in print, and from a historical and from a scientific point of view, we may add also from the point of view of mere literature, it will well repay the time spent in perusing it. His opening paragraph is as follows :—

"Having treated at large in the preceding papers of the numerous irregularities which take place in most of the operations of gunnery by the deflection of the projectiles from their first direction, which, as we have seen, is occasioned by their whirling motion; it is now but reasonable to consider of the most effectual means for preventing these troublesome and perplexing deviations. But before I offer any methods of my own for this purpose, it is proper to describe a practice, which has long prevailed in several parts of Europe; and which, though in all probability originally intended for different ends, doth yet in many instances prevent the deflection here treated of; the producing of this effect being indeed the sole excellence, all its other boasted advantages appearing on examination to be only imaginary."

The practice to which he refers is the cutting of spiral grooves inside the barrel to give the ball a spin;

"it being usual for the threads, with which the rifled barrel is indented, to take a little more than one turn in its whole length. The number of these threads in each barrel are different, according to the fancy of the workman, and the size of the barrel; and in like manner, the depth these channels, or rifles, are cut down to, is not regulated by any invariable rule; but differs according to the country, where the work is performed, or the caprice of the artificer. This is the general idea of a rifled barrel."

The real use of this practice, he points out, is to give a definite and regular spin to the ball, instead of the accidental spin caused by the friction of the ball on one side or other of the bore, and further to diminish the difficulties due to the imperfectly spherical shape of the ball. The phenomenon of "drift" was particularly well known to him, although there is no record of his having played golf with a bramble marked ball. He knew that an imperfectly

made spherical ball drifted to one side or to the other and even up or down, according to the direction of the spinning axis, and that rifling, by causing the ball to have a predetermined angle of axis must necessarily get rid of the accidental errors due to drift. On this subject his knowledge is co-extensive with our own. We know that every spinning projectile drifts, and we know the direction of the drift, but when we pass from "the how to the how much" we are even in the twentieth century as much in the dark as the finest mathematician of the eighteenth century. Almost every sergeant-instructor is prepared to tell his class the cause of drift, and most writers willingly spend pages in explaining the reasons of this curiosity in natural science, but the great European authority on the gyroscope to whose writing we shall have to refer again presently, prefers to content himself with a few lines on the subject. In the *Text Book of Gunnery* 1902. Professor Greenhill writes of drift:—

"This is an effect observable with all rifled guns, by which the shot is deflected in its flight more or less from the vertical plane of fire; the deflection is to the right when the gun is rifled with a twist on a right-handed screw, to the left with a left-handed twist,"

and continues:

"disregarding theories and explanations the established facts connected with drift are as follows:—With service projectiles having pointed heads and right-handed rotation, the drift is to the right; other things remaining unchanged, it is found that the greater the twist the greater the drift; the smooth and well-centred B.L. projectiles drift less than the M.L. shells, which are roughened by studs; at extreme ranges the drift always increases rapidly, and the projectile becomes unsteady in flight, owing to the greater curvature of the trajectory."

Such reticence should give the public reason to pause. A grave scientist writing on his own special subject does not disregard theory for any reason other than that theory is too profound for the reader, or too problematic for his reputation. As the matter is also summarised in a few words in the Encyclopædia Britannica by the same writer, it is not rash to suppose that it involves the solution of equations for which the mathematical world will have to wait for many years.

To return to Robins. The boasted advantages of rifling which he dismisses as imaginary are a higher muzzle velocity due to increased reluctance to start, greater power of boring the air and greater penetration into the solid. By actual experiment he showed that these three claimed advantages were contrary to truth, but curiously enough the claimants could have made out a good case for their first claim if they had had access to our modern work, where a short lead enables us to burn the cordite to better mechanical advantage. Needless to say Robins' reasoning was exact as far as it went, as he was concerned with fine-grain powder and poor obturation.

Proceeding with his thesis he remarks upon the effect of friction in the barrel and of lubrication and mentions that only in England were breech-loaders used at all, and then for the purpose of loading a projectile bigger than the bore. After that he gives as his solution for obtaining increased accuracy, the employment of an egg-shaped bullet with the small end towards the powder, fired from a rifled piece. He adds the caution that such guns can only be made use of with leaden bullets without the employment of other artifices, presumably the artifice employed with the R.B.L. guns of having a leaden envelope on an iron core.

After his death the question of rifling remained in abeyance until Whitworth's time, and even then the mathematical treatment of the subject was quite indeterminate. Until 1883 the application of rifling was left to a system of trial and error. The spin was increased or diminished arbitrarily until a good result was obtained. In that year, however, Professor Greenhill published his analysis of the question, and since then it has been open to any maker to use his results without fee or licence. Although they are to be found in any of the usual text books or works of reference, so little are they known even in professional circles that it is the rarest thing to find an intelligent acquaintance with the subject even amongst people whose actual duty it is to know all that there is to be known on the subject. In quite recent years one maker rifled his gun with a diminishing spiral, and a professional scientist expected wooden projectiles to fly point first from a gun rifled for steel shot. Yet in common practice Professor Greenhill's rules are followed either by chance or by experience almost to the letter. In his original article, Proceedings Royal Artillery Institution, Volume XI., he commences by assimilating the motion of an elongated rifled projectile to the motion of an oval shot, which is the only one for which the equations of the air streamlines is known. He deduces then that the muzzle velocity has nothing whatever to do with the rotation necessary for stability, then that the necessary rotation is one turn in so many calibres of advance, and that the skin-speed of the shot is irrelevant. He also points out that the rotation necessary varies as the square root of the density of the medium, *i.e.* if water is 900 times as dense as air, the rotation necessary for stability in water is 30-fold as fast as in air. Further, it is shown that the necessary spin varies inversely as the square root of the density of the material of the shot, *i.e.* if the density of iron is nine and of wood is one, the wooden projectile must have three times the spin of the iron one, *ceteris paribus*. The longer the projectile the greater the spin required, and the bigger the hollow inside the shell the faster must the shell spin, and lastly a shell filled with water should be unstable whatever the spin unless it is more than three calibres long. The actual tables for stability of rotation will be found on page 158 of the *Text Book of Gunnery*, 1902.

Concerning the resistance of the air, Robins was nearly as well informed as Bashforth, until Bashforth had quite finished his experiments. He invented the ballistic pendulum, recently perfected by Mallock, and devised the whirling test for examining the resistance at low speeds. He was sensible that in trajectories with a great maximum height, proper corrections for the rarity of the higher air should be employed, and that at velocities below the velocity of sound the resistance of the air varied as the square of the velocity. The accuracy of Robins' work on the resistance of the air is well summed up by Bashforth in

his "Motion of Projectiles" and "The Bashforth Chronograph," and need not now detain us.

In conclusion of this notice of the bicentenary of a remarkable man it may be permitted to us to quote the elegant speech of Mr. Folkes, the President of the Royal Society when presenting the Copley medal to him 1747 :—

"It is now, Sir, with the greatest satisfaction that I can assure you of the high esteem the Royal Society have for you, and of the just value they set upon your very curious and useful communications. It is by their command, and in their name, that I put into your hands this faithful token of their regard: in which you will not attend to the smallness of the gift, but consider it as it comes from a Society, neither abounding in sums of silver or gold, not pursuing or coveting worldly riches, but the improvement only of philosophical knowledge. You will please therefore in such a light accept this medal, and in some sort to compare it to those crowns, that were given to eminent persons, in the first ages of simplicity of the ancient Greeks; and which although only wreaths of olive, or even garlands of grass, were not on that account the less esteemed by those upon whom they were bestowed, as they were still authentic testimonials, of the most exalted virtue, and of the most distinguished merit."

THE W.O. MINIATURE RIFLE.

THE War Office miniature rifle has unfortunately not justified the expectations of its promoters. The authors of its being were wrong to undertake the design of a rifle, about which they were entirely ignorant. They designed it without reference to the most elementary requirements of the situation, and with characteristic obstinacy refused to take warning of the risk they were running. War Office influence was exerted to force Government contractors to manufacture at their own risk a rifle needlessly expensive in design and containing defects which were bound to show themselves in practical use. One accordingly reads with regret, rather than with surprise, that it has been decided to suspend further issue of the rifle until certain modifications of design, having for object the removal of present defects, have been completed and proved effective. This process of muddling through somehow is usually carried out with the taxpayer's money. Unfortunately in the present instance it is the trade which suffers and which has to bear the brunt of the complaints of shooters who find that the rifle with the high-sounding title is not safe to use. There is an attempt on the part of the War Office to fix the blame on smokeless ammunition, because burst cases arise with its use, the escaping gases getting underneath the extractor and blowing it out of the rifle. The War Office were specifically warned in the first instance that this kind of thing was bound to happen, and that disaster was invited by fitting the extractor in a box-like cavity, from which the escaping gases could not find a vent except by a destructive lifting of the extractor spring. They laid down as one of the fundamental laws of rifle science that ·22 cartridge cases never burst, for the simple reason that they never give sufficient pressure to produce this result. They were warned of the fallacy of their argument, but on the principle that no one is so blind as the person who refuses to see they disregarded the warning which had been uttered.

Burst cases have continually occurred ever since ·22 rifles were first used, but more especially since the introduction of smokeless powder. Rifle makers have naturally recognised the possibility of this contingency, and the provision of suitable vent holes is the A.B.C. of rifle construction. Military rifles, although provided with relatively stronger cartridge cases, must at all times encounter the same mishap, and one of the routine tests of a military rifle is to ascertain what damage is inflicted by the bursting of deliberately weakened cartridge cases. One cannot theorise concerning the behaviour of gases in motion. They may travel with a velocity of 5,000 f.-s., and this implies the existence of a momentum which may lead to unforeseen results. The suddenness, moreover, of the escape necessitates the provision of vent holes in the immediate vicinity of the escape, and if possible in direct line with the travel of the gases. The problem involved is to construct the rifle mechanism so as to diminish as far as possible the liability of the cartridge to burst, and to ensure that no harm is done on the rare occasions when this mishap does arise. In the War Office miniature rifle the absence of proper support for the cartridge around the head represents a direct incentive for the cartridge to burst, and the situation of the extractor, and the way in which it is fixed, makes the occurrence of a burst cartridge a danger to the shooter and those in the immediate vicinity. The rifle shooting movement has received a slight check by reason of this unfortunate occurrence, but there is no reason why its effect should be lasting. There are plenty of rifles other than the War Office miniature for shooting the ·22 cartridge, and these will no doubt be used until the promised modifications of design have been perfected. Sympathy and forbearance must in the meantime be extended to the companies who have lost money and reputation in furthering War Office ambition. It has always been our view that when the public finds the money and the manufacturer finds the rifle official authority should only be exercised in laying down a general specification of design. Manufacturers under such a system would then be encouraged to compete with one another in producing the best rifle for the purpose in view. The Enfield experts should have recognised that in the service rifle there were plenty of problems to occupy their attention.

Mr. Arthur Greenwood, in presiding at the annual meeting of the King's Norton Metal Company dealt at length with the situation which had given rise to the small profits earned last year. He pointed out that, unless a fair proportion of whatever stores were required by the Government in times of peace and retrenchment was given to the private trade, the Government would be deprived of their help in a time of national emergency. The Company was mainly equipped for the carrying out of Government orders, and it had suffered in consequence of the diminished demand. It was not an easy or rapid process to fit the works for doing a private trade. Meanwhile the lack of employment had affected their own workpeople just as much as those of the Government factories who were better situated for making their grievances known.

ROUND THE TRADE.

The fifteenth championship meeting of the Clay Bird Shooting Association will take place at Southall, near Ealing, on the three days ending the 6th inst.

Major J. H. Mansell, R.A., Chief Experimental Officer at Woolwich, has contributed to the Royal Society a paper on his investigations as to the burning of modified cordite. A notice of the same has been prepared for these columns, but considerations of space have delayed its publication.

Mr. Newitt, whose indefatigable exertions in the promotion of miniature rifle shooting are everywhere apparent, is the author of a small booklet entitled *How to Shoot*. In it he expounds under suitable chapter headings the principles of rifle shooting and how they can be mastered by the use of miniature rifles.

The Rexer Arms Company, whose career has been unduly punctuated by laudatory press notices of a financial nature, decided, at a meeting held on the 11th ult., to wind up its affairs. The proposal for raising £15,000 of debentures had resulted in a totally inadequate response, and there is, accordingly, now no alternative but to take the course proposed.

Messrs. Kynoch have forwarded to this office a very interesting letter dealing with the new pointed match bullet which has been designed to give great accuracy over long ranges. It is loaded into several sizes of cartridge, and naturally the ordinary service ·303 gives the least striking results because of the restrictions laid down by the capacity of the case. The main feature of the new design seems to consist in the fact that the pointed formation when combined with the match bullet weight of 225 grains, gives consistent regularity of angle and a diminished sensitiveness to wind deflection. The ·322 is a new cartridge with a 2430f.-s. muzzle velocity and a 250-grain bullet.

At the time when our previous issue was in the hands of the printer Mr. E. J. D. Newitt was delivering a lecture before the gun section of the London Chamber of Commerce on the trade aspects of the civilian rifle club movement. The general idea of the lecturer seemed to be that gunmakers should find a useful outlet for their activity in catering for the requirements of civilian riflemen, but in the course of the discussion which followed it was pointed out that profits do not attain a remunerative level whilst such bodies as the National Rifle Association constitutes themselves distributors of rifles and ammunition. Complaints were also made to the effect that rifle clubs find but little difficulty in obtaining goods wholesale.

The accounts and report of the National Explosives Co., Ld., show a loss of £13,704 for the past year, exclusive of the interest paid on the debenture stock. Mr. Athol Thorne presided at the annual meeting, and dealt in detail with the position. In the course of his remarks he referred to the heavy loss which might be entailed by the rejection of a large quantity of cordite, by reason of the presence of chloride of mercury. The meeting was followed by an extraordinary general meeting, at which it was resolved to transfer the whole of the undertaking to a new Company in accordance with a scheme which had been agreed upon between the Company and the debenture holders. At a meeting of the last named, held on the following day, resolutions, approving the reconstruction scheme, were adopted, this scheme being considered preferable to foreclosure. It was hoped that under the new arrangement capital would be found for continuing the business of the Company. With the advent of better times the debenture holders were advised that the works and equipment were of a kind which might be considered capable of earning profits.

Messrs. Eley Bros. have received from Christchurch, New Zealand, the welcome intimation that their exhibit of cartridges at the New Zealand International Exhibition has been awarded the gold medal.

British Westfalite, Ld., is the name of the business which formerly traded as The British and Colonial Colliery Supply Association, Ld., and a recent circular announces that after 24th ult. the offices were to be transferred from the city to the works at Denaby, Yorks.

Mr. Charles Lancaster has issued an illustrated pamphlet relating to the North Western Shooting School, which is the name by which his shooting ground will in future be known. The equipment has been extended, and comprehensive arrangements exist for giving shooting tuition of a high order.

It will be seen from an announcement in our advertisement columns that the King's Norton Metal Company have appointed the Miniature Ammunition Company, Ld., of 48 Dover Street, W., as their distributing agents for their miniature and mid-range ammunition, and that trade enquiries should be sent to that address.

The report of Messrs. Greenwood and Batley Ld., shows a further decline as compared with the two previous years in the amount of profit. The actual amount after deducting debenture interest stands at £12,428, which, with the carry forward, gives £18,552 available. From this amount £4,000 is written off for depreciation, a 4 per cent dividend is declared, and £654 is carried forward.

The decision of a London magistrate some months back to the effect that a toy air pistol is not, to quote the Pistols Act, a "firearm or other weapon from which any shot, bullet or other missile can be discharged" has resulted in an order that the case shall be sent back for the magistrate to decide whether the pistol was a weapon under the Act. If he finds that it is he is told he must convict.

The Schultze Gunpowder Co., Ld., have issued to the trade a list of "price maintained cartridges" in which the trade purchase price is clearly shown after deducting the various discounts, side by side with the minimum selling price. A third column shows the profit per hundred cartridges according to whether the purchase is effected at best prompt cash prices or whether credit is taken, The proprietary brands include the "Rainproof," the "Eyeworth," the "Westminster," the "Yeoman" and the "Pickaxe.' The new season's cartridge catalogue is now in the press, and copies may be available at any time from now. Pending united action in the matter of price maintenance the trade will be well advised in heartily supporting the efforts of individual companies towards the same end.

From the new Explosives Co., Ld., there has arrived a pamphlet referring to the new sporting powders: Felixite, Red Star and Shot-gun Neonite. The first is a 42-grain bulk powder, the second is of the 33-grain class, and the last is a gelatinized smokeless powder which can be loaded in ordinary flat base cases, the charge recommended for a 12-bore cartridge being 30 grains with 1 oz. to $1\frac{1}{8}$ oz. of shot. It is of further interest to note that the last named powder, though of the gelatinized construction occupies the 3-dram bulk when loaded into a 12-bore cartridge One might, therefore, describe it as a 30-grain powder this phrase having the same significance as 42-grain and 33-grain as applied to other classes of powder with which the loader is familiar. The bulk of the pamphlet under notice is devoted to a specification of loads for different bores of cartridge, and a catalogue of prices covering powder in bulk, and also loaded into cartridges. A final page is devoted to special rifle powders for various calibres and styles of cartridge.

MERCURIC CHLORIDE IN PARLIAMENT.

THE Home Office prosecution of Messrs. Kynoch for adding mercuric chloride to explosives has, during the past month, formed the subject of numerous questions in Parliament, both as concerning the Home Office in respect to the proceedings in Court, and the War Office in respect to cordite delivered under contract.

Mr. Herbert Gladstone, in answering a question concerning a letter by the chairman of Kynoch's, in which the Home Office was accused of straining the law against this Company, stated that this was not so, and that he had been bound to take the action referred to in the interests of public safety. A further question alleged that the Inspectors had ignored explosives by other makers which included the same ingredient. Mr. Gladstone denied that the other cases which had come to the notice of his department were similar to that of Messrs. Kynoch, but he assured the questioner that steps were being taken to deal with all the offences which had come under notice. The difference was, however, that in one instance all explosives containing the objectionable ingredient were at once withdrawn, whereas Messrs. Kynoch declined to admit that the ingredient was present, and in the other it had been accidentally introduced in imported guncotton. The settlement of other cases necessarily depended on ascertaining the state of the law in regard to the original offence brought before the Courts. Replying to questions, alleging that Messrs. Kynoch's were prosecuted because they were an Irish firm, Mr. Gladstone stated that it was quite impossible to make a more ridiculous statement. Pressed to state whether mercuric chloride was in reality an antiseptic for explosives, and was habitually used for that purpose, and whether he could give the number of accidents which had occurred in certain factories, he replied :—

"The quantity of mercuric chloride mentioned is quite sufficient to vitiate the official test. The use of an antiseptic in gelatinised explosives is unnecessary. Mercury is not habitually used in this country, and there is reason to believe that elsewhere it is used for the purpose of masking the heat test rather than as an antiseptic. The number of accidents at the factories mentioned can be obtained from the annual reports of His Majesty's inspectors of explosives, but I may say at once that the result of such comparison is quite favorable to Kynoch's. The danger of the use of mercuric chloride, however, arises principally after the explosive leaves the factory, because it lies in the keeping and using of the explosive rather than in its manufacture."

Various questions raised the point whether arbitration should not have been resorted to instead of a prosecution in so technical a matter. Mr. Gladstone justified the course taken by the fact that the point was first brought to notice by a spontaneous ignition of some of Kynoch's explosives containing mercury, and that arbitration proceedings would not have given authority to place the suspected explosives under seizure. Referring again to the charge of hostility to Irish industries Mr. Gladstone pointed out that the firm have a preponderance of factories in Great Britian and a still greater preponderance of employees, and that proceedings were taken without regard to the locality of their different factories, he further affirmed that nothing would be done to interfere with the manufacture at Arklow of lawful explosives. Mr. Gladstone gave the most emphatic denial to the charge that the inspectors had passed explosives by other manufacturers containing the ingredient complained of and only objected to its use when Messrs. Kynoch were attacked. Replying to the leader of the Irish party concerning the distress which would be caused at Arklow by the possibility that the factory would have to be closed as a result of the proceedings Mr. Gladstone replied :—

"I should be extremely sorry if any action on the part of my department led to any interference with the works at Arklow. I can give that assurance to the hon. member quite cordially. But I cannot see why the prosperity of the works at Arklow should depend upon the manufacture of an explosive which contains an unauthorised ingredient and which constitutes a public danger. (Cheers.)"

Questioned as to the alleged use of mercury in foreign countries for antiseptic purposes Mr. Gladstone replied :—

"The witnesses mentioned (Capt. Thomson and others) did not state that mercury was used as an antiseptic in foreign countries; they only said they had heard statements to that effect. Captain Thomson moreover expressed his disbelief that the mercury was for antiseptic purposes only. The reasons why the Home Office hold that this ingredient is probably used elsewhere for the purpose of masking the heat test rather than as an antiseptic are that the explosives of two foreign firms who have abandoned the use of mercury in consequence of the rejection of their goods previously sent to this country, have since that abandonment failed to pass the heat test; and one of them has since been detected in the attempt to use another masking agent to conceal the very impure nature of their explosive."

Certain points in the above reply were queried, and the Home Secretary promised to look further into the matter. Questioned a few days later concerning the inconvenience to Kynoch's business by the continued seizure of the magazines Mr. Gladstone pointed out that

"the inconvenience, if any, to Messrs. Kynoch's trade is not due to the action of my department, inasmuch as the case in connection with this magazine would have been disposed of several months ago but for the postponements which Messrs. Kynoch have themselves obtained."

Questioned further as to the name of the other firm against whom proceedings were pending he stated that it was the National Explosives Company, not Messrs Eley as was erroneously reported in some of the newspapers, who were known to have used mercuric chloride in their explosives. At the present time a large quantity of explosive containing mercury belonging to this firm is under seizure.

The matter was brought up again on the 11th ult. in connection with votes for supplies. Mr. Bellairs, the member for King's Lynn, who had previously asked questions on the subject, spoke at length on the application of the mercury treatment to explosives supplied to the War Office. He said :—

"The question of cordite was far more serious than it was in 1895, when it resulted in turning out the Government of the

day. The Government would be judged in this matter by the way they grappled with the difficulty; and by the way they showed their determination to provide the navy and the army with efficient cordite without regard to expense so long as the lives of men were concerned. The Government could not be held responsible for the fact that a quantity of explosives doctored with chloride of mercury had been seized belonging to Messrs. Kynoch and other firms. They could not anticipate that any firm in this country would attempt to introduce an ingredient into explosives which would have the effect of masking the only test for distinguishing good cordite from bad, and the only test which stood between the safety and the destruction of our sailors and soldiers.

" He wished to know whether the Government proposed to withdraw the whole of the cordite which was known to have been manufactured by Messrs. Kynoch and by the National Explosives Company, so far as they contained mercuric chloride, and the explosives of one other firm who had used German gun-cotton, not knowing that it contained mercuric chloride."

In some subsequent remarks he pointed out that " suspicion began to take form, owing to an explosion in Wales last year, that explosives were being illegally treated by the firm which had secured the bulk of contracts from the War Office and the Admiralty; and on March 12 suspicion became absolute certainty when the manager of the high explosives department said that Kynoch's always added mercuric chloride to their explosives."

He pressed the Government for a full and frank disclosure on the subject, and asked for a statement which would " allay all anxiety upon this question, and which would show they were taking action to prevent all possibility of disaster by cordite both in our land magazines and those afloat."

Mr. Haldane, the Secretary of State for War, said his " hon. friend had been well justified in raising this vitally important question. No subject ought to produce more uneasiness in the mind of the House of Commons than one in which an idea was involved that there might be, not only in our land magazines but, what was much worse, in our ships at sea, large stores of dangerous material which would not only destroy the most valuable property of the nation, but, worse still, possibly destroy numerous human lives. Therefore it was right this question should be probed to the bottom, and it was the more necessary because irregularities had recently come to light which had caused doubts as to the quality of the cordite supplied by various firms.

" He understood his hon. friend desired that the Government should destroy all cordite in the preparation of which mercuric chloride had been used; but he thought there lay at the bottom of the hon. gentleman's argument a fallacy. Mercuric chloride did not in any way affect cordite. It did not make it more dangerous; what it did do was to mask the use of the heat test, thus making it necessary to subject all cordite in which the presence of mercuric chloride was discovered to close examination by means of other tests. The course the Government had taken was that they had stopped all cordite in which there was any trace of mercuric chloride, and they were taking other stringent steps. As regarded cordite about which there was any suspicion, they were subjecting it to a different heat test to that which cordite was ordinarily subjected, and which mercuric chloride could not mask, and in cases where there was the least doubt other tests were applied. To destroy the whole of the cordite which was even under suspicion would be a very wasteful proceeding. He had taken care to ear-mark all cordite, and no cordite about which there was any suspicion would be made available for use until it had passed the test. Wherever cordite was under suspicion an embargo had been laid upon its use until tested.

" Coming to the point which had been much discussed, could it be said that the mercuric chloride was useful in cordite, or served any other purpose than masking the heat test. He emphatically said no. He quite agreed that in the case of gun-cotton, on the contrary, mercuric chloride was used for a useful purpose. Gun-cotton, unlike gelatinized cordite, was not a hard, horny substance but had an open texture. Like everything else easily accessible to the atmosphere, it was apt to be ravaged by bacilli, which formed a fungus that destroyed the gun-cotton. Mercuric chloride, which was a very fine antiseptic, destroyed the bacilli and prevented the fungoid growth. The nature of cordite however, excluded these fungoid growths, and there was not any excuse for using mercuric chloride as an antiseptic in cordite. In the case of cordite there was one purpose only for which, in the opinion of his advisers, mercuric chloride could be used, and that was for masking the heat test.

" If there were the least risk to the ships or the men the Government would destroy the whole of the cordite, regardless of expense; but if by testing they could make sure that the cordite was good, it was well to do so, always taking care to use the tests which eluded the mercuric chloride. The question had been submitted to perhaps the strongest scientific committee that had ever sat, on which there were some of the first men of science in the country, under whose advice and guidance everything would be done. They thought that, in a matter of life and death like this, they ought to have the highest authority that could be obtained, they were deeply aware of the gravity of the situation, and were sparing no pains in their power."

The other speakers who continued the debate emphasised the gravity of the situation, and urged the Government to spare no expense in obviating all possibility of danger. One speaker asked what were the conditions of the contract to supply the cordite and whether, if the material supplied was not according to specification, the cost of destruction would fall on those supplying what had not been ordered. Mr. Haldane stated that the ingredients were specified in the contract, and that mercuric chloride was excluded by the specification. It was, therefore, in violation of the contract that mercuric chloride had been put in. He further stated that his friend need not be apprehensive as to placing against the contractors the cost of the material destroyed. In a further statement Mr. Haldane deprecated any attempt to raise a scare on the subject. He denied that mercury injured cordite, but he assured certain members who had spoken that no cordite was being obtained from the manufacturers who had put mercuric chloride into it. He was sorry to say that no absolute security existed even in the case of the cordite manufactured by the Government. The explosions which had recently taken place in India concerned the Government's own cordite. In its earlier forms cordite was a dangerous substance. As now manufactured it was much safer, but it required to be carefully watched, because under the influence of heat and age it tended to become dangerous. Mr. Bellairs in concluding the debate, contrasted Mr. Haldane's assurance that, apart from the heat test, mercury was not an objectionable ingredient, with the evidence of the Government's expert witnesses in the recent prosecution, who affirmed that mercury was not a desirable substance to add to an explosive, and that it might give rise to decomposition.

THE STANDARDISATION OF ·22 AMMUNITION.

By L. BARTON.

MINIATURE rifle shooting has undoubtedly received its present day favour through being a sport.

Looked at from this point of view, instead of a bat and ball, a rifle and cartridge are required for its enjoyment, but with this great difference, that whereas in cricket for example the bat and ball with which the game is played are standardised, in miniature rifle shooting the choice of weapon and ammunition is left practically in the hands of each individual competitor. What would be said of cricket if some players used a bat 6 inches wide and others one 7 inches, whilst some clubs bowled with a 3-inch and others with a 4-inch ball. The thought is dismisssed as ridiculous, yet, when we come to miniature rifle shooting a comparitavely similar state of things is looked upon and tolerated in all seriousness. One man will shoot Gaudet ammunition in a rifle weighing over 9 lbs. whilst another aside of him is shooting ·22 ammunition in a rifle weighing nearer 5 lbs. and 6 inches shorter. One shoots with a bullet ·303 in. in diameter, the other with one only ·22 in. in diameter. Is such shooting competitive in the strict sense of the word? Under present conditions miniature rifle shooting is not only a question of man against man, but of gun against gun and of ammunition against ammunition, and for this reason competition is shorn of a deal of its merit and interest. The basis of all true sport is equality of everything except the human element and why, I say, should miniature rifle shooting be an exception? Unless it is standardised with respect to rifle and ammunition it will never rise to be the ideal sport of which it is capable. True, it is a comparitavely young sport in this country and when it becomes acclimatised an equalising process may make itself felt and the various forms of arms and ammunition with which the game is now played may gradually converge so as to produce a universal ideal, but if the tendency works the other way, instead of inter-club competitions we shall rather be having what are practically inter-rifle and ammunition competitions, a state of affairs which is not wholly absent even at present. So much for the theoretical or logical side of the question, now for the practical.

Any practical steps taken to bring this national patriotic sport into true line with other sports must certainly come from those bodies possessing the power of authority. The individual may theorise, but the enforcement of theory into practice rests in the hands of such controlling bodies as the N.R.A. and Society of Miniature Rifle Clubs, and unless they take the matter in hand, the individual will be left to amuse himself competing against others more or less favourably equipped.

The matter of standardisation is one which could be approached from two standpoints, depending on the two views which may be taken of miniature rifle shooting, viz., as a sport pure and simple or as a more serious patriotic duty. In either case standardisation is called for, but its nature should undoubtedly be influenced by the view taken. The Society of Miniature Rifle Clubs might look after the requirements of the sporting community whilst the N.R.A. devoted its attentions to the more serious patriots. Not that the sporting community are one bit less patriotic than those who would come under the fold of the N.R.A., but there are two classes to cater for and this should be kept clearly in mind in any scheme of standardisation.

The standardisation of a rifle for the sporting clubs would certainly be a matter of some difficulty with such a range of weapons to choose from, but it should not be difficult for a committee of experts to draft a satisfactory specification meeting all requirements. At present with all the various forms of breech action, and of striker, different methods of extraction and various sights, ·22 miniature rifles bear no resemblance to one another. With all these varying differences of construction the ammunition maker finds himself faced with innumerable difficulties which would disappear if he had a standard rifle to work to. In making his priming composition sensitive enough to respond to the weak blow of some strikers he is running the risk of a burst or pierced rim now and again when his cartridge is fired in a rifle with a much more powerful striker. Ignition of a priming composition and therefore of the powder charges, varies considerably with the strength of blow given, and for this reason the ballistics of the same ammunition in two different makes of ·22 rifle are very often widely divergent. The trouble does not end here, for even rifles of the same make will often be found to vary considerably in strength of striker. Standardisation is the only solution of these difficulties and a specification should be carefully drawn up with due regard to all these points. Then, with the collaboration of ammunition experts a result should be arrived at which would go a long way to putting the sport of miniature rifle shooting on a sound basis.

The N.R.A. should not have the same difficulties to contend with, but they seem to court this complexity of affairs by their definitions of miniature rifles and ammunition. They have various classes of miniature rifles, and they define miniature ammunition in a most elastic manner. Instead of energy, why not weight and velocity? In the service rifle bored for ·22 L.R. ammunition with a special bolt, they have at hand an excellent weapon, unexcelled for accuracy and the best possible substitute for familiarising the civilian with the use of service arms. All they want in the way of ammunition is the ·22 L.R., with weight of bullet and velocity defined and some limits specified as to accuracy. They might give the ammunition makers the choice of powder, but with excellent smokeless ammunition on the market it would be a step in the right direction to specify a smokeless powder.

As a last word, is it not distressing to see the patriotic sportsman shooting with perhaps an American rifle and German ammunition? In the early days of miniature rifle shooting before English firms catered for its followers

such action was excusable, but now that home-made rifles and ammunition are on the market and have proved themselves second to none. there is surely no excuse for not being patriotic in the commercial as well as military spirit. Standardise the rifle and ammunition first, then the man to use them if possible.

THE KYNOCH REPORT.

THE report and accounts of this Company are based on the new capitalisation which results from the issue during the year under review of ordinary shares, and also debentures for £200,000 making up the total to £500,000 which constitutes half the issued capital of the Company, being the limit of borrowing power allowed under the Articles of Association. In May of last year £100,000 of debentures, in addition to the £300,000 shown in the last report, were issued. It was explained in the debenture prospectus of last November, in which the final £100,000 was put up for subscription, that 12,500 ordinary shares of £10 each had been issued at par, thereby bringing the total ordinary share capital of the Company to £500,000, which, with a similar amount of preference shares, made up the million of share capital, so justifying the half million of debentures already referred to. The present balance sheet accordingly shows under capital liabilities £500,000 of preference shares, the same amount of debentures, whilst as regards ordinary shares the issued capital stands at £387,500. The difference between this total and the half-a-million of issued ordinary shares is accounted for by the circumstance that although the 12,500 ordinary shares, which were mentioned in the debentures prospectus of last November as having been issued at par, had only been paid up on the date of the balance sheet of March 31st last to the extent of £1 per share, making £12,500 of actual cash in respect to a subscription of ten times that amount.

The prospectus already quoted stated that the total sales for the year ending March 31, 1906 had again formed a record, being ten per cent greater than during the previous year. It then went on to say that the sales for the seven months ending October last were still increasing in the same ratio. The directors explain in their report presenting the complete accounts for the year, that the falling off of the Company's profits is due to two causes. The first and principal one, they say, is the serious and long continued advance in the price of metals for which, in the ammunition department, it has not yet been possible to obtain any corresponding advance from consumers. A second, though less important cause, is the falling off in the War Office demands and the unremunerative nature of the few contracts obtained. The directors have already taken steps to meet the situation now disclosed, and they anticipate that the permanent results of the necessary changes will be beneficial to the Company. The progress of the Company's peaceful industries has been very satisfactory, and the volume of business during the year has again increased.

The accounts show a profit on the year amounting to £72,656. To this has to be added the sum of £62,278, making a total of £134,934 available. The interim preference dividend, debenture interest, and expenses are set down as having together absorbed £34,299. The interim preference dividend amounts to £12,500, which leaves £21,799 for debenture interest and expenses. A full year's interest on the entire debenture issue would amount to £20,000. The last issue received, however, only half a year's interest, so that the item for expenses probably stands somewhere in the region of £3,799. Directors' fees absorb £5,000 and the remaining preference dividend, at the rate of five per cent, a further £12,500. The above payments can be summarised as follows:—

Profit on year		£72,656
Carry forward		£62,278
	Total	£134,934
Debenture interest, etc.		£21,799
Five per cent preference dividend		£25,000
Directors' Fees		£5,000
	Total	£51,799

Out of the balance of £83,135 above shown to be available the directors propose to pay ten per cent. on the ordinary shares. This will absorb £37,500 in respect to the fully paid ordinary shares. A similar dividend is paid *pro rata* on the partly paid ordinary shares since the payment of the first call. This absorbs about £700, and leaves £45,145 to be carried forward. It will thus be seen that rather more than half the above dividend on the ordinary shares has been earned during the year under review, the remainder having been drawn from the undistributed profits brought forward from previous years. The balance sheet shows that capital expenditure on account of new factories, etc., during the year amounts to £71,391. Investments and cash are less than last year by about £40,000 so that the new money paid into the business, apart from the above capital expenditure, is accounted for by a diminished liability to creditors, an increased amount owing by debtors, and an increased amount of stock in trade. The financial papers have published abstracts of recent balance sheets of this Company, and the following table compiled on a somewhat similar basis gives the same class of information:—

	Capital paid up	Declared Profits.	Ratio.
1900	545,000	54,801	10 per cent.
1901	664,926	100,275	15 ,, ,,
1902	859,194	100,065	12 ,, ,,
1903	870,370	100,023	11½ ,, ,,
1904	870,370	91,357	10½ ,, ,,
1905	1,170,370	92,423	8 ,, ,,
1906	1,170,370	93,039	8 ,, ,,
1907	1,387,500	72,656	5 ,, ,,

The annual meeting was held at Birmingham on the 25th ult., and the chairman dealt at length with the position of the Company and the situation which had arisen in connection with the use of mercury in their explosives. He pointed out that the diminution of Government orders during recent years had made it necessary to develop other sources of demand. In consequence of the keen com-

petition which resulted, prices were reduced and profits disappeared. The advantages of Government orders were dearly purchased by the great irregularity of employment involved. The peaceful industries are all progressing, and the Company is in a position to cut losses or follow profits, as the conditions may require or judgment may direct. Losses by reason of the high price of metals amounted to no less than £26,000, but prices would readjust themselves in due course. The Company do not expect to recover Government orders, but this loss of trade has been met by drastic economies and by the substitution of other and more dependable work. After referring to these and other conditions which justify the directors in regarding the drop in the profits as temporary, and therefore justifying the payment of part of the dividend out of the amount brought forward from previous accounts, the chairman went on to refer to the mercury question. He emphasised his belief that the Company have been severely treated for political motives, and urged that the offence with which they had been charged was of a technical character, and ought to have been dealt with accordingly. In answer to an enquiry the chairman stated that the Company had given up using mercuric chloride. The motion before the meeting was duly carried.

APPLICATIONS FOR PATENTS.

MAY 21—JUNE 15, 1907.

11,749. Ordnance Sighting. L. K. Scott.
11,829. Cartridge Feeding Device for Machine Guns. F. Ruszitszka.
11,880.* Projectile. S. Hoffmann.
11,905.* Gun Mountings. A. F. Petch and R. Redpath.
12,021.* Firearms. S. Rogozea. (Belgian application, May 23, 1906).
12,051. Bolt Action Rifles. E. Harrison.
12,112. Rifle Sights. B. Howdle.
12,147.* Ordnance Firing Mechanism. A. F. Petch, R. Redpath and H. Hellberg.
12,159. Trigger Guards. C. J. Coleman.
12,228. Range Keepers. A. T. Dawson and G. T. Buckham.
12,236.* Ordnance Firing Mechanism. W. H. Bevans.
12,351.* Small Arms. H. W. Lake.
12,373.* Ordnance Projectiles. A. Cabella, R. Cabella and S. D. Cabella. (Italian application, May 28, 1906).
12,378. Compressed Gun-cotton. The New Explosives Co., Ltd., and J. A. Carter.
12,440.* Ordnance Breech Mechanism. Fried Krupp, A.-G. (German application September 5, 1906).
12,545. Disappearing Targets. H. Whitaker and H. E. Davis.
12,609. Sighting. H. S. L. Scott.
12,631. Firing Mechanism of Automatic Guns. A. T. Dawson and G. T. Buckham.
12,667. Moving Targets. J. E. Whitehouse and H. J. Whitehouse.
12,684. Automatic Disappearing Target. H. P. Jones.
12,959.* Ordnance Sighting. A. F. Petch, F. Duncan, and O. C. F. King.
12,961. Ordnance Sighting Gear. Sir W. G. Armstrong, Whitworth and Co., Ld., and J. Richardson.
12,994.* Detachable Cartridge Belt Boxes. H. R. Lemly.
13,122.* Small Arms Breech Mechanism. K. Ebert (German application June 8, 1906).
13,194. Automatic Gun Firing Apparatus. J. Theofanidis and A. Pallis.
13,306. Ordnance Sighting Apparatus. A. Barr and W. Stroud.
13,336. Ordnance Sighting Apparatus. A. Barr and W. Stroud.
13,372. Ordnance. W. Beardmore and Co., Ld., C. R. S. J. Hallé and A. Bremberg.
13,394. Firearms. F. Pritzkow.
13,423.* Sights for Small Arms. H. T. Ashton and J. J. Speed.
13,498.* Breech-loading Small Arms. H. T. Ashton, J. J. Speed and E. A. Reavill.
13,509.* Actuating Gun Rammers. A. F. Petch and F. Duncan.
13,528. Military Accoutrements. A. T. Dawson and G. T. Buckham.
13,562. Range Finders. H. D. Taylor.
13,623.* Automatic Pistols. C. P. Clement.
13,691. Powder Bottles. A. Macphee.
13,721.* Ordnance Sighting Gear. A. F. Petch and F. Duncan.
13,805. Compensating for Range Errors. A. M. Y. Brown.
13,814.* Ordnance Sighting Gear. A. F. Petch and F. Duncan.
13,904.* Gun Sighting Apparatus. A. F. Petch, R. Redpath and T. A. Petrie.

*These applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

MAY 30TH—JUNE 20TH, 1907.

COMPILED BY HENRY TARRANT.

9,977 (1906). **Electrical Arm Indicator.** F. Mitchell, London. A thin cord is stretched from the bore of the gun used for imparting aim instruction to the target when the gun is aimed correctly, the cord is at right angles with the target, but when this angle varies the point at which the gun is aimed, is electrically indicated. Accepted May 28, 1907.

10,424 (1906). **Explosive Compound for use in Dangerous Mines.** Dr. F. Volpert, Germany. (*See Selected Patents*).

10,896 (1906). **Recoil Brakes for Ordnance.** H. Hellberg, London. A device for automatically regulating the recoil of ordnance, no matter whether the apparatus is of that type in which the cylinder rotates in relation with the piston or *vice versa*. The same arrangement is made to operate equally well in either case. Accepted May, 9, 1907.

13,099 (1906). **Recoil Brakes for Ordnance.** A. T. Dawson and G. T. Buckham, London. A method of regulating the length of recoil where fluid pressure brakes are employed, the advantage of the method consisting in the elimination of certain valves or loose parts. The valve cylinder is provided with a valve key by means of which the size of its circumferential channels are regulated. Accepted May 16, 1907.

13,321 (1906). **Machine Gun Construction.** M. Otto, Russia. The barrel of a machine gun is provided with a ribbed shell, the ribs being adapted to radiate the heat. The shell is enclosed in a casing containing cooling liquid, and the ends of the casing are provided with stuffing boxes so that the ends of the ribbed shell protrude, but even the ends of the barrel are cooled by the liquid in the case. Accepted May 23, 1907.

13,983 (1906). **Detonating Compound.** W. C. White, Sidcup. A detonating compound is made up of 87½ % of fulminate of mercury and 12½ % of fulminate of silver. It is prepared either in water or in the dry state, and if necessary by mixing the two metals first. The inventor only claims novelty for the compound consisting of the fulminates in exactly the above proportions. Accepted May 30, 1907.

14,903 (1906). **Artillery Director.** Capt. J. N. B. Fulton, Glen of Imaal, Ireland. An artillery director for determining without calculation the angle of sight for guns firing at a concealed target. The instrument consists of a telescope fitted with a clinometer and mounted

to rotate on a disc connected by a universal joint to a rotatable base, and is set by an observer posted in such a position that he can see the target. Accepted May 16, 1907.

16,676 (1906). **Nitrating Nitrocellulose.** A. T. Cocking, Four Oaks, and Kynoch, Ld., Birmingham. A method of, and suitable apparatus for, removing the nitrating acids from nitrocellulose are dealt with in this patent. Instead of downwards displacement by water, sulphuric acid containing 2 % of nitric acid is forced in beneath the mass to displace the nitrating acids in an upward direction. The sulphuric acid is displaced downwards by water. This method is economic, since the nitrating acids are not diluted and other advantages are said to accrue. Accepted May 16, 1907.

18,078 (1906). **Sighting of Ordnance.** Major L. E. Ballantine-Dykes, Shoeburyness. The inventor takes advantage of the law that range for range at different muzzle velocities the angle of projection varies approximately inversely as the squares of the muzzle velocities. He mechanically applies this law to sights of the rocking bar type, so that after one adjustment further corrections, no matter what the range, need not be made providing the muzzle velocity is not altered. Accepted May 16, 1907.

19,858 (1906). **Sighting of Ordnance.** A. F. Petch and F. W. H. Shepherd, London. Regarding ordnance sighting gear of the type in which a range dial is employed with a spiral groove to accommodate the pointer arrangements are made whereby after the first correction has been made any range may be indicated by the pointer correctly, providing the muzzle velocity does not alter. Accepted May 7, 1907.

19,954 (1906). **Automatic Small-Arm Breech Mechanism.** K. Bräuning, Holland. An improved form of automatic recoil operated mechanism is dealt with in this patent. It is actuated in the usual way, but special attention is paid to the cocking parts and to the safety locking device. Accepted May 23, 1907,

22,505 (1906). **An Improved form of Projectile.** G. H. Hoxie, U.S.A. A spherical ball of hard material is inserted in a V shaped groove in the lead core of an enveloped bullet. On impact the ball drives back, and with the assistance of the air in the cavity behind it the projectile is broken up. Accepted May 23, 1907.

28,029 (1906). **Pneumatic Recoil Brake for Ordnance.** J. A. Deport, Paris. The pneumatic brake to take up the recoil of a gun moving on its own carriage and to run it back without shock, consists of an air-tight cylinder and a piston sliding within it. Apertures are arranged so that the effects developed during the movement of the piston follow a given law. Accepted May 16, 1907.

345 (1907). **Breech Mechanism for Ordnance.** Rhenische Metallwarren-und-Mg., Germany. A simple device by means of which a catch holding in the closed position the closing lever of the breech block of a big gun is operated to turn the lever and unlock the breech during the return movement of the gun after recoil. Accepted May 23, 1907.

988 (1907). **Semi-Automatic Ordnance.** Société des Anciens Establissements, Hotchkiss & Cie., Paris. Semi-automatic ordnance of the type dealt with in Patents Nos. 22,270, 1899, and 12,847, 1901, is provided according to this invention with a modified form of extractor and with means whereby the mechanism may rapidly be adapted for operation either by hand or in the usual semi-automatic fashion. Accepted May 16, 1907.

1,939 (1907). **Fixed Rest for Small-Arms.** O. Strohbach and A. Nemeth, Hungary. (*See Selected Patents*).

2,236 (1907). **Telescopic Sights for Ordnance.** Fried. Krupp, A.-G., Germany. The type of oscillating mounted prism telescope having a cylindrical prism chamber and in which the optical axis passes through the outer surface of the prism chamber and the axis of oscillation coincides with the axis of the prism chamber, is adapted for gun sighting by making the prism chamber in the form of a closed casing-like chamber for the reflector of a panoramic telescope. Accepted May 23, 1907.

3,166 (1907). **Armour Piercing Projectiles.** C. Grinwald, Prussia. A core of hard steel is seated in the heavy base of the heavy projectile, and its forward end is nearly covered by the casing. When the projectile strikes, the casing is dispersed but the smaller core of hard steel is helped through the plate it strikes by the heavy base. Accepted May 30, 1907.

3,393 (1907). **Recoil Operated Mechanism for Small-Arms.** F. R. C. von Stechow, Berlin. (*See Selected Patents*).

3,422 (1907). **Automatic Small-Arm Mechanism.** A. Christophe and P. Menteyne, France. An improved construction form of the recoil operated breech mechanism for small-arms dealt with in Patent No. 11,007, 1906, is set out in this specification. There are several features of novelty, the principal being a special form of striker and an arrangement for holding the breech block after the last cartridge has been fired and for ejecting the empty magazine. Accepted May 9, 1907.

4,255 (1907). **Aim Instructing Device.** C. von Kroff, Germany. A double mirror arrangement is fixed to the rifle in such a position that an observer can see when standing at the side of the gun a reflection of the sight as the shooter has them in relation with the target. Accepted May 16, 1907.

5,284 (1907). **Recoil-operated Pistol.** C. A. Allison, London. (Agent for *J. Kornuro, Japan*). The recoil-operated mechanism for a pistol is actuated on the well-known principle, the novel features consisting of the magazine, the trigger, the extractor and the firing pin. Accepted May 30, 1907.

5,289 (1907). **Recoil Brake for Ordnance.** Fried. Krupp, A.-G., Germany. In recoil operated ordnance a part of the brake, adjustable from the outside, is provided to enable the length of recoil to be regulated. This adjustable part is arranged so that it may be easily inserted or detached. Accepted May 30, 1907.

6,296 (1907). **Empty Cartridge Case Remover.** V. A. Obregon and J. A. Ingraw, Nicaragua. A rod provided with a sharp forked end is so constructed that the end may be forced into the metal of the cartridge case, which cannot be removed from the barrel by the extractor. Accepted May 16, 1907.

SELECTED PATENTS.

SAFETY EXPLOSIVE FOR MINES.

10,424 (1906). Dr. F. Volpert, Germany. For the purpose of rendering explosives proof against fire-damp, salts have hitherto been used which on combustion of the explosive are transformed into vapours and absorb some of the heat of explosion. Ammoniacal salts have been used principally but other salts containing water of crystallisation can also be used.

If permanganate of potash and ammonium chloride are added on equal quantities the heat of explosion produces chloride of potassium, manganic oxide and steam. The first two remain as harmless smoke on the gases of combustion but the steam participates in producing the explosive effect. Chromates and bichromates as well as chlorates and perchlorates mixed with ammonium chloride or other halogen salts of ammonia act in the same way as the permanganate and ammonium chloride.

Employment of these bodies is already known but the effect produced by their introduction into explosive mixtures may, says the patentee, be enhanced by replacing part of the permanganate, chromate or bichromate by an equal quantity of metallic nitrate, for instance nitrate of potash, soda, or baryta. By the addition of saltpetre the initial temperature of explosion is increased and thus the dispersion of other bodies entering into the reaction is more rapid and extensive than without

saltpetre. The addition of saltpetre in small quantities increases the safety giving effect, while a predominance decreases it.

The invention consists in adding to an explosive a mixture of sal-ammoniac or other halogen salt of ammonia with equivalent quantities of metallic oxygen salts of manganese, chromium and chlorine—especially the permanagnates, chromates and perchlorates of the fixed and earth alkalies in quantities above 0.5% of the whole explosive mixture—the metallic oxygen salts being replaceable by equivalent quantities of metallic nitrates especially the nitrates of the fixed and earth alkalies. Accepted May 3, 1907.

FIXED REST FOR SMALL-ARMS.

1,939 (1907). O. Strohbach, and A. Lemeth, Hungary. Fixed rests already in existence take up the backward recoil of the weapon being tested but, the patentee says they do not allow of an upward movement of the barrel such as is imparted when the gun is not clamped. This invention provides, therefore, that the barrel shall simply rest on a fork and the part to which the stock is clamped shall be capable of a pivotal movement on a vertical plane. Special attention has also been paid to the lateral and vertical adjustment of the arm when fixed in the rest.

The rest is illustrated in the drawings here reproduced and it consists of the table *a* to which is pivoted at *b* the bed *c*. The lateral position of the bed on the table is regulated by the toothed wheel *d* which operates on the toothed sector *e*. The sector *e* is slotted and a holding screw *f* is arranged to clamp the bed in any position in relation with the table. This provides for the lateral adjustment of the sights of the gun or rifle held by the carriage *g*. This carriage is adapted to slide on the bed *c*, but it is always pulled back to its original position by the spring *h*,

Fig. 1

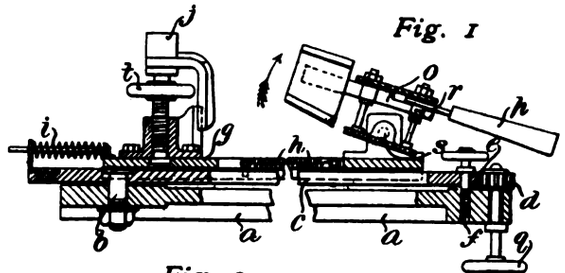
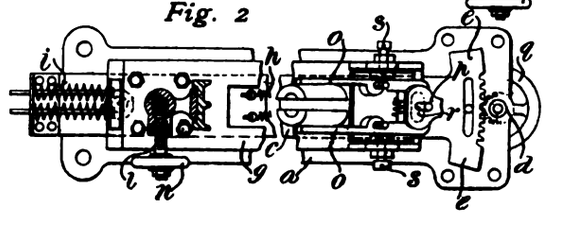


Fig. 2



one end of which is fastened to the bed and the other to the carriage. When the gun recoils the carriage is forced towards the rack *e*. The spring *h* draws it back and the carriage is received by the buffer springs *i*. No shock occurs in either direction.

The fork *j* in which the barrel of the gun rests may be raised or lowered and it is held in position by the pressure spindle *l* operated by the hand wheel *n*. The clamp jaws *o* in which the stock is held are closed by the handle *p* and are opened by the spring *q*, when the cam-like part *r* is turned out of the locking position by the handle *p*. The clamp and the parts connected with it are pivoted at *s* so that the gun may be elevated as required by means of the hand wheel *t*. Accepted May 16, 1907.

BREECH MECHANISM FOR AUTOMATIC ARMS.

3,393 (1907). F. R. C. von Stechow, Germany. The breech parts dealt with in this specification are components in a simplified automatic arm and are applicable either to small-arms or machine guns. The recoiling breech and barrel are held together until a breech locking lever is automatically put out of action and the breech block is allowed to proceed on its travel alone. The spring which is compressed by the energy of recoiling parts force them forward again and also keeps a part or place which locks the hinged top of the action in its closed position.

From the drawings reproduced it will be seen that the barrel with the sleeve *a* and the breech bolt *b* (Fig. 1) must recoil together in the breech casing *c* because the end of breech lever *d* pivoted in the sleeve *e* abuts against the rear end of the breech block *b*. When the parts thus locked together reach a certain point (Fig. 2) the tail *f* of the lever *d* contacts with the inclined part of the back of the casing *g* and the nose of the lever is thus forced downwards. The breech bolt is consequently freed and is allowed to continue its backward movement to perform

Fig. 1

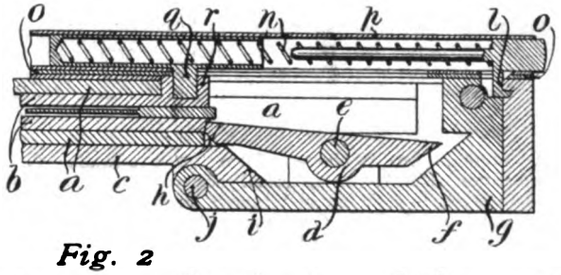
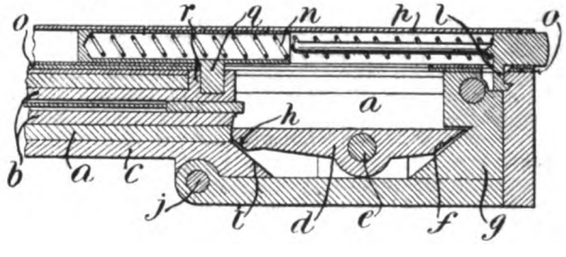


Fig. 2



the usual functions of ejection. On the return journey the inclined part *h* of the nose of the lever *d* slides over the inclined surface *i* of the casing *c* and is carried up into its former locking position. The back *g* of the casing *c* is pivoted at *j* to allow of easy access to the underside of the action.

The top of the action may be examined by freeing the bayonet connection *l* against the resistance of the spring *n* and raising the cover *o* on its hinge on the front of the breech casing. The cover *o* carries the spring case *p* which is provided with a lug *q* engaging a cavity in the lug *r* of the breech block. When the breech block is forced backwards by the recoil this spring is, through the lug connection, caused to resist and so to store up enough energy to return the breech block to its closed position.

The breech block is provided with a lateral handle to allow of the parts being operated to insert the first cartridge, and the mechanism may easily be adapted for quick firing guns. Accepted May 23, 1907.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

A Criticism on the Patent Bill.—A very influentially signed letter on the subject of the Patents and Designs Bill now before Parliament appeared in the *Times* of the 19th ult., and it is to be hoped that this criticism of a single passage in the Bill may be met without delaying its progress through the House. The criticism in question is directed against the power which it is proposed to give to the Comptroller to refuse to grant a patent in the case of an invention which has been wholly claimed or described in any previous specification. It is held, and apparently with good reason that no authority less than a court of law is competent to decide whether the whole of the material in a patent specification is old and has been published before. Such matters are ruled entirely by personal opinion, and many instances have occurred in which the commercial success of a device has been accepted as evidence of originality on the grounds that there must have been something which was meritorious and new if an idea previously held to be worthless and of no account was so developed and improved as to form the foundation of a commercial success. The British patent law is held to be sound in principle, in that inventors take out patents at their own risk. The public is well secured against unjustifiable claims by the power now given to the comptroller to force the patentee to admit in his specification the existence of earlier discoveries covering similar ground. These admissions constitute a most valuable means of interpreting a specification; but they in no way prejudice the right of the patentee to make what claims he may think proper, and to support them with the machinery of the law should he so desire. The proposed extension of the revising powers of the comptroller to the absolute refusal of patent rights will, it is pointed out, cause even more harm than the individual patentee affected will experience. Such refusals will impart a false suggestion of validity to the many doubtful patents which may have the luck to escape the penalty of cancellation.

Finish of the Kynoch Litigation.—Whilst our last issue was in the printer's hands the Home Secretary announced in Parliament that the litigation on the subject of mercuric chloride had been settled by agreement with Messrs. Kynoch. The terms of the settlement are given in another column, and it will be seen that the Home Office has been successful in sustaining the position it has taken up in connection with the breach of the law which had been committed. One cannot perhaps take any very serious exception to the attitude of conciliation which Mr. Gladstone adopted. Political pressure of an exceptional kind was applied by certain members of the Irish party in the evident belief that a bias existed against the firm of Kynoch, because they had a factory in that country. Public opinion naturally endorsed the Home Secretary's repudiation of this unfortunate allegation, but even so it seems to have been considered necessary to assure Messrs. Kynoch that no bias existed, and that they would receive every assistance in developing a legitimate business. One cannot, however, avoid the feeling that the Home Secretary went rather too far when he promised that within scope of their duties His Majesty's inspectors would be at all times glad to advise Messrs. Kynoch or any other public company con-

cerned in the manufacture of explosives with regard to the due development of a legitimate business. One may of course leave the inspectors to interpret this carefully guarded and somewhat vague promise of assistance in a spirit appropriate to the special relations they hold with the trade. It is no part of the inspectors' duties to give informal advice as consulting experts. They have unrestricted access to all explosives factories, and they naturally regard most of the information which they glean in their visits of inspection as strictly confidential, and not to be communicated from one firm to another. However that may be, a delicate situation always arises when the actions of an administrative department are reviewed by a superior official. H.M. Inspectors are, therefore, most heartily to be congratulated on having survived without loss of prestige or authority the ordeal of a political attack. Kynoch's may equally congratulate themselves on having secured the release of explosives and magazines only indirectly involved in the seizures which had taken place. This, however, does not constitute a precedent, for the inspectors endeavour at all times to minimise as far as possible the commercial inconveniences arising from the due exercise of their functions. All points of controversy are now set at rest, and the Home Office fight against the employment of mercury in the manufacture of explosives has been brought to a termination. It was, however, made clear in the Parliamentary debate which took place on the subject that the settlement of this aspect of the question is independent of the problem which has still to be settled, viz., what shall be done with the explosives containing mercury which have been delivered to the services for use on land and sea.

A Composite Cadet Rifle.—The War Office have apparently commenced to unload some of their vast store of Martini-Henry rifles. Some 20,000 of these weapons have it is stated been sold for a matter of 1s. 6d. each, to the National Rifle Association, who will make a contract for re-barrelling and re-sighting them to take the ·22 cartridge. It is expected that these weapons will sell for something in the region of 30s. apiece, and it is understood that the services of the retailer will be dispensed with, and that they will be distributed directly to the rifle clubs. An official announcement by the War Office on somewhat similar lines suggests that this method of supplying rifles for miniature range practice will be widely adopted in the future. The reception accorded to a proposal of this kind must vary according to the point of view adopted. Gunmakers were always sceptical concerning the possibility that the miniature rifle movement could ever be of any great benefit to themselves. A certain amount of trade, however, has been built up; but the profits have mostly accrued to the manufacturer on the one hand, and on the other to the retailer willing to accept a very modest profit for his services as distributor. By the new arrangement the sole person benefiting will be the manufacturer who makes and fits the new barrels and sights, and the better and cheaper he does his work the more certain is the scotching of manufacturing enterprise in other directions. From the trade point of view, therefore, the new style of miniature rifle is unlikely to be accepted as a blessing in disguise, or in fact a blessing of any kind whatsoever. The stock and action of a rifle cannot be manufactured for 1s. 6d., and rival weapons will hardly stand a chance. The rifle club movement will undoubtedly benefit from a generous and economical supply of rifles whose shooting qualities may easily be of the best. The chief element of satisfaction to be derived from the above announcement must be restricted to the knowledge that the extension of marksmanship, however achieved, must benefit the trade which lives by the supply of firearms. The education of large numbers of shooters in every part of the country must naturally give rise to the creation of enthusiasts whose keenness will not be satisfied by the possession of a single kind of rifle. The possession of one arm will give rise to the desire for another, and the sum total of trade is likely in the long run to be enhanced rather than reduced by the plentiful supply of an extremely economical form of weapon with which the earlier lessons can be learnt. If anyone is in doubt on this subject it is only necessary to refer to the reports of the miscellaneous miniature rifle competitions at Bisley to read in the list of prize winners the names of many keen enthusiasts whose names are new to the annals of rifle shooting. One kind of shooting leads to another, and the gun trade, which has survived the period when firearms were regarded with horror in the ordinary household, must benefit from the change of sentiment which now makes every parent desirous that the son shall learn to shoot, to say nothing of those who encourage the adoption of the pastime by their daughters.

The late Dr. Dupré.—With the death of Dr. Dupré there passes away an important link with the initiation of what must be regarded as practically a new industry. The period of his connection with the explosives department of the Home Office covers the transition from the old empirical ideas which governed black powder manufacture to the exact scientific methods of producing the modern chemical explosives. Dr. Dupré's share in the growth of the new industry is one which entitles him to far more credit than his published achievements would appear to justify. He has been the final referee on all chemical questions relating to the authorization and manufacture of new explosives. At times he may have appeared hard to convince; but his whole career has been marked by an attitude of scientific cautiousness coupled with an openness of mind which never allowed him to make a mistake by checking a new development for preconceived reasons. To his lasting credit stands the record of never having had to admit an error, and never having delayed progress through fear of taking the responsibility of sanctioning a new process or material. He was the recipient of all the secrets of explosive manufacture, and he possessed a fund of knowledge which none could equal, yet he carefully avoided entering into any kind of rivalry with those he advised. The soundness and impartiality of his decisions have lent a strength to the operations of the Home Office inspectors which can only be properly valued by realising how different things would have been had a less able scientist occupied the position of chemical adviser.

POINTED BULLETS.

THE man who first touched two electrically opposite metals to his tongue and noticed the characteristic taste which accompanies the passage of electric current was not the first discoverer of electricity. In a similar fashion the first user of a pointed bullet did not discover the pointed projectile which the newspapers have just found out after nearly two years' existence. The originator of the pointed bullet must surely be the one who first noticed and turned to practical account its unexampled properties of passing through the air with an extraordinary lessening of what had hitherto been regarded as the irreducible minimum of resistance. So far as this country is concerned, the Germans must undoubtedly be credited with the origination of the new idea. From the point of view of our own country the first information which reached us was a short description of the Spitzer cartridge which appeared towards the end of 1905 in the *Kriegstechnische Zeitschrift*, a German military periodical. The article in question described a bullet weighing ten grammes or 154 grains which had a very high velocity and a pointed nose. Details of its trajectory and striking velocity were given in metric values over metric distances. The *Field* in its issue of December 2, 1905 published an article in which these values were converted into English measures and English distances of range. Comparative tables, showing the alleged behaviour of the new bullet and cartridge in reference to that of the British service cartridge, were published. The *Field* then invited Captain J. H. Hardcastle, R.A. to submit the results claimed for the new cartridge to a careful mathematical examination.

Captain Hardcastle immediately discovered that the only possible explanation of the alleged behaviour of the new bullet was that it must be credited with a lower value of air resistance than had hitherto been regarded as possible. This in fact constituted the British publication of the true merit of the pointed bullet. The elements of its behaviour were sorted out in such a way that differences of muzzle velocity were eliminated, and it was then clear that with equal initial velocity the new form of bullet must cover the course far quicker than its blunt nose predecessor. Experiments were very soon begun after that, and attention was naturally concentrated on the examination of the ballistic co-efficient of the new bullet. The early doubts as to the soundness of the German claims were at once set at rest, and it became an admitted fact that the pointed nose lessened the air resistance far below that of the conventional blunt nose bullet, in which the shape of the shoulder was considered the sole factor worthy of attention. Amongst private experimentalists must be included Colonel the Hon. T. F. Fremantle, who used pointed bullet cartridges of King's Norton manufacture on the Bisley long ranges at last year's meeting, also Sir Charles Ross, who has made similar experiments during the past year. Mr. Holland has also conducted a large number of experiments with a bullet where the density was adjusted by a light weight filling at the nose. His earlier models possessed a conventional exterior, but subsequent tests have been made, and practical shooting results have been obtained with the same idea applied in a pointed shape of bullet. With Capt. Hardcastle rests the credit of having worked out on behalf of Kynoch's a bullet which embodies the pointed principle in combination with the ordinary weight, in fact a slight excess thereon.

It is this style of cartridge which has produced such extraordinary results at the recent Bisley Meeting. With one or two exceptions which cannot be ignored, the light weight bullets of pointed shape have not shown themselves to possess a sufficient degree of accuracy at long distance ranges to show their good features to the best advantage. The hitting of a three-foot bull at 1,000 yards is entirely a marksman's problem. The elevation of the cartridges used for this work must be so constant that the shots must fall within a horizontal band two feet in vertical height. If the separation between the highest and the lowest shots is four feet the bullet is condemned for match rifle target shooting whatever may be its military advantages. This uniformity and regularity of angle had hitherto only been obtained with ·303 rifles firing a 225-grain bullet, in place of the ordinary 215-grain weight, and having a velocity some 250 feet in excess of that of the service cartridge. Captain Hardcastle must be accorded full credit for the discovery that the extreme regularity of the match rifle cartridge was not diminished by pointing the bullet, and that the latter change introduced a marked reduction in the deflection caused by cross winds. All pointed bullets show the same characteristic in varying proportions, but the actual scoring results were not improved in practice because the best conditions for accuracy were not easy to determine. The heavy bullet being well understood does not introduce this difficulty, and the shooting results accordingly benefited by the use of a cartridge which gives the ordinary match rifle standard of accuracy combined with the lessened wind effect which indirectly arises from the pointed nose and the consequently higher remaining velocity.

The new cartridge, whilst it has undoubtedly settled the Bisley problem of the moment, has done but little towards bringing the true Spitzer conditions into harmony with target shooting requirements. The National Rifle Association some years ago decided that the match rifle with its large calibre and heavy lead bullet was far divorced from practical military conditions. The calibre and weight were accordingly brought into harmony with modern military conditions, and the Palma cartridge was the ultimate exponent of the revised specification. If match rifle shooting is to fulfil its accepted function the bullet weight must for next year be that considered best for the military service rifle. The cartridge, which then gives the best target results, will also exemplify the best military conditions, but so long as the match cartridge gives us the half-loaf of the pointed nose, and withholds the equally vital condition of the correct military weight, target successes will not be synonymous with military utility.

THE BISLEY MEETING.

The Bisley Meeting, which has just ended, has provided an unusual amount of material of an interesting technical nature. The uppermost point of all is the success at the long ranges of the pointed bullet, but this subject has been discussed in a separate article. Second to the pointed bullet, but not a subject which would appeal to the general public, is the curiously varied behaviour of rifles at the long ranges, according to the condition of the barrel, and the number of shots which have been fired. Some rifles which were discarded in the early part of the meeting, because they would not shoot, were taken up afterwards when the favourite barrel had gone to pieces, and proved to shoot with a degree of accuracy which had previously been unsuspected. Other rifles, which made brilliant scores in the first few competitions, went wrong afterwards, not so badly as to justify their abandonment, but enough to spoil the high level of scoring which the shooter's skill is capable of accomplishing. The evil is mainly attributable to the amount and situation of the metallic fouling which has accumulated in the barrel. The King's Norton solvent has proved a great boon in securing its removal, but the deposit again accumulates when shooting is resumed, and the great difficulty is to get a barrel into just such a state for a given competition as will enable it to maintain a constant angle. Starting with a perfectly clean barrel the elevation alters for the first few rounds and then there is a definite tendency for uniform conditions to set in. When the shots at one range have been completed personal opinion differs as to whether the metallic fouling which has accumulated should be smoothed down and made even by the use of a wire gauze pull-through, or whether the barrel should be left alone. Other shooters having in mind the half-hour's interval which may separate the shooting at the two ranges, apply an application of oil to soften and neutralise the sticky fouling that remains in the barrel. Before shooting is resumed two shots at least are fired into the ground to warm up the barrel and re-establish normal conditions. The shooting results which follow frequently suggest that a longer series of blow-off shots would be more likely to place the barrel in a state for maintaining a regular angle for the shots to be fired in competition. The elucidation of these points is complicated by the personal errors of the shooter, but even more by the idiosyncracies of the barrel. A careful gauging with a series of plugs differing in diameter by ·002 of an inch will show that barrels differ very considerably in average diameter, and that the bore is by no means uniform from end to end. Most barrels are tighter at the muzzle than elsewhere, and show a general tendency to get tighter from the lead to the muzzle.

Service rifles at the Bisley Meeting have given exceptionally good results, with the consequence that some extremely fine scores have been made. This applies mainly to the shooting at 200, 500, and 600 yards, and possibly at 800 yards as well. Beyond this distance the open sights introduce too much uncertainty for the aim to be regarded as reliable when difficulties of light are introduced, such as a glaring sun beating down on the unshielded sights. The service cartridge is again incapable of responding to the best efforts of the shooter.

A large number of varieties and designs of mid-range cartridges have been tried at the recent Bisley Meeting. The ·32–·40 has earned the high regard of shooters for the accuracy and consistency of the work which it has performed. Other cartridges, most of them containing 200-grain bullets, and with a velocity approaching very close to the limit laid down by the Association, have been used, and the general conclusion is that rifles firing this class of ammunition will be most useful for target practice up to 500 yards on ranges where the hard-jacketed military bullet would be considered dangerous.

The miniature rifle contests have as usual brought to the Bisley ranges a number of the more skilful shots of the miniature rifle clubs. Some very fine scoring has been made, but the results do not compare with the ordinary performances of meetings held on club grounds of more convenient access, where a large body of shooters are to be found. Mr. Greener has enjoyed the great satisfaction of seeing a highest possible ten-shot score made at 100 yards with the Greener ·310 rifle and cartridge. The size of bull is two inches and this record score has been made under the new conditions which require that the centre of the shot hole shall lie within the bull, and not merely that the edge of the bull shall be cut by the periphery of the bullet. The Stevens and Savage rifles have done some very good work, but for reasons already mentioned the Bisley performances are unlikely to equal those made at club shoots. The Martin-Smith contest has this year fallen away from previous records, in that only one seven-shot possible has been made, whereas, the usual custom is for several shooters to achieve this distinction. There is of course no criterion by which the conditions of the Bisley 100 yards range can be compared with those existing in other clubs. Many shooters hold the view that the tall hedge which runs alongside the range breaks any wind that may be blowing into a series of draughty currents of air which tend to make the flight of the bullet more erratic than would be the case on an ordinary range.

Amongst other items worthy of mention the success of Messrs. Webley, in having scored with one of their revolvers one of the few highest possibles ever made at 50 yards must be placed on record. In the matter of air rifles a good deal of interest was bestowed on the new military pattern of B.S.A. air-rifle, which combines the shooting capabilities of the ordinary rifle with the exterior form, the weight and the balance of the military service rifle. The Company claim a great future for the new rifle on the strength of the fact that its entire cost is covered by the saving effected on the first 7,000 rounds fired in it, as compared with the ordinary ·22 ammunition. Telescope sporting sights have not attained any fresh notoriety as a result of the competition set aside for their display. The prizes were based on the amount of entries received, and a little arithmetic suggests that they numbered thirteen.

THE WAR OFFICE AND INVENTORS.

AN appendix to Army Orders for July contains a revised "Memorandum for Inventors,' dated April 1, to which the attention of general and other officers is drawn by the Army Council. It is stated that persons who desire to submit any invention for the consideration of the Army Council should do so by letter addressed to the Secretary, War Office, London. The letter should state the nature of the invention and give sufficient particulars to enable its merits to be fully considered, and adduce any evidence there may be of the usefulness of the invention obtained by actual previous experiment.

The letter should also state what renumeration or terms the inventor would ask it the Army Council should desire (1) to acquire exclusive use of the invention; (2) to acquire unrestricted use of the invention in his Majesty's Service, but also allowing the inventor a free hand to let others use it. If no renumeration is desired the fact should be stated. Expenses or loss of time incurred before or after the submission of an invention will give no claim unless authority for such expenses has been previously given by letter signed by the Secretary or Assistant Secretary, War Office, or by the Director of Artillery, and the liability will be strictly confined to the limits of expenditure authorized in such letter.*

Should the Army Council consider it desirable to try an invention, the inventor will, as a general rule, be required to bear the expense of the provision of the article, its carriage, fittting up and removal, but the question whether such expenses shall in special cases be finally borne by the Crown or by the inventor will be decided by the Army Council according to the circumstances of the case.

The Army Council reserve the right to retain for future reference any designs, plans, drawings, models, samples, or papers forming an essential part of the description of the invention which may be forwarded; but if the inventor desires their return, the Army Council will not refuse it unless they think there is good reason for doing so. It is desirable, however, that the inventor should keep copies.

Should the invention be adopted into his Majesty's Service, terms for its use will be fixed by subsequent agreement, and such terms will include the supply of two copies of all designs, drawings, patterns, and particulars relating to the invention which may be considered necessary by the War Department; and it is to be understood that all such designs, drawings, patterns, and particulars will be absolutely at the disposal of his Majesty's Government for all purposes whatever, and that for them reasonable prices only will be paid by the War Department to cover the cost of draughtsmanship and manufacture.*

No claims for renumeration for an invention will be held to be established, unless the invention has been adopted into the Service.

All claims for remuneration will be carefully considered; but any award which may be made will only be payable to the claimant when approved by the Treasury, and money is available from funds voted by Parliament for such purposes.

Paragraphs marked * do not apply to the inventions of officers and subordinates who are required to obtain official permission before obtaining a patent, whose remuneration will be decided by the Army Council, and whose inventions, if patented, are dealt with under special regulations, which give them no right of appeal to the Treasury under section 27 of the "Patents, Designs, and Trade Marks Act, 1883."

THE ANNUAL REPORT ON EXPLOSIVES.

THIS report contains a reference on the first page to the benefit derived from the valuable services of Dr. Dupré. In the separate report dealing with the work of the chemical department Dr. Dupré remarks that research work on stability tests has unavoidably been postponed, and that remarks thereon must be postponed till the next report. The doctor's death will make it necessary for others to continue the work he has carried so far. The references to the case against Messrs. Kynoch are necessarily brief and formal, chiefly no doubt because the matters dealt with do not go beyond the end of last December. Under "seizures" the following occurs:—"At the factory of Messrs. Kynoch, Ld., one of us seized 137,315lbs. of Cordite, and Cordite M.D. and 2,460lbs. of Rifle Cordite, and 650lbs. of blasting gelatine; 109,549lbs. of Cordite and Cordite M.D. were subsequently released, the remainder being kept under seizure pending the result of proceedings."

Dr. Dupré refers separately to the subject in his chemical report, wherein he deals with the methods tried for detecting the presence of mercury. The only point now of special interest is the remark that "there is some evidence that it (mercuric chloride) rather reduces the stability." The reference is guarded and qualified, and must be read in connection with the date of the document, Jan. 1st this year. This is a point which the cordite committee must decide in the light of the more complete experimental knowledge which is now available. It is also incidentally mentioned on another page that a special report concerning an accident which occurred in thawing gelignite has been withheld as legal proceedings are pending in respect of the same. Appendix U contains a list of the seizures effected in December last.

The work of the department has been exceptionally heavy during the past year in connection with the authorization of new explosives and the amendment of the definitions of existing explosives. This work arises partly from the introduction of new smokeless sporting powders, but more particularly from the adaptation of mining explosives to meet the requirements of the safety tests carried out under the Coal Mines Act. The local authorities come in for the usual rap on the knuckles for not paying more careful attention to the inspectorial work entrusted to them. Arrangement for local inspections for Ireland have been made under the Local Government (Ireland) Act 1898,

and details are given in the Appendix of the officers appointed, the districts they serve, and the work performed during the year.

The summary of the accidents in the use of explosives, which have occurred during the year, is again most interesting from the scientific standpoint. The Inspectors justifiably take credit for the circumstance that 94 per cent of the accidents causing death or personal injury occur in the use of explosives, and under miscellaneous conditions to which the controlling provisions of the Act do not apply, and that such accidents caused 48 out of 55 deaths, and 371 out of 395 cases of injury. Amongst the classified references to accidents in the use of explosives are 28 cases of hang-fires where the workers returned too soon to the shot holes. One of these was a fully authenticated case in which a hang-fire of five minutes occurred. One of the most prevalent causes of accidents in mines is the tampering with miss-fired shots in the hope of recovering the labour lost in making the hole and the explosive charge therein. Other sources of danger are clearly specified and it may be hoped that workers in the mines will appreciate more and more as time goes on the necessity to avoid taking dangerous risks.

The work of the explosives testing station and the other matters arising out of the Coal Mines Regulations Act fill many interesting pages. The following table of results is exceptionally interesting as showing the relative favour with which the permitted explosives are regarded:—

List of principal permitted explosives used in mines and quarries in the year 1906:

Name of Explosive.	Manufacturer.	Quantity used.	Percentage of Total.
		lbs.	
Bobbinite	Curtis's & Harvey	1,215,085	18·2
Saxonite	Nobel's	1,119,088	16·7
Carbonite	Carbonite Syn.	569,833	8·5
Westfalite	British Westfalite	511,992	7·7
Ammonite	Miners' Safety Exps. Co.	507,669	7·6
Monobel	Nobel's	473,688	7·1
Roburite	Roburite Exps. Co.,	460,829	6·9
Bellite	Lancashire Exps. Co.	319,549	4·8
Arkite	Kynoch	314,212	4·7
Faversham	Cotton Powder Co.	171,709	2·6
Stowite	New Exps. Co.	159,947	2·4
Ammonal	Roth, Felixdorf	143,079	2·1
Rippite	Curtis's & Harvey	140,635	2·1
Amvis	Roburite Exps. Co.	118,939	1·8
Electronite	Curtis's & Harvey	115,333	1·7
Abbcite	Kynoch	70,550	1·1
Negro	Roburite	53,610	0·8
Geloxite	Cotton Powder Co.	49,407	0·7
Celtite	Nalınsen & Co.	46,656	0·7
Aphosite	Nitrate Exps. Co.	14,921	0·2
Dragmite	Curtis's & Harvey	14,913	0·2
Permitite	Westphalia Anhalt	13,200	0·2
Kynite	Kynoch	13,081	0·2
Rexite	Cotton Powder Co.	10,019	0·1
Withnell	Lancashire Exps. Co.	9,295	0·1
Cambrite	Nobel's	9,007	0·1
Haylite	National	8,300	0·1
Ammonal B.	Ammonal Exps. Co.	7,589	0·1
Cornish	National	6,905	0·1
Fracturite	British Exps. Syn.	6,140	0·1
Normanite	Cotton Powder Co.	4,399	0·1
Eleven other Explosives	———	16,333	0·2
	Total	6,695,912	100·0

It is supplemented by a further table giving the consumption of all explosives as follows:—

Name of Explosive.	Quantity Used.		Percentage of Total.
	lbs.		
Permitted Explosives	6,695,912		30·2
Gunpowder	13,912,814		62·8
Gelignite	1,485,711		6·7
Blasting Gelatine	15,409		
Gelatine Dynamite		67,611	0·3
Cheddite	47,624		
Dynamite	4,578		
Total	22,162,048		100·0

Comparing the figures with those of the previous year it is satisfactory to notice that the consumption of permitted explosives for 1905 was 5,863,700 lbs., as against 6,695,912 lbs., the total shown in the first table. The total of all explosives gives the following comparison:—

1905—20,316,194, 1906—22,162,048.

The following particulars of importation are abstracted from the list given in an appendix to the report. It is pointed out that the large increase during recent years arises mainly from explosives transhipped abroad. Thus out of the 3,558,662 lbs., of blasting explosives containing nitroglycerine imported during 1906, 2,741,050lbs. are known to have been transhipped for other countries.

Abbcite—Kynoch Ld. 1,950 lbs.
Baelenite—J. Russell 17,000 lbs.
Blasting Gelatine—
Alliance Explosives Co., Ld. 320,000 lbs.
A. J. Brown & Co. 1,000 lbs.
W. Marden & Co. 438,750 lbs.
National Explosives Co., Ld. 400 lbs.
J. Russell 1,100 lbs.
J. R. Watson & Co. 5,000 lbs.
Carbonite—
Carbonite Syndicate Ld. 227,400 lbs.
Fr. Richter & Co. 66,100 lbs.
Celtite—
A. J. Brown & Co. 21,500 lbs.
W. Marden & Co. 5,000 lbs.
Cooppal Powder—J. R. Watson & Co. 6,450 lbs.
Detonators—
Alliance Explosives Co., Ld. (Number) 160,000
Ammonal Explosives Co., Ld. 500,000
G. Austin 30,000
A. J. Brown & Co. 970,000
W. Marden & Co. 2,555,000
C. G. Mueller 6,903,225
Pulvermann & Co. 2,000
F. R. Richter & Co. 1,002,000
S. Salisbury 770,000
J. R. Watson & Co. 10,640,000
Detonators for Fuses—C. G. Mueller 400,000
Dynamite—
Alliance Explosives Co., Ld. 155,000 lbs.
W. Marden & Co. 155,000 lbs.
National Explosives Co., Ld. 1,250 lbs.
Wainwright Bros. & Co. 65,000 lbs.
Gelatine Dynamite or Gelignite—
Alliance Explosives Co., Ld. 198,500 lbs.
W. N. Blakeney 19,600 lbs.
A. J. Brown & Co. 273,500 lbs.
W. Marden & Co. 1,292,750 lbs.
National Explosives Co., Ld. 37,600 lbs.
Nobel's Explosives Co., Ld 200,000 lbs.
Manufactured Fireworks— 619,539 lbs.

ROUND THE TRADE.

Mr. William Cullen, who was thought to be fixed in South Africa for some time to come, is expected home for a few months stay. His arrival was timed for the end of July.

A notice has been issued to the effect that the offices of the Army Inspection Department, Birmingham, have been transferred from Montgomery Street, Sparkbrook to 136, Golden Hillock Road, Small Heath.

Messrs. Cogswell & Harrison Ld., have issued an eight page leaflet giving particulars for the coming shooting season of their various specialities, of which cartridges of their make and loaded with powder also manufactured by them, form a prominent feature.

The New Explosives Company have issued a singularly effective show card in connection with their sporting powders which depicts a moorland scene in the best style of three-colour printing. The original painting is by the well-known artist, Mr Whymper.

The two companies engaged in the manufacture of the W.O Miniature rifle notify that pending final arrangements permission has been given to fit these rifles with an added device to prevent the blowing out of extractors in the case of burst cartridges. Existing rifles can be modified on the same lines at the cost of about half-a-crown.

Messrs. Joseph Lang & Son, Ld., have issued a most effective illustrated pamphlet giving views of their new ground at Neasden with particulars of the varied kinds of practice there available. The woodcock drive is claimed as a unique feature, and the photograph relating to the same is singularly successful as a piece of artistic work.

The Schultze Gunpowder Co., Ld., have issued a well got up pamphlet showing their leading brands of loaded cartridges. As was mentioned last month the named brands of cartridge are sold on a price maintenance basis, but this arrangement naturally does not extend to the ordinary cartridges made up from Eley cases which anyone in the trade may buy.

For purely private reasons the well-known firm of William Bennett, Sons & Co., Ld., fuse manufacturers of Roskear, Camborne, Cornwall, has been registered as a limited liability company. The whole of the share capital has been taken up by the members of the firm. Mr. W. F. Bennett and Mr. E. J. Bennett who for several years past have been the Managers of the firm will be the Managing Directors of the new company, so that there will be no change of administration, and the business will be continued as heretofore. The registered offices will be the old offices at Roskear.

A serious charge of forging the proof mark of the Guardians of the Birmingham Proof House resulted in the prisoner receiving a sentence of one month. Mr. Joseph Rowlands, who prosecuted, said that in September 1902 the defendant, George Walker, was carrying on business in Bath Street, Birmingham as a gunmaker, and that a firm of merchants sent him an order for twelve double guns to bear their trade name of Hamilton. The guns were in due course shipped to Australia, and nothing more was heard of them until two were returned in July last year as being defective. They were submitted for examination by the proofmaster when it was found that the definitive proof marks on one of the guns were forged and that one barrel had a serious defect in it. The barrels were traced to the prisoner by means of a private mark he was in the habit of applying to guns of his make. Mr. Rowlands pressed for a severe punishment, on the grounds of the serious danger to the public of a fraud of this description, and the above sentence was passed.

At the annual meeting of the Society of Miniature Rifle Clubs, the Duke of Norfolk announced that the number of clubs affiliated had increased from 360 to 793 in the course of twelvemonths, or to be exact 13 months. This result is to a large extent due to the competition founded by the Queen.

The Vinner Explosives Manufacturing & Sales Company of Nikolsk in the Government of St. Petersburg, with numerous branches throughout Russia, made a profit of £22,649 in its eighth (1906) working year as compared with £24,863 in 1905. The dividend for 1906 will be 8 per cent. It was 9.2 per cent. in 1905.

Messrs. Jos. Lang & Son in a leaflet relating to sporting cartridges for the current season say that they are carefully loaded in accordance with the instructions of the powder makers. In the long run this will bring better business than the alternative plan of saying that the cartridges are loaded in a special way, the discovery of the firm in question.

To those who are especially interested in the protection of buildings from damage by lightning, a perusal of the reprint of Mr. Alfred Hand's lecture before the School of Military Eng neering delivered last December can be recommended. It is published by Messrs. J. W. Gray & Sons of 91 Leadenhall Street, E.C., Mr. Hands being senior partner in the firm.

A correspondent has forwarded for our inspection a booklet entitled *Pour Former un Tireur* of which the authors are *M.M.* A. Violet and G. Voulquin. *M.* D. Mérillon *Président de l'Union des Sociétés de Tir de France*, contributes a preface. The book is not only interesting as an account of French methods of shooting and the rifles used, but as a proof that the lessons of recent wars are appreciated outside Great Britain, especially as regards the importance of making shooting a national pastime.

At the first annual meeting of the New Explosives Co., Ld., in its re-organised form Mr. E. H. Hindley, who presided, expressed regret that the trading for the eight months ended February 28 last had resulted in a loss of about £4,000 owing to keen competition. The staff had been engaged in research work, and the company had met with a certain amount of success with the new sporting and rifle powders which it had put on the market. In this respect the present season, so far as it had gone, was satisfactory. The prices of blasting explosives were unremunerative. With regard to Government orders, mainly in respect of cordite, the position was perhaps not so hopeless. Owing to certain matters which had come prominently before the public, the Government orders had been given to fewer firms (the company included among the number), and prices were a little better.

Mr. T. R. Bayliss, managing director of the King's Norton Metal Company, Ld., writes :—"With regard to the extraordinary merits and origin of this bullet there appears to be some misconception. As a matter of fact no one at this late date can claim it as his invention for it so happens that in the year 1862 I made some sharp pointed bullets similar to the bullet in question for an Austrian—Count Stuart, who was, I was informed a descendant of the Stuart line. The only difference between the Count's bullet and those used at Bisley, is :—the sharp pointed end with a a taper shank was of iron with a lead tube shrunk on the taper part to form the parallel with the rifle grooves on it, whereas those now in question consist of a leaden core with a cupro-nickel envelope. The King's Norton Metal Company began making experiments with sharp pointed bullets in 1905, this resulted in the excellent exhibition at Bisley last week. My Company is quite satisfied with its efforts in having succeeded in producing a bullet of very superior merits to those now in general use but do not claim the sharp point as an invention.

INVESTIGATION OF THE LAW OF BURNING OF MODIFIED CORDITE.

THIS is the title of a paper by Major J. H. Mansell, R.A., read at the Royal Society February 14th, this year and deals with the combustion in closed chambers of M.D. Cordite. The object of the research was the measurement of the pressure of various loading densities and the determination of the rate of combustion at these pressures. The apparatus used consisted of a bomb with a capacity of 28·18 cubic inches and an internal diameter and length nearly equal. There were three openings from the bomb, viz., a valve to release the gases, a firing plug and the piston of the crusher gauge. A contrivance was attached to the outside part of the piston which registered the decrement of the copper crusher and thus the pressure in terms of time, on a revolving drum. The final reading gave the pressure for the particular loading density and the time rise of the pressure curve gave the rate of burning when the geometrical form of the powder was considered.

M. Vieille in 1893 was the first to make experiment scientifically on the combustion of explosives. He showed that contrary to the accepted view that black powder burnt in concentric layers, that gelatinized preparations were the only propellants which took on this role of combustion. Vieille showed that gunpowders like Cordite burnt perpendicular to the superficies and the velocity in this direction can be represented by an equation of the following form viz :—

$$v = cp^x \quad .. \quad .. \quad .. \quad .. \quad (1)$$

where v = the velocity in inches, of combustion along a right angle to the surface burning, p is the pressure existing in gases and c and x are constants for each explosive, e.g., for Ballistite he found $v = p^{\frac{3}{4}}$ and for a pure nitrocellulose powder $v = p^{\frac{1}{2}}$. A careful study of Vieille's results, obtained by setting out all his determinations on squared paper, would show that in the selection of a curve to represent this relation (1) a good deal is left to the discretion of the draughtsman. The actual values of the velocities of combustion for a given powder and pressure varied considerably with the density of loading and the thickness of the powder grains. Consequently any proposed mathematical expression relating the velocity of combustion and pressure should be built on a basis containing the more general views as regards explosive action. It is on this ground that writers have accepted the relation (1) because it is of a form easy to handle, gives a velocity nil for a vacuum, and is nevertheless capable of interpreting experimental results as well as any other alternate proposal.

Major Mansell has taken Vieille's apparatus and methods and applied them to the service explosive M.D. Cordite. By his position as Chief Experimental Officer at Woolwich he is able to speak with great authority. Mansell's results are condensed into four tables at the end of the paper under review. These tables give values for every one-tenth ton of pressure. In table I. herewith these values are set out for each ton of pressure only.

Pressure per sq. in.	Loading density of the charge burnt.	Reduction in diameter of M.D. cordite cords per 0·001 second		Reduction in the annulus of M.D.T. per 0·001 second at 80° F.
		at 60° F.	at 80° F.	
1	0·0144	0·00150	0·00162	0·00188
2	·0290	·00273	·00295	·00329
3	·0438	·00395	·00428	·00469
4	·0588	·00517	·00562	·00610
5	·0740	·00639	·00696	·00751
6	·0885	·00762	·00830	·00892
7	·1025	·00884	·00963	·01033
8	·1171	·01006	·01097	·01174
9	·1307	·01129	·01230	·01314
10	·1441	·01251	·01364	·01454
11	·1567	·01373	·01498	·01595
12	·1692	·01496	·01631	·01736
13	·1811	·01618	·01765	·01878
14	·1925	·01740	·01899	·02018
15	·2035	·01862	·02032	·02159
16	·2143	·01985	·02166	·02300
17	·2243	·02107	·02299	·02440
18	·2342	·02229	·02433	·02580
19	·2437	·02352	·02567	·02720
20	·2527	·02474	·02700	·02860

Mansell found that the rate of combustion of Cordite increased with the temperature, between 60° F. and 80° F., he found an increase of about 9%. He also found that the rate obtained for cords did not apply to M.D.T., viz., tubular powder. He explains this by the existence of a greater gas pressure inside than outside the tubes during combustion. The excess pressure inside the tubes will obviously depend on the diameter of the hole and the length of tube of powder thus making the problem a very difficult one. Therefore the figures for M.D.T. in table I., are provisional and may only hold for restricted conditions.

Investigations such as these are made principally to enable one to calculate the ballistics of a gun. Major Mansell appears to have invented a novel system of Interior Ballistics and makes the following remarks respecting it :—"I have preferred to follow the system adopted by Mr. Bashforth in his calculations of extended trajectories, that is to say, I break up my time-rise curves into small arcs, and, assuming a mean pressure for the interval, find from the calculated end pressure if my assumption has been correct. If not, I have now a guide to the mean pressure to assume, and so on. The application to the practical case of the gun is outside the scope of this paper, and it is obviously undesirable to publish such investigations in connection with English ordnance."

It is very difficult to appreciate what Major Mansell means in the above by "obviously undesirable to publish." Calculations cannot give a better answer than experiment for the pressure and velocity of ordnance and yet these experimental details are published in the handbooks. As far as one can tell from the above, Mansell's system of Interior Ballistics is one of trial and error. Suppose he is dealing with the rising pressure and velocity curve just after the bullet has moved the distance of a calibre. As-

sume he has found the pressure at this point to be ten tons. He then says let the mean pressure for the next ·001 sec. be 12 tons. This pressure acting for the stated time will increase the velocity by so much and also move the projectile a determinable distance. During the same time a certain amount of Cordite will be burnt as shown by the tables. From all these details the pressure at the end of the ·001 sec. can be ascertained and if it does not equal 14 tons another trial is made and so on until the assumed average pressure is the mean of the initial and final pressures. In this way velocity and pressure curves can be built for the whole of the projectile's movement in the bore.

There are one or two points in Mansell's paper which can hardly be allowed to pass without comment. He says that :—" Vieille was the first to propound the law of combustion by parallel surface for smokeless propellants. By a propellant we distinguish an explosive which explodes from one that detonates ; and it is this combustion by parallel surfaces which is the distinguishing characteristic of the difference of the two phenomena." The use of the terms burning and combustion to explosives has objection but Mansell's distinction between explodes and detonates does not improve matters. For instance cordite can be detonated and Schultze gunpowder does not burn by parallel surfaces, nevertheless the characteristic in the combustion of Schultze is not detonation. Certainly we can say that smokeless propellants for ordnance burn by parallel layers but it does not follow that gunpowders burning otherwise take the role of detonation.

To interpolate the values of the rate of combustion at different pressures, Mansell adopted an expression differing in form from (1). For the combustion of cords of M.D. at 80°F., this expression is as follows :—

$$v = 0{\cdot}66805\, p + 0{\cdot}14$$

Mansell points out that when the pressure is nil the velocity cannot be 0·14 inch per second and explains this anomaly by saying that the ends of the cords burn before the charge is properly ignited. The new expression is therefore not radically different from (1) and as a matter of fact Mansell's results fit in very well with an expression of this form viz :—

$$v = 0{\cdot}716\, p^{\cdot 98} \quad .. \quad .. \quad .. \quad (2)$$

the agreement is shown in table II.

TABLE II.

Reduction in diameter of cords at 80° F.		
Pressure.	Mansell's figures.	Figures by fomrulæ (2)
Tons.	Inch.	Inch.
5	0·00696	0·00693
10	·01364	·01366
15	·02032	·02035
20	·02700	·02697

The closed chamber pressures obtained by Mansell differ materially from those hitherto published, also an attempt is made to argue from these results that previous writers on the pressures of gases at high temperatures have made a serious omission.

Major Mansell gives the following empirical expression for calculating pressure from the loading density Δ.

$$p = 360\,\Delta^3 - 54\,\Delta^2 + 69{\cdot}8\,\Delta \quad .. \quad (3)$$

he further points that if in Van der Waals' general equation

$$\left(p + \frac{a}{v^2}\right)(v - b) = R\,T$$

$\frac{1}{v}$ is replaced by Δ it may be written

$$p\,(1 - b\,\Delta) = ab\,\Delta^3 - a\,\Delta^2 + R\,T\,\Delta \quad .. \quad (4)$$

From the similitude of (3) and (4) Mansell argues that the term of Van der Waals equation $\frac{a}{v^2}$ should not be ignored as has been done hitherto. The apparent similitude of (3) and (4) is of a doubtful nature. Moreover the signs R T in (4) contain the values of the gases evolved per gram and the absolute temperature, both of which vary with Δ. There is therefore, no similitude. The term $\frac{a}{v^2}$ is included in a general expression for the relation of pressure and volume to take account of what physicists term " Cohesion," a factor which becomes negligible at high temperatures such as obtain at the temperature of combustion of explosives. When cohesion is ignored in Van der Waals expression the pressure in tons per square inch is given by

$$p = \frac{T\,v_0\,\Delta}{41640\left(1 - \frac{\Delta v_0}{1000}\right)\left(1 - \frac{\Delta v_0}{1000}\right)} \quad (5)$$

where T is the absolute temperature and v_0 the specific volume of the gases evolved per gram. In *Arms and Explosives* of January 1907, the temperature of combustion of M.D. Cordite was calculated from Noble's experiments by means of specific heat values of *M.* Sarrau. These are again given in the table III., and also the pressures calculated by (5) using Noble's values of v_0.

TABLE III.

Density of Loading.	Noble's Results.			Mansell's pressures by formulæ (3)	Pressure calculated by formulæ (5)
	Pressure.	Total gases per gram.	Calculated temperature by Sarrau's method.		
	Tons.	C.C.	°C.	Tons.	Tons.
·05	3·00	956	2450	3·40	3·28
·15	10·50	931	2490	10·47	10·58
·25	20·95	894	2567	19·70	19·71
·35	32·45	852	2687	33·25	30·05
·45	43·95	810	2877	53·28	43·45

Turning to table III. it will be seen that Mansell's pressures differ very much from Noble's. This difference is so great at high density that one might believe Mansell's equation (3) had never been used beyond ·25 density because at ·5 density it gives to M.D. Cordite a closed chamber pressure greater than has ever been obtained with any propellant, notwithstanding that M.D. Cordite is comparitively a mild explosive. Mansell was no doubt misled by the apparent similitude of (3) and (4). It is difficult to understand how anyone could seriously accept the pressures taken with explosives in closed chambers as

evidence in favour or otherwise of a general equation like Van der Waals', when the great variation in results by different experimentors is considered. The published closed chamber pressures of Cordite mark I., differed up to 5 tons and now we have M.D. Cordite with even a greater difference.

EXPLOSIVES REPORTS FROM AUSTRALIA.

Mr. C. Napier Hake, who is at present on a visit to this country, has been followed by the printed copy of his report as Chief Inspector of Explosives for Victoria for the year 1906. The document naturally deals with a large amount of the routine work of the department, but the statistics and observations which relate to importation are of general interest.

One hundred and forty-three licences to import explosives were issued during the year. The nature and quantities of explosives imported in 1906 and 1905 respectively are given in the following table :—

Name of Explosive.	1906.	1905.
	lbs.	lbs.
Gelignite	1,001,150	1,086,050
Gelatine Dynamite	309,950	303,950
Blasting Gelatine	164,250	166,050
Cheddite	43,100	47,750
Bobbinite	50	4,000
Rippite	2,000	*Nil*
Powder Fuse	87,500	70,050
Powder, Blasting	183,650	232,500
Powder, Sporting	39,875	53,700
	1,831,525	1,964,050
Detonators (total number)	2,906,500	2,728,000

The total number of factories under licence is eight, and the number of magazines 210, the same as in the previous year. There are now thirteen Government magazines available for public use, chiefly for the storage of commercial explosives, as against fourteen in 1905. Sixteen licences were issued during the year in connection with the carrying out of the Melbourne sewerage system. According to Mr. Hake the storage and use of explosives in public thoroughfares is, under any circumstances objectionable, but the necessities of the economical carrying out of this important public work have rendered it unavoidable. The amount of explosive allowed to be stored is in every case reduced to the lowest possible minimum. Magazines have to be constructed, and their management is subject to special rules ; a keeper is in charge of the magazines day and night, and they are frequently inspected. During the year there have been no accidents by fire or explosion in the manufacture, storage or transport of explosives. The statement of revenues derived from the administration of the Act shows that the sum of £3,479 has been received as rent from magazine sites belonging to the Government.

The following observations relate to the explosives imported during the year :—

Blasting Gelatine.—The blasting gelatine imported from European ports was of a satisfactory nature, only 1,950lb. being condemned, on account of exudation of nitro-glycerine, of which 1,400 lb. was destroyed, the balance being returned to the port of origin.

Gelatine Dynamite.—The gelatine dynamite imported during the year from European ports was of a very satisfactory nature, the whole of the consignments being passed. One small lot, consisting of 750 lb., which had been kept under observation for some time, found to be showing signs of instability, was condemned, but subsequently allowed to be returned to the local factory for treatment ; 100 lb. stored in a country magazine were condemned, and destroyed, on account of exudation.

Gelignite.—The condition of the gelignite imported during the year was on the whole satisfactory, only one consignment from a European port being condemned, on account of instability. The consignment was destroyed. A consignment of 9,450 lbs., which had been kept under observation for some time, was condemned and destroyed on account of insufficient purity. Two small lots of 2,100 lbs. and 1,350 lbs. respectively were found to be slightly below the standard of purity, and were condemned, but, at the request of the owners, were returned to the local factory for treatment. One consignment of 2,500 lbs. stored in one of the magazines on the Truganina Explosives Reserve was condemned and destroyed, owing to instability. One small consignment (50 lbs.), which had been stored for some time in a Government magazine in the country, was found to be exuding, and was destroyed.

Cheddite.—The cheddite imported during the year was, with the exception of a few cases damaged by water, satisfactory. The damaged cases were destroyed.

Fireworks.—The fireworks imported during the year were solely from Japan and China. The only samples rejected were two very small consignments, which were imported from Japan as "Fancy Goods." In each consignment a certain variety of firework (known as scintillators) were on examination found to contain a composition consisting of potassium chlorate in admixture with sulphur, such a mixture is liable to spontaneous combustion, the same being prohibited by Order in Council. The whole of the fireworks in each consignment found to contain this illegal mixture were condemned and destroyed, and the importers concerned were warned that a repetition of the offence would not be overlooked.

Safety Fuse.—The whole of the safety fuse imported during the year complied with the requirements of the Act.

Mr. E. A. Mann has issued his report as Inspector of Explosives for Western Australia for last year. In it he expresses regret that it has been impossible in the absence of extra assistance in the laboratory to make further experiments in connection with the gases formed by explosives. There have been a number of cases during the year where accidents have been attributed to faulty fuse, in spite of the rigid examination to which all fuse entering the State

is subjected. As was pointed out in the last report, an attempt was made to minimise the danger by specifying the burning rates of fuse to be used in mining, but accidents are still rather frequent and very difficult to account for.

The importations for the year 1906 are shown in the following table :—

Kind of Explosive.	Quantity.	Value.
Blasting gelatine	445,650 lb.	28,502
Dynamite	7,000 lb.	308
Gelatine dynamite	424,250 lb.	20,739
Gelignite	2,544,565 lb.	107,685
Explosives for Army	..	11,061
Explosives, N.E.I.	..	12,725
Fuse	507,096 coils	10,893
Blasting powder	112,544 lb.	2,317
Sporting powder	4,500 lb.	610
Fireworks	..	586
Detonators	..	3,322
Carbonite	1,000 lb.	233
Caps (percussion)	..	272
Total value of importations.	..	£199,253

As will be seen from the following comparison of importations during the last five years this represents a record, with the exception of the year 1904 when the value of the total imports was £312 in excess of that for 1906.

Total Value of Importations for the last Five Years.

Year.	1902.	1903.	1904.	1905.	1906.
	£	£	£	£	£
Nitro-glycerine compounds ..	157,100	152,071	160,817	158,472	157,467
Blasting powder	5,577	5,113	3,352	5,026	2,317
Sporting powder	224	601	652	97	610
Fuse	13,439	10,433	15,653	14,762	10,893
Rackarock ..	115				
Fireworks ..	341	..	245	..	586
Cartridges ..	8,593	..	14,781	..	11,061
Detonators ..	4,358	5,967	4,043	..	3,322
N.E.I.	..	4,651	22	2,641	12,725
Caps	..	..	..	..	272
	189,747	178,836	199,565	180,998	199,253

The principal item is, of course, the nitro-glycerine compounds, and following the usual custom, figures are now given showing the kinds of the various explosives making up this item. It will be seen that gelignite still retains the first position, but that gelatine dynamite has largely replaced blasting gelatine when compared with the corresponding figures for last year.

Nitro-Glycerine Compounds imported in 1905 6.

	1905.	1906.
	lbs.	lbs.
Gelignite	2,384,600	2,554,565
Blasting Gelatine	522,500	445,650
Gelatine Dynamite	240,000	424,250
Dynamite	14,000	7,000

An interesting comparison is afforded by the accompanying table showing the importation of industrial explosives into all the States of the Commonwealth for 1906.

The table is compiled from returns kindly furnished by the various Governments. All military explosives and cartridges have been excluded from the table, which deals only with explosives used for blasting, and sporting powder.

It will be seen that the importations into Western Australia amount to one-third of the total for Australia. This is less than the proportion noted in previous years, Western Australia showing a falling off and some of the other States, especially Victoria, showing a considerable increase.

Return showing importation of Industrial Explosives into the various States of the Commonwealth during 1906.

	1 West Australia	2 Victoria	3 Queensland	4 New S'th Wales	5 South Australia	6 Tasmania
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
N.G. Compounds ...	3,432,465	1,520,000	1,535,100	936,600	774,100	354,180
Blasting Powder ...	112,544	188,000	207,500	927,300	129,000	74,785
Sporting Powder ...	4,500	48,734	18,723	42,041	17,869	15,100
	3,549,509	1,752,434	1,761,323	1,905,941	920,469	444,155
	£	£	£	£	£	£
Fuse	10,893	2,745	7,728	Not stated	4,095	Not stated
Detonators	3,322	3,870	5,070	3,445	1,701	1,500
Other Explosives ...	38	5,761	580	7,631	*Nil*	5,172
	14,253	12,376	13,378	11,076	5,796	6,672
Total value of Explosives enumerated above	£174,647	£101,465	£94,618	£61,974	£50,687	£27,854

Other items touched upon in the report include the samples of explosives tested during the year under review, the necessity to pay systematic attention to the condition of lighting conductors on magazines, and the general state of the storage facilities provided in the colony. The leases for all magazines on Government reserves have now been issued, and this matter is now in order for the first time since these reserves were established.

THE PROCEEDINGS AGAINST MESSRS. KYNOCH.

Mr. Herbert Gladstone, in replying to questions raised in debate by Mr. Mooney, re-affirmed that his actions had not been animated by any feeling of hostility or prejudice against Messrs. Kynoch. In his judgment he had a very clear public duty to perform, and he discharged it to the best of his power. In these matters it was always desirable if they could to come to a settlement which was consistent with a public duty and with the public interest. The conditions which had been accepted by Messrs. Kynoch were these :—" Messrs. Kynoch agree to withdraw their appeal to the High Court and to accept the decision of the Essex Quarter Sessions. They will write a letter to the chief inspector of the Home Office undertaking not to use mercuric chloride, or any ingredient which will have a masking effect on the Abel heat test, and generally to revert to the terms of their licence. They will indicate to the Home Office the explosives now under seizure in the magazines which contain mercury, and will hand them over to the inspectors to be ultimately dealt with as the committees

appointed jointly by the War Office and the Home Office may recommend. The Home Office agree that the cases now pending against Messrs. Kynoch shall be withdrawn. That all explosive not containing mercury shall be released. At the same time, the magazines required by Messrs. Kynoch for trade purposes shall be cleared of their present contents—namely, the explosives seized under the Act by concentrating the seized explosives in such places or places as may be approved by the chief inspector."

Those were the terms on which this matter had been settled, as he believed, in the public interest and to the advantage of everybody concerned. He could say with the utmost frankness and confidence that his Majesty's inspectors had never shown any partiality in the discharge of their duties—duties which they had performed admirably and without fear or favour. Within the scope of their duties his Majesty's inspectors would be at all times glad to advise and consult Messrs. Kynoch or any other public company concerned in the manufacture of explosives with regard to the due development of a legitimate business. He might explain that the settlement did not go beyond his own Department, and had nothing whatever to do with other Departments which might be concerned in the manufacture of explosives, such as the War Office or Admiralty.

In answering Sir F. Banbury, who took exception to the terms of the settlement, Mr. Gladstone further stated that any one who had followed this case very well knew that upon his instructions and responsibility a prosecution had been instituted for a certain infringement of the law, and that judgment was given and confirmed at quarter session. Messrs. Kynoch appealed to the High Court, and delay occurred in hearing the appeal; and in the interval it was not possible to follow up the prosecution. What the Home Office wanted was a clear admission by Messrs. Kynoch that they had infringed the law; what they wanted was prevention of a repetition of the offence with which the firm was charged. Messrs. Kynoch had withdrawn their appeal, and in so doing had admitted the justice of the action taken against them; they had given the Home Office everything that was wanted by an undertaking that they would not in future put the unauthorized ingredient, chloride of mercury, into their explosive, that they would not put in any ingredient that would have the effect of masking the Government test, and that they would strictly observe the terms of the licence under which they were allowed to manufacture. That had been his object from the first, and with that he would have been contented months ago. Messrs. Kynoch chose to fight the case before the law, but had now consented to accept the decision of the Court, pay their costs, and pay their penalties, giving an undertaking that the offence should not be repeated. Messrs. Kynoch, though perhaps late in the day, had acted in a proper spirit. He had been made the target of uncomplimentary remarks from gentlemen connected with the firm, but to that he was indifferent. He had given the House the terms of agreement, and he challenged any hon. member to say what more he could have done in the public interest and for the maintenance of the law.

ELECTRIC BLASTING APPARATUS AND EXPLOSIVES.

The above is the title of a book under the authorship of Mr. Wm. Maurice, and published at the *Electrician* Office, Salisbury Court, Fleet Street, price 8s. 6d. It is specially characterised by the wealth of information which the author imparts concerning the apparatus and materials used in coal mining, and lucidity of his explanations. The illustrations are numerous, and appear wherever needed. Whilst explosives are dealt with, they take the secondary position in the book which the title indicates, but as the practical use of explosives is more concerned with the proper manipulation of the sundry apparatus for preparing shots and firing them than with the theory of the explosives employed, the book amply and well fulfils its purpose.

APPLICATIONS FOR PATENTS.

JUNE 17—JULY 13, 1907.

13,924. Shoulder Shooting Shoe. R. B. Townshend.
13,935.* Ordnance. Fried. Krupp, A.-G. (German application October 15, 1906).
14,095.* Guns. Compagnie de Fives-Lille (French application, June 26, 1906).
14,354. Trigger Mechanism for Automatic Firearms. E. J. Leeding.
14,366. Explosive Compositions. H. W. Lake.
14,373. Bolt Action Rifles. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
14,427.* Ammunition Waggons. Fried Krupp, A.-G. (German application, October 19, 1906).
14,447. Guns. J. Lucking.
14,669. Time Fuses. Z. Michaelides and G. H. Parker.
14,718. Ordnance Sighting Gear. Sir W. G. Armstrong, Whitworth & Co., Ld., and C. H. Murray.
14,763.* Ordnance Projectiles. A. Cabella, R. Cabella and S. D. Cabella. (Italian application June 27, 1906).
14,854. Hydraulic Gear for Gun Turrets. Sir W. G. Armstrong, Whitworth & Co., Ld., and J. C. Stirzaker.
14,866. Target Holders. P. H. Wanner.
14,950. Fuses for Lyddite Shells. King's Norton Metal Co. Ld., T. A. Bayliss and E. Whitworth.
15,007. Signalling Targets. B. R. Clarke.
15,014. Firing Mechanism of Breech-loading Guns. A. T. Dawson and G. T. Buckham.
15,112.* Fluid Pressure Brakes for Barrel Recoil Ordnance. Fried. Krupp, A.-G. (German application October 12, 1906).
15,200. Split Image Range Finders. H. D. Taylor.
15,233. Ammunition Hoists. Sir W. G. Armstrong, Whitworth & Co., Ld., and J. C. Stirzaker.
15,234. Electrical Signalling Apparatus for Guns. A. T. Dawson and G. T. Buckham.
15,238.* Ordnance Adjusting Gear. N. Sjöquist. (Swedish application July 5, 1906).
15,286. Adjusters for Windgauge Slides. A. G. Parker.
15,319. Rifle Targets. C. Reid.
15,337.* Automatic Fuse Setters. Sir H. W. W. Barlow, Bart., W. Charlesworth and W. J. Griffiths.
15,372. Mountings for Ordnance. A. F. Petch and F. Duncan.
15,552.* Gun Cleaners. H. J. Haddan.
15,760.* Anchoring Barrel Recoil Ordnance. Fried Krupp, A.-G. (German application November 13, 1906).
15,772. Powderless Gun. M. Tartakowsky and C. Weiss.
15,811.* Sighting Telescopes for Small Arms. Optische Anstalt, C. P. Goerz, A.-G. (German application July 27, 1906).
15,884.* Shot Making and Apparatus Therefor. T. E. Reddy.
15,911. Rammers for Ordnance. A. F. Petch and F. Duncan.
15,917. Air-Guns and Sights. C. G. Bonehill and H. Horner.
16,080.* Projectiles. T. Tucker.
16,157. Explosive Compounds. A. T. Cocking and Kynoch, Ld.
16,173.* Indicating Periods of Time in the Flight of Projectiles. A. F. Petch, F. Duncan and O. C. F. King.

*These applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

JUNE 27—JULY 18, 1907.

COMPILED BY HENRY TARRANT.

13,108 (1906). **Breech Mechanism of Ordnance.** A. T. Dawson and G. T. Buckham, London. The improvements dealt with in this patent relate to breech mechanism of ordnance of the complete withdrawal class in which the breech screw is withdrawn by the action of a rack and pinion arrangement, as set out in Specification No. 5,765, 1901. Increased efficiency is obtained. Accepted June 6, 1907.

15,159 (1906). **Sighting Ordnance from a Central Station.** Siemans Bros. & Co., Ld., and F. Turner, London. In patents Nos. 8,362, 1902 and 13,567, 1906, motors and switches were dealt with through which big guns were automatically elevated or deflected from one station. The present arrangement provides for the co-operation of the switch and a scale through which the switch is merely adjusted to bring about certain movements of the gun. Accepted June 27, 1907.

15,837 (1906). **Liners of Projectiles.** R. A. Hadfield and A. G. Mck. Jack, Sheffield. To secure the liner in the interior of an armour piercing shell so as to prevent the passage of gases of combustion should the base fracture, the rear end of the liner is made to fit snugly in an annular recess on the outside of the prolonged portion of the inner part of the base plug. Accepted June 13, 1907.

16,266 (1906). **Training Ordnance.** A. F. Petch and R. Redpath, London. The improvements described in this patent relate to carriages for field artillery where the line of sight is independent of the gun. Apparatus is introduced whereby the training of the gun is facilitated. Accepted June 27, 1907.

17,547 (1906). **Sighting Apparatus for Ordnance.** A. T. Dawson and G. T. Buckham, London. Various improvements in the sighting apparatus described in patent No. 16,767, 1904, are dealt with in the present specification. The apparatus is worked by means of a rack and pinion, the elevation being indicated by a graduated dial and a pointer. The modifications relate mainly to this dial and to the means for adjusting the sight to compensate variations such as diminution of velocity. Accepted June 13, 1907.

17,844 (1906). **Range Keeper.** A. T. Dawson and G. T. Buckham, London. In patent No. 9,461, 1904, a range keeper is described. The variations in range were, by this apparatus shown only, and a man had to make corresponding alterations in the adjustment of the gun. The present invention provides for the direct transmission from range keeper to gun and the manual labour is thus eliminated. Accepted June 27, 1907.

19,240 (1906). **Breech Mechanism of Ordnance.** Sir W. G. Armstrong, Whitworth & Co., Ld., and C. H. Murray, Newcastle-on-Tyne. In order to prevent rebound of the breech due to the action of air compressed between the block and the powder charge when closing the gun, a device is provided which co-operates with the block during the closing movement and is withdrawn on opening the block. Accepted June 27, 1907.

21,462 (1906). **Stereoscopic Telemeter.** C. von Hofe, Germany. To prevent derangement of stereoscopic range finders through accidental alteration of the position of one movable part of the telescope the measuring marks are transferred so that only the parts lying behind them are movable. Accepted June 27, 1907.

24,305 (1906). **Manufacture of Shell Bodies.** J. W. Spencer, Newcastle-on-Tyne, and C. Finch-Hatton, London. In patent No. 3,119, 1891, is described a method of producing a shell body from a piece of steel or iron the cross section of which is the same as the diameter of the hollow cylinder to be produced. The improvements dealt with in the present patent consist of a method of first forming the base, and then reheating and simultaneously punching and shaping the shell. Accepted June 20, 1907.

26,611 (1906). **Attaching Pistols to Umbrellas or Sticks.** H. Renfors, Finland. A device consisting of two clips rigidly attached to each other, one of which is adapted to receive the stock of a pistol and the other the walking stick. The pistol may be aligned without interference from the clips. Accepted June 13, 1907.

27,200 (1906). **Target Apparatus.** E. W. Chant, Shrewton. A series of targets are arranged on the ends of arms attached to a hub. The target arms are at right angles one with the other and when one is exposed by turning the whole arrangement the rest are under cover. The apparatus is locked in each of its various positions, and may if necessary be operated from the firing point. Accepted June 27, 1907.

791 (1907). **Elimination of Muzzle Flames.** C. Dullenhoffer, Germany. (*See Selected Patents*).

1,601 (1907). **Automatic Pistol Mechanism.** F. T. Murray and J. Carter, Birmingham. (*See Selected Patents*).

4,747 (1907). **Blasting Cartridges for Use under Water.** P. Selbach, Germany. (*See Selected Patents*).

7,508 (1907). **Safety Percussion Fuse Mechanism.** C. G. Bastrup and J. H. Mentz, Denmark. Percussion fuses of the type which contain locking bodies having a passage for the flame from the cap to the main charge are dealt with in this patent. Springs are not used and the striker is locked by a pin which is withdrawn when the projectile is projected. Centrifugal force does not move the striker which is impelled forward only when the rotary movement ceases. Accepted June 27, 1907.

8,156 (1907). **A New High Explosive.** O. F. von Schroetter, Upper Silesia. (*See Selected Patents*).

8,157 (1907). **Detonating Wet Guncotton.** O. F. von Schroetter, Upper Silesia. The inventor claims that wet guncotton can be detonated with certainty and more advantageously than by means of dry guncotton by nitro-compounds of the aromatic series, for instance by trinitrophenol, trinitrobenzene, or trinitroaniline. Substances of this kind are said to convey the detonation from the cap to the wet charge of guncotton with enhanced effect as well as with certainty. Accepted June 27, 1907.

11,053 (1907). **Improvements in Case Fuses for Projectiles.** Sir A. W. W. Barlow and W. Charlesworth. (*This Patent Specification is a Secret Document*).

SELECTED PATENTS.

ELIMINATION OF MUZZLE FLAMES.

791 (1907). C. Dullenhoffer, Germany. In Patent No. 24,782, 1904, a process is described whereby it is intended to prevent muzzle flames where gunpowders of the nitrocellulose and nitroglycerine type are used.

Small portions of indifferent substances in combination such as vaseline, and small amounts of alkali bicarbonate were used. The patentee has discovered that flames may not only be prevented by the above combination but also by the addition solely of soaps. This addition is claimed to have certain advantages as compared with others. Soda, potash, lime or magnesia soaps or so-called soaps such as colophonic soda, baryta, or argillaceous earth may be used. The keeping quality of the powder is said to be improved when either of these soaps is added, and its efficiency is not prejudicially affected in any way.

As an example 5 per cent of finely powdered soda soap is claimed to prevent muzzle flames as certainly as 5 per cent of vaseline and 1 per cent of bicarbonate of soda, whilst the ballistic power of the powder containing soap is higher than that having the combination mentioned as constituents. Accepted June 6, 1907.

A NEW HIGH EXPLOSIVE.

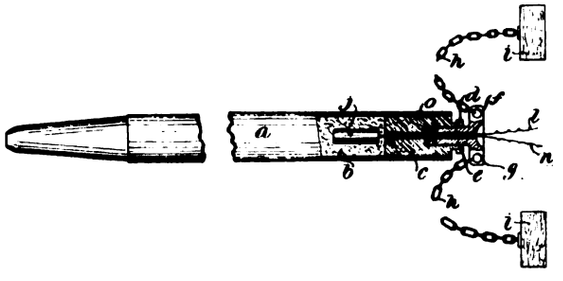
8,156. (1907). O. F. von Schroetter, Upper Silesia. Hexanitrodiphenylamine, also called diparapicrylamine is known in the form of its ammonium salt as a dyestuff under the name of Aurantia.

The inventor's researches on the use of polynitro-derivatives of the aromatic series for the manufacture of explosives have shown him that hexanitrodiphenylamine may be advantageously used as a high explosive best in the compressed condition. This compound is said to have the advantage over picric acid because it contains a larger proportion of nitrogen, and its action is claimed to exceed that of trinitrophenol or trinitrotoluene. It is stable when stored and free from danger in handling. It is detonated by fulminate of mercury and its melting point may be lowered and its sensitiveness and explosive action adjusted by the addition of a suitable admixture such as a nitrohydrocarbon of lower melting point. Accepted June 20, 1907.

SUBMARINE BLASTING CARTRIDGE.

4,747 (1907). P. Selbach, Germany. The blasting cartridge dealt with in this specification is specially designed for use in blasting operations under water. The explosive is contained in a metallic case the open end of which is closed by screwing in a plug. Through the centre of the plug the conducting wires run to the detonator. The plug is provided with chains so that should water get at the explosive or from other cause render it necessary to withdraw the cartridge from the bore hole this operation can easily be performed by means of the chains. Floats are attached to the free ends of the chains. The disappearance of these indicates that the cartridge has been exploded.

In the drawing appended the metallic tube *a* is shown to contain the charge of explosive *b*. The top of the tube is screw-threaded inside and is adapted to take the screw plug *c*. The explosive can be compressed by means of this plug to give better detonation, the plug being screwed down by the action of a spanner on its hexagonal head *d*.



The gland *e* screws into the plug and is provided with eyes *f* and *g* adapted to carry the chains *h*. The floats *i* are attached to the free ends of the chains and form an indication as to whether the cartridge has been fired or not. The chains are used to withdraw the cartridge should it be necessary. The detonator *j* is attached to the two conducting wires *l* and *n* which pass up through the hole in the plug through the stuffing box *o* and the gland *e*. Accepted June 13, 1907.

AUTOMATIC PISTOL MECHANISM.

1,601 (1907). F. T. Murray and J. Carter, Birmingham. The arrangement of automatic pistol components set out in this specification is intended mainly to obviate the use of a spring or flexible trigger guard for locking the detachable, but non-reciprocating, barrel to the frame. The objection to spring guards is that owing to their substantial construction considerable force has to be used to remove them from the locking engagement and an implement has often to be employed to lever them out of their fastenings. The patentees not only provide a simple barrel locking construction but also arrange that when the barrel is released by disengaging the lock imposed by the trigger guard the trigger is automatically prevented from releasing the sear.

Fig. 1

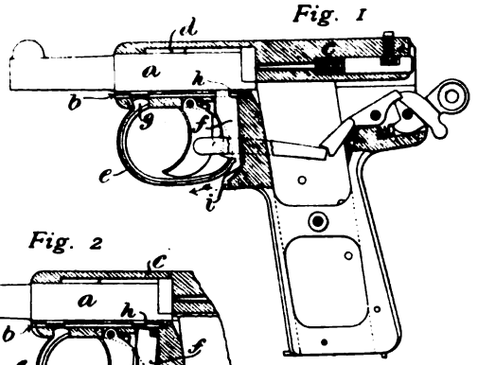
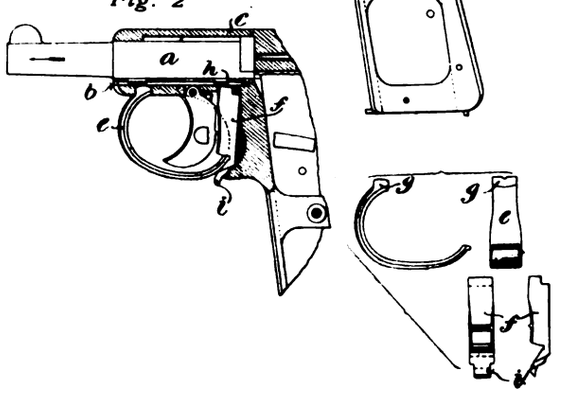


Fig. 2



The invention is illustrated in the drawings we here reproduce, and it will be seen that the barrel *a* has a flange on its under side which slides in the slot *b* made for it in the top of the forward platform portion of the pistol frame. The barrel does not reciprocate when recoil operates the parts for ejecting the spent cartridge and inserting a fresh one, but the breech block *c* does. The forward sleeve portion *d* of the breech block practically surrounds the barrel and the two are so arranged that the barrel must be removed from the pistol together with the block before the latter can be detached.

The locking of the barrel in position on the frame is accomplished through the trigger guard *e* and the bolt *f*. The forward end of the guard is fulcrumed or pivoted at *g* so that it may be swung downwardly. Its rearward end engages the vertical bolt *f* the nose at the top of which enters a recess *h* in the underside of the barrel and holds it securely in the firing position.

When the trigger guard is pulled downwards and rotated on its pivot, the nose of the locking bolt *f* is also drawn out of engagement with the recess *h* in barrel which may then be removed by sliding it through the groove *b*. The breech block is carried with it by a system of stops and may be disengaged from the barrel by bringing certain gaps into register with ribs.

The upright bolt *f* carries the spring tongue *g* which keeps the trigger guard and bolt in position. When the guard is drawn downwards as shown in Fig. 2 the bolt *f* is carried up against the back of the trigger. The trigger cannot in this position be pulled to allow of the discharge of a cartridge which may happen to be in the unlocked barrel.

The barrel locking device can be utilized as a buffer to take up the energy of the returning breech block by providing its top portion with a spring and allowing the bolt to have a certain amount of play in its slot. Accepted June 20, 1907.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Shooting Season.—To satisfy the farmer, all the twelve months of the year must comply with the necessary conditions, and he is accordingly hard to please. The shooter limits his demands for fair weather to the one solitary period of the year when the old birds are laying their eggs and bringing up their young. How often he is disappointed is but another evidence of the fickleness of our climate. The warm dry spring which this year promised to develop in due course into an agreable summer gave place to the most distressing conditions of cold and damp. The young partridges which had in so many quarters hatched off successfully were unable to survive the harsh conditions, and reports are coming in from all parts of the country to the effect that partridges have done very badly. The grouse reports from the north contain many cheering references, but the partridge is essentially the stand-by of the shooter, and a bad partridge season means loss of business to all who cater for the sportsman's requirements. The pheasant is always with us, and the natural difficulties of the climate are to a large extent compensated under the artificial conditions of rearing which prevail. The partridge must shift for himself in a large measure, and together with the rabbit he has suffered severely under the exceptional weather conditions which have prevailed. Although the general consensus of opinion is unfavourable, the lateness of the harvest has necessarily curtailed the opportunities for observation, and this leaves open the slender hope that when the ground is free from crops better prospects will be in evidence. There is also the possibility that as the season advances many of the birds of the second hatching will fill some of the blanks which are now apparent. Nothing can, however, at this late stage compensate for the many losses which are so self-evident in the numbers of barren birds which are everywhere to be seen.

The Patents Bill.—The two Patents Bills before Parliament have now been passed. The one consolidates the existing patent legislation, the other introduces new procedure likely to have wide-reaching effects. The consolidation Bill would have lost a part of its purpose by existing side by side with an amending Bill; and the House of Lords amendments have accordingly incorporated the new with the old, so that one Act of Parliament will contain the whole of the law of patents and designs. The essential feature of the new law is that if, after four years, a patented article or process is exclusively or mainly manufactured or carried on abroad, it is open to any person to apply to the comptroller for its revocation. The clause applies to existing patents, but in such instances twelve months grace dating from the passing of the Act is allowed. The Bill if passed will become law on January 1st next; consequently the owners of patented articles made abroad have no time to waste if they desire to protect their patents by making arrangements for manufacture in this country. There are many articles enjoying a large sale which are protected by the monopoly constituted by a secure patent, and the engineering industry should benefit by the equipment of the factories which will be required for their production in this country. Any increase in the class of employment represented by the manufacture of goods of a single stereotyped pattern will go far to help

all the trades which depend on a supply of semi-skilled artizan labour. The difficulties which arise from an altered demand for the output of the large rifle and cartridge factories will be lessened by an extension of the area of employment. With this increased area of employment there should be a greater reserve of surplus labour to call upon when orders are plentiful. In fact this country needs a better organised and more extensive department of repetition manufacture, and there can be little doubt that the new Patent legislation will work in that direction. Our manufacturers will doubtless receive in the future more offers than in the past to take over the British production of successful contrivances patented by foreigners. Whilst the British patent rights were secure without British manufacture there was no special inducement to decentralize the output; but in future the inducement will exist, and the granting of British rights of manufacture should include the right to sell in the markets most easily dealt with from such an important centre of distribution as Great Britain. There will of course be many instances where patents will be allowed to lapse in reliance on the kind of monopoly which established manufacture grants; but the various trade associations will doubtless take care that the position is well defined in regard to all goods into whose commercial success patent monopoly enters. If the new Patent Bill exercises anything approaching the influence on manufacture which many anticipate, a manufacturing boom may result. Commercial success is not entirely assured by the existence of a sound patent, as may be seen by the many unpatented articles which sell in large quantities by sheer merit. The loss will be great if a tide of Company promotion sets in, by which schemes are developed in connection with every patented contrivance not now manufactured in Great Britain. The new Bill is undoubtedly a move in the right direction; and one may trust that no disappointment is in store for those who hope great things of it.

The Chief Inspector of Small Arms.—The fact that Col. J. D. Hopton has accompanied the British rifle team to Canada, which is but a stopping place in the longer journey to Australia, confirms the regrettable report that not only does his term of service as chief inspector of small arms come to an end but also that the army will no longer enjoy the advantage of his distinguished services. Always a man whose opinion carried great weight he rose to influence at a time when the problems connected with the soldier's rifle had been sadly neglected. The peculiar kind of insight which alone comes from familiarity with the problems of marksmanship was distinctly his, and he brought to his work an enthusiasm for the purely shooting aspects of the soldier's duties which has produced widespread and probably permanent results. His connection with the School of Musketry at Hythe, and his more recent work at Enfield have been well combined with an intimate connection with the operations of the National Rifle Association. Wherever he has gone he has infused the right spirit amongst those who worked with him and were eager to give effect to his policy. The Army Rifle Association owes a great deal to his inspiring efforts, and his own career as a marksman has done much to interest the officers of the regular army in the pursuit of marksmanship as a hobby. He has in fact done more than any single individual to raise rifle shooting to a higher level in the estimation of army officers than mere drudgery of drill. The unfortunate traditions and rules of the service prevent the further employment of one who is still in his prime, but to whom no higher post can be offered. His work will live after him; but as there is still much to be done it may be hoped that the kind of service he renders so well can be utilized after his retirement. The National Rifle Association will afford continued scope for his efforts on behalf of rifle shooting, but in addition means should be found for reserving for the more direct benefit of the services the unexampled experience he has gained.

Misappropriation of Government Ammunition.—The court-martial proceedings which were taken at Portsmouth against two colour-serjeants of the regular army in connection with the sale of government ammunition call attention to the difficulty of properly checking the return of fired cartridges and thereby lessening the waste due to petty pilfering. At Bisley where ammunition is granted free by the War Office for use on the ranges, the large staff of attendants on the range, who are there to take the scores and generally supervise the shooting, is incapable of preventing a large shortage between the live cartridges issued and the empty cases returned to the store. Volunteer units are similarly troubled by the difficulty of keeping the proportion of unaccountables within the percentage margin laid down. In defending the charge of misappropriating government ammunition in the above proceedings it was stated that large quantities of unfired cartridges could be picked up on ranges where rifle practice had been proceeding. One can understand this being true of fired cases, which from the scrap metal hunter's point of view, are a legitimate harvest; but it seems less credible to suppose that any large quantity of unfired cartridges can be left lying about except in the form of the familiar packages bearing the government marks. The popularity of conducting rifle practice under field conditions of firing necessarily increases the risk of waste, for the open country between the firing point and the butts would be more difficult to search for dropped cartridges than the better defined area of the regular firing point. South African war experiences must not be forgotten in this connection. The soldier throws himself down behind cover and places ready to hand on the ground beside him a neat pile of cartridges. These may or may not be forgotten when the time comes for the next advance, and the Boers are credited with having replenished their exhausted supplies by carefully going over the ground where the Britishers lay. One might almost deduce from the Portsmouth court-martial that cartridge pilfering would be better dealt with by introducing a proper system of clip loading than by taking proceedings against those who help themselves to what they find lying on the ground. It is reported from time to time that the War Office have adopted a design of clip or charger which answers the required purpose; but the rim on the cartridge operates against successful working. One hears of these new designs, but brown paper and string continue to remain the adopted form of clip.

THE CHAMBER OF COMMERCE REPORT.

If it were not for the injurious effects of any document tending to prove that an industry is on the down grade, the report of the gun section Committee on the condition of the trade in fire-arms could be accepted with thanks and approval. The document which has been submitted is more a collection of statistics than a report, an omission which is to some extent admitted and excused by the statement that recommendations having for object the improvement of business will not be framed until the substance of the present report has been digested. Even so it seems a pity that more has not been done by the experts on the Committee to interpret the statistics which have so laboriously been compiled. The proof statistics are already well known, but mere quantities give but little indication of the nationality of the arms proved in Birmingham, their general classification as regards quality and price, and the proportion represented by the department of output it is most desirable to see increased. The tables of exports to different countries are of particular interest, because they show in parallel columns the total quantity and the total value of the arms delivered. Over a number of years the average price per arm varies but little for each country. To European and other civilized countries the average price is very high running as a rule from £5 to £30 per weapon exported. The following table shows an interesting series of figures which have been built up from the more detailed results shown in the original table.

Total Exports to Foreign Countries during the five years 1901–5 *from the United Kingdom of Small Arms other than Revolvers.*

To	Number of Arms.	Total Value.	Average per Arm.
		£	£
Austria Hungary ..	250	7,659	30
France	2,300	52,693	23
Spain	435	8,765	20
Russia	974	13,604	14
United States	2,167	27,754	13
Argentine Republic ..	810	7,823	10
Italy	1,659	16,196	9
Belgium	1,347	11,469	8
China	738	5,488	7
Portuguese East Africa..	2,547	13,680	5
Germany	4,394	18,559	4
Egypt	6,515	20,688	3
Arabia	41,387	78,842	2
Brazil	16,011	20,412	1
Peru	28,958	32,020	1
Other Foreign Countries	98,726	106,291	1
Total	209,218	441,943	
Average per year.. ..	41,844	92,389	

In the official text no attempt has been made to extract average values, this being no doubt a part of the process of digestion to which the figures are intended to be subjected. Our own table makes it very obvious that civilized countries having a wealthy population come to England for their best guns. A high average price per arm is as a rule accompanied by modest annual sales. Where the monetary turnover is large the average price per weapon is low. The inference seems obvious. This country is well organised for the manufacture of high class guns and rifles. The demand is limited; greater energy might increase the sales, but the possible expansion cannot be great. As regards the cheaper classes of hand-made weapon Belgium is known to be better organised than ourselves; therefore to forward this branch of enterprise it is necessary to improve the conditions of production in every way possible, so that the English standard of work may be rendered available at lower prices than hitherto. Where the limit has already been reached as regards the cheapening of hand labour, machinery must be brought into play; but this involves a totally different problem, viz., the selection and design of suitable models, and the courage to lay out capital in anticipation of large sales. The two methods of production are so different as to involve a change of personnel as well as of plant, and yet both are included in the general term gunmaking. The problem of finding work for the large class who are skilled in the art of gunmaking is quite different from the other and equally important problem of devising attractive models for the machinist to reproduce in endless repetition. Yet the one merges into the other, and the many prints of contact suggest that each individual manufacturer must amend and organise according to the particular conditions of his own markets.

It is generally shown by statistics of trade that increased orders from the British dependencies balance any loss of business that may occur with foreign countries.

Total Exports to British Colonies during the five years 1901–5 *from the United Kingdom of Small Arms other than Revolvers.*

To	Number of Arms.	Total Value.	Average per Arm.
		£	£
Bombay	5,150	54,156	11
Burmah	1,204	7,802	7
New South Wales ..	19,437	72,046	7
British East Africa ..	5,697	25,846	5
Aden	2,119	9,994	5
Madras	1,471	7,450	5
Bengal	13,043	67,341	5
Cape Colony	24,824	101,588	4
Natal	16,611	67,679	4
Straits Settlements ..	6,955	23,321	4
West Australia	5,049	18,521	4
South Australia	5,086	19.385	4
Queensland	7,250	28,878	4
Tasmania..	3,516	13,863	4
New Zealand	32,412	121,524	4
Victoria	30,035	97,837	3
Ceylon	8.017	18,130	2
Canada	11,806	27,826	2
British Guiana	3,959	8,109	2
British West Africa ..	45,823	41,943	1
Other Possessions ..	11,150	28,091	2
Total	260,514	861,330	

The trade with the British possessions is just double that with foreign countries, and the column of average value per arm shows that the class of trade involved is worth every attention. The colonial demand for firearms represents a valuable mean between the very expensive guns which are in small demand and the trade in African guns which denotes savages for customers. When the total trade with a country works out in the region of five pounds per weapon, the consumption must largely include double barrel fire-arms of the class which our manufacturers are so well equipped for supplying. The improvement and development of such a trade does not involve radical alterations in the methods of business. What is wanted is a systematic extention of the various means for bringing the manufacturer and consumer into touch with one another, and a careful study by the former of the needs of the latter. The systematic standardization of models with a view to their cheaper production will afford the most practical means of extending what on paper appears a steady and renumerative business.

The terms of reference to the special committee which is responsible for the important report now under review were to ascertain if the trade is in an advancing, stationary or declining condition, and if stationary or declining to inquire into the reason for the same, and to consider what steps can be taken to improve these conditions. The second part of the programme has been shelved pending a decision as to the interpretation which may be placed on the collected statistics. As the bulk of the figures relate only to the five years ending 1905 it may at once be concluded that the period is too short for any general trend to be observable, bearing in mind the large fluctuations which are shown, and the disturbing influences of the South African war. The following table of exports by the United Kingdom, Belgium and the United States will illustrate the difficulty of arriving at definite conclusions with regard to figures which cover so short a period as five years :–

	1901	1902	1903	1904	1905
	£	£	£	£	£
United Kingdom (not including revolvers) ..	308,706	208,908	267,940	293,720	223,999
Belgium (1901–2 returns including revolvers)	682,398	436,961	467,773	600,192	632,426
United States (all firearms) ..	191,665	187,416	200,482	304,079	279,824

The Belgium records show a most valuable increase of trade on the last of the three years which are uncomplicated by the presence of the revolver and pistol totals. The United States shows a tendency towards increasing values, but the nearly stationary totals for the first three years require some elucidation. An examination of the details which are given for individual countries suggests that the general trend of the American arms trade is decidedly upward, but that aggregate values are apt to be disturbed by large contracts with countries buying military arms. The totals for the United Kingdom on the other hand show considerable fluctuations in the aggregate values without any conspicuous variations in the records of the individual countries. It seems more as though the variations which occur are the result of natural ups and downs of trade activity than of causes from which deductions can be drawn. The markets are so scattered and so subject to political conditions that no broad conclusions can be drawn, other than that the trade returns do not show the steady upward tendency that should follow from the known increase of the areas being brought under conditions of civilization. An unruly warlike country is a good customer for arms intended for military use. There then follows a period of supervision during which the trade in arms is checked in the interests of civilization. The subsequent development of trade in better class weapons for sport and personal protection is not rapid, and a long period of apparent stagnation intervenes. It is in the direction of trade in sporting weapons that one must look for the future prosperity of the gun trade, and it is here where the enterprise of individual manufacturers may be expected to show an increase of legitimate business.

How difficult it is to extract really definite information from trade statistics is well known by comparing two tables in which the exports from the United States to this country are separately shown. The exports of fire-arms from the United States to the United Kingdom are given as follows in one table :—

1901	1902	1903	1904	1905
£19,568	£17,695	£20,453	£16,439	£18,134

The imports of small arms into the United Kingdom from various countries are given in another table, and the following are the figures for our importations from the United States in the same years :—

1901	1902	1903	1904	1905
£18,552	£11,112	£14,703	£10,832	£12,024

Experts in such matters will no doubt be able to supply suitable explanations for such apparent contradictions. No one should be better able to explain them than those who have had the patience and skill to compile the present report. The present article is but the barest attempt to draw a few general conclusions from the mass of figures made available. We give the following quotation from the written portion of the report, and although all the observations are most interesting one may still hope that when the figures have been further studied and digested additional comments and conclusions will be published in the form of a supplementary report :—

EXPORTS.—The total value of the exports of firearms, gunpowder, cartridges and caps, from the United Kingdom were, in 1901, £844,249, and in 1905, £726,510 a decline of £117,739, or a contraction of 14 per cent., or taking guns, rifles and revolvers, £315,709 to £239,796, a reduction of £75,913.

That the home trade has declined as well as the export trade, is shown by the Birmingham Proofs, the gun licences, and the admitted decrease of the London Proofs, and although this may be fairly attributed to the monetary exhaustion and heavy taxation due to the Boer War, and

the counter attraction of motoring and golf for the wealthy classes, some other explanation must be found to account for the decrease in our foreign trade in fire-arms, so out of harmony with the expansion of the total trade of the country.

With regard to the exports of arms to British possessions compared to foreign countries, these have aggregated during the period 1901—1905, to British Possessions £895,153, and to foreign countries £445,009. The fall in the exports of arms to British Possessions has been £90,303, from £230,953 to £149,650.

The United States exports during the period 1901—1905 show on the whole only a small increase of $440,796, and is $104,795 below the 1900 figures, but the enormous increase in their own population and home requirements must not be forgotten, and the increase of their exports of arms to Canada alone rose from $93,711 to $316,291, The value of the exports of arms to Canada in 1905 being, from United States, £63,258, United Kingdom, £4,499, Belgium, £6,763.

The Belgian exports of arms show on the whole a decrease of 1,249,303 francs, or £49,972, although the number of proofs were greater than ever. If we assume the home consumption not to have increased, this shows a reduction in value per piece, which is presumably a cheapening of production.

The German exports, more than two-thirds of which consist of military Mauser rifles, appear in our tables for the three years 1903–5 only, and if the figures for the two years 1901–2 could be added it would be found that Germany has nearly if not quite equalled Belgium both in money value and in the employment given to the industrial classes. This result will not surprise those who are aware that in the course of twelve years seven million Mauser rifles were manufactured in Germany for their own as well as for many foreign governments.

A result partly due to the intrinsic merits of the weapon, to which the labours of a Government commission materially contributed, and partly to the policy of the German Imperial Government, which looks upon the manufacture of fire-arms as a national industry, and in many instances has diplomatically assisted in obtaining orders from foreign governments for their own manufacturers.

In Belgium, also, the manufacture of fire-arms is looked upon as a national interest by the Government, and a large contract for military arms would have had to be refused in Liége a few years ago but for special facilities allowed to the manufacturers by the Government. A member of your Committee, who has recently visited Liége, reports that he inspected a factory containing over 300 machine tools driven by a 500 h.-p. engine, entirely devoted to the production of barrel tubes for guns and rifles, of which the weekly output exceeded 20,000, or over 1,000,000 in a year. Such an organization forms a backbone for a world-wide trade, and owing to the lower rate of wages it is doubtful if for actual cheapness of cost of production it can ever be equalled in this country. As shown in table B7 exports, the United States is the largest foreign purchaser of Belgian arms. The total exports of fire-arms from the principal countries for the years 1901–5 give the following results :—

Belgium	£2,819,751
United Kingdom	£1,345,162
United States	£1,163,466
Germany (three years only)..	£1,909,550

IMPORTS.—Our tables only include the United Kingdom and the United States, for which they show the total imports of fire-arms, but from the export tables we are able to compile the following figures of the principal imports of fire-arms for the five years 1901–5, from the United Kingdom, United States and Belgium only, for the following countries :—

	United Kingdom.	United States.	Belgium.	Total in 5 years.
	£	£	£	£
United Kingdom	—	92,289	189,584	346,908
United States ..	27,754	—	495,583	809,203
Germany ..	18,555	86,737	343,500	448,792
France	53,093	35,262	420,340	508,695
Russia	13,604	8,241	196,649	218,494
India	200,652	8,715	(not given)	209,367
Australia and New Zealand	372,054	139,129	470,802	988,171
Africa	242,271	(not given)	68,368	310,639

From these results it will be seen that the largest importer of fire-arms for which we can give the figures, during the five years 1901–5, has been : Australia, first ; United States, second ; and France and Germany, third and fourth.

The report is signed by the following gentlemen :— Edgar Harrison, *Chairman of the Section*, (Cogswell & Harrison, Ld.), M. Pulvermann (Martin Pulvermann & Co.), H. J. Blanch (J. Blanch & Son), S. R. Hollick (C. Osborne & Co.), H. A. A. Thorn (Charles Lancaster).

The sincerest thanks of the trade are due to them for their public spirited efforts, and the least that the general body of gunmakers can do to show appreciation of the same is to send a shilling to the London Chamber of Commerce for a copy of the report and to make a point of carefully scrutinizing its contents. Orders should be addressed to the Society's offices at Oxford Court, Cannon Street, London, E.C.

REVIEWS.

Balistique Extérieure Rationnelle. Problèmes balistiques secondaires. By Le Commandant Charbonnier. Published by Octave Doin, Paris. 400 *pages with* 161 *figures. Price* 5 *francs.*

This is a companion volume to that noticed in our issue of May. The latter dealt with the principal ballistic problem which in the words of the author relates " to the study of the movement of a heavy body, in a resisting medium at rest and of constant density, which opposes a tangential resistance to its movement. It is supposed that the earth is plane and motionless and gravity constant in direction and intensity." The second volume now under review, discusses the secondary problems, viz., the effect on the general equations established in the previous volume, by the various elements known to act on a projectile in its movement through the air. These are :—The spheroidity and movement of the earth. The variation of the force of

gravity both in direction and intensity at different points of the earth's surface, the variation of the resistance of the air due to altitude and its general movement, i.e., wind, and lastly drift. This volume on secondary problems is therefore less academic but of greater interest than its precursor. The subject is necessarily mathematical, but the thoroughness of *M.* Charbonnier's treatment will recommend its study to all readers of Exterior Ballistics.

Subject List of Works on Military and Naval Arts, including Marine Engineering in the Library of the Patent Office. Published at the Patent Office, London. Price 6d.

The Patent Office library must be recognised by all who have examined its well-stocked shelves as the finest collection of technical works, both in text-book and serial form in the world. No public department here or abroad could pursue technical literature wheresoever it may appear with more avidity and skill than the officials of the Patent Office library. There are doubtless other libraries particularly in America where the same zest is shown for collating technical material, but our Patent Office has a long start, and it accords to the reader the inestimable benefit of unrestricted access to the shelves. It is, therefore, in the nature of an epoch marking event that a catalogue should have been issued covering a subject list of the works on Military and Naval arts to be found in the library. The list comprises 2,432 works which are made up of 111 serials and 2,321 text books, etc., and as these are spread over some 4,708 volumes, some idea can be gained of the value of the task which has been accomplished. What makes the catalogue of all the greater value is that in placing a work under a given heading the contents of the work have been regarded in preference to the language of the title page, which is often misleading. The catalogue thus aims at facilitating research on any given subject rather than of serving as a means of tracing a work by its title. The latter task must as in the past be performed by consulting the general catalogue of the library. Under various headings, the several works have been specified in chronological order, the idea being to facilitate research upon questions of novelty or historic interest. Key numbers are provided for locating the position of each book in the library itself. Some of the lists of books are of particular interest to the student of explosives. Under Ballistics, although Robins occupies the accepted premier position as the first writer on the subject it is interesting to notice that his work of 1742 is preceded by three others dated respectively 1537, 1644 and 1685. Nearly eight pages are devoted to a catalogue of the works under the various sub-headings which fall within the general term ballistics, showing at any rate that the history of this interesting subject is very considerable. The explosives and portable fire-arms sections of the work are also very precisely laid out. Dictionaries of the literature of guns and explosives may be more complete, but the surpassing merit of this sixpenny handbook is that the volumes it details are all accessible to the reader in the Patent Office library. The only unindexed and unclassified literature now remaining, are the important contributions which appear from time to time in the technical press. Perhaps in the future these also may be indexed.

THE SPORTING GOODS LOADING CARD.

Our contemporary the *Sporting Goods Review* has once more issued the annual loading card which is now so well established as a seasonable indication that shooting has begun. When this card was first issued the gunmaker was perplexed with demands to stock and load a multiplicity of nitro powders having different characteristics and needing special treatment of one kind and another. The new comers received as a rule a cold reception for the simple reason that they added a fresh complication to business without adding to its profits. The loading card removed most of these difficulties, and showed that a new nitro powder need not be regarded as an evil to be quashed. As time went on the loading card proved to exercise another function. It afforded a daily object lesson of needless variations of load and treatment having no visible justification. Powders of the same kind were in due course classified under the same heading, and the more obvious differences of charges and waddings began to disappear. For a time it may have looked as though the loading card was automatically harmonising powders, to an extent which seemed to put a period to the continued need for its publication. But so far from this being the case the latest edition of the loading card has more than ever justified its existence. Whilst loads and waddings have become simplified, the number and variety of the charges specified have increased in due proportion. In a word the disappearance of unnecessary variations has made room for the introduction of fresh combinations which had not before received attention, and one may hope that future editions of the card will mark further extensions of the list of loads.

The typographical arrangement of the new card is worthy of a passing mention, as a sweeping change has been made in the method of presenting the recommended loads. In the past the whole contents of the cartridge were specified in the order of their insertion into the case beginning with the powder and running through the series of three wads between powder and shot, and finally the over-shot wad. This caused an inconvenient separation of the two main elements of the charge, viz. the powder and the shot, and the eye found a certain amount of difficulty in picking out the related items in closely packed columns of figures. The necessity for specially naming the card wads has now disappeared, since everyone recognises the two twelfth-inch cards on either side of the felt, and the over-shot wad measuring one-sixteenth of an inch thick, or thereabouts. The only items thus left to be specified are the powder, the shot and the thickness of the felt wad. These have been expressed in the following form :—42—1⅛—⅜, the result being that each powder can be dealt with in a column one inch wide, instead of several times that width, as before. The effect has been to condense the whole of the powders specified under the respective headings—33 grain powders, 42 grain powders and unclassified powders—into a compact form which will doubtless be highly appreciated by the loader. Copies of the card can be obtained, mounted, price 9d. each, and unmounted at 4d. in both instances post free.

ROUND THE TRADE.

The next sale of guns at Messrs. Debenham's has been fixed to take place on the 13th inst.

The directors of the Roburite Explosives Co., Ld., have declared an interim dividend on the preference shares at the rate of 10 per cent. per annum for the six months ended the 30th of June.

The Cotton Powder Co., Ld., have forwarded to this office a pamphlet dealing with Mr. F. Marten Hale's patent improved hand shrapnel grenade, which is a contact exploding bomb fitted with a rope tail piece which is used in the first place as a sling for its projection by hand, and afterwards acts as do the feathers of an arrow to give it an end on flight. The Japanese war showed the effectiveness of these instruments at close quarters in attacks on trenches and earthworks; and special attention has as a consequence been devoted to the production of a design capable of performing the required work in the most effective possible manner.

Messrs. Eley Bros.' new catalogue opens with illustrations of four new cartridges which are to be sold on a price maintenance basis, the "Zenith" at 10s. 6d., the "Aquoid" at 11s., the "Acme" at 8s. 9d. and the "Ecar" at 8s. These prices compare favourably with the net cost to the gunmaker who is thus assured a living profit. Great improvements have been made in the method of displaying the large variety of rifle and pistol cartridges which the Company make. In the previous edition the particulars of charge and load were separately tabulated, and the illustrations appeared on an adjoining page. Now, the view of the cartridge is given beside the details of load and price, and facility of reference is greatly enhanced. Amongst the new rifle cartridges is the Eley "Midrange" for the service rifle with a 200 grain metal base bullet, also the Ross-Eley cartridges which should enjoy a great future for deer-stalking purposes. It is ·280 bore, and carries alternative bullets weighing 140 and 160 grains respectively. The muzzle velocity stands at the phenomenal level of 3,000 f.-s. and according to a recent *Field* notice, all shots taken inside a 300-yards range may be fired without altering the elevation of the sights. The catalogue is neatly bound in limp cloth, and reflects great credit on the Eley printing department which has been responsible for its production.

According to the *Times* a petition has been filed in the United States Circuit Court at Wilmington, Del., against E. I. du Pont Nemours and Co., the E. I. du Pont de Nemour Powder Company of New Jersey, and 24 other corporations and 17 individuals connected with the 26 corporations named as defendants in the case. The complaint alleges that all of the defendants are engaged in inter-State trade and commerce in gunpowder and other high explosives, and are violating the law known as the Sherman Anti-Trust Act. In its prayer for relief the Government asks, among other things, that the three main operating companies be restrained from operating and engaging in inter-State commerce, or, if the Court is of the opinion that the public interest will be better subserved thereby, that receivers be appointed. The prayer in respect to such receivership is identical with that in the Tobacco Trust petition. The Government also asks that the holding ownership and control of certain capital stock in other companies by the various holding companies which are defendents be adjudged unlawful and void. While it will be some time before this and similar litigation is definitely settled, this further activity by the Government in its anti-corporation campaign, coupled with the uncertainty as to what interests will next be attacked, has aggravated an already unsettled state of affairs, with no prospect of confidence being restored until the extent and outcome of the "trust-busting" policy are known.

Military Inventions Co., Ld., is the name of a company registered on the 10th ult. with a capital of £10,000 to adopt an agreement with the Fairfax Trust and to carry on a business dealing with guns, rifles, etc.

Mr. Charles Lancaster has issued from 11 Panton Street, Haymarket, his new price list and catalogue. The illustrations are throughout excellent, and they effectively display the leading types of gun made by the firm. The rifles are dealt with equally well, and the catalogue further displays an exceptionally carefully chosen assortment of special arms and sundries. This catalogue may certainly be regarded as a model of its class.

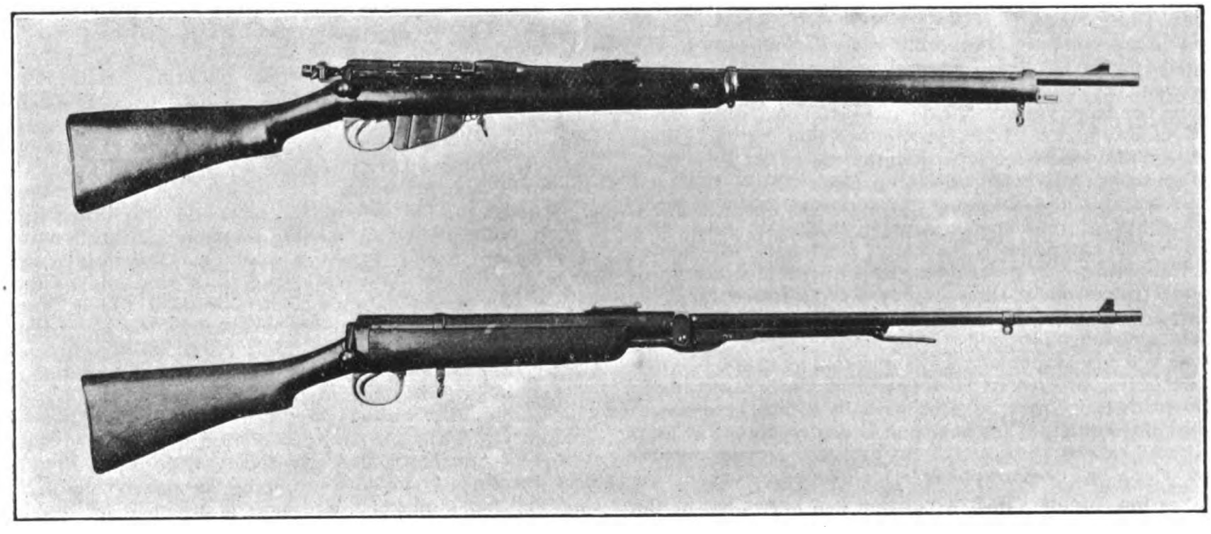
The E. I. du Pont de Nemours Powder Company have issued to the press a statement showing the successes which have been attained by their smokeless powders at the recent Eastern Handicap Tournament at clay birds held in the United States. It is interesting to see that Mr. Gilbert and Mr. Crosby continue to show the high form which they displayed when on their visit to this country, the former having during the tournament made a run of 130 straight and Mr. Crosby 126 straight. These, together with 97 straight by another shooter, were made with Du Pont smokeless powder. The winner of the Eastern Handicap used New E. C. powder, an American edition of the home product.

Messrs. Curtis's & Harvey have forwarded to this office their series of show cards which have been prepared for use by retailers during the current shooting season. The specialities comprise cartridges loaded with Smokeless Diamond, Ruby and Amberite powders. Of greater technical interest than these however, is the new edition of Curtis's & Harvey's *Shooter's Year Book*, which aims at combining the functions of a pocket diary and a ready reference book for shooters. Although the information coming under the latter heading is condensed into a matter of 26 pages there is hardly a question concerning powder and shot charges, bores and weights of gun, and patterns with different quantities and size of shot, which cannot immediately be answered by turning up the appropriate table. The diary represents in fact a series of lectures to young gunmakers with the lecture left out and the tabulated information left in. The numberless quantities and values which constantly arise in connection with guns and shooting is so vast that no one can answer from memory a tithe of the questions that constantly recur. *The Shooter's Year Book* successfully aims at supplying the deficiencies of the shooting man's memory, and as it is intended for free circulation no one should begrudge the trouble involved in securing a copy.

Messrs. Charles Osborne & Co., Ld., in their new wholesale catalogue to the trade, have boldly differentiated the guns illustrated into "standard guns" and guns made to order. Realising that they could not meet competition whilst making a multitude of patterns the firm decided to reorganise their works with a view to making a limited number of types in large quantities. All standard guns can now be supplied from stock at extremely low prices, other patterns being subject to the state of the stock of partially completed work. It is pointed out that the trader benefits by being able to keep his stock in reasonable limits, knowing that what is sold can be promptly replaced. It is understood that the policy of concentration on a limited number of patterns has materially enhanced the value given for money by reason of the extra dexterity acquired by the workpeople and the opportunities which are constantly afforded of economising labour by devising special tools to perform operations which are frequently repeated. The range of standard guns and rifles is very complete and the catalogue further contains a number of other designs and also miniature and other miscellaneous arms which for convenience of reference are differentiated from the firm's standard business by the colour of the ink used in the printing.

THE B.S.A. MILITARY AIR RIFLE.

The accompanying illustrations very effectively emphasise the similarity of appearance between the ordinary service rifle and the B.S.A. military pattern of air rifle, the latter having recently been placed on the market as an alternative to existing methods of practising at miniature ranges. The new weapon is likely to establish a market of its own wherever the conditions demand an unlimited amount of rifle practice at a virtually nominal price. Where large numbers of boys have to be instructed in the elements of marksmanship, the financial problem is entirely different from that which exists at a rifle club where the cost of ·22 calibre ammunition is small in itself, and each individual member pays for his own consumption. Rifle shooting is amongst the arts which are best acquired when young, and the military air rifle aims at giving the required standard of accuracy at a cost porportional to the school boy standard of wealth. Even when the corps provides the necessary ammunition, the cost of ·22 cartridges which may seem immaterial to the individual, becomes a serious item in the year's budget when multiplied by the total number who go through the shooting course. The comparative cost of air slugs and cartridges has been ingeniously expressed by the B.S.A. Company, who claim that the first cost of the B.S.A. military air rifle is covered by the first 7,000 rounds fired from it. This is to say that the combined cost of a rifle and 7,000 slugs is the same as 7,000 rounds alone of ordinary ·22 calibre ammunition. If a similar comparison is instituted with Morris tube cartridges, 3,000 to 4,000 rounds establish a corresponding equilibrium.



The B.S.A. military air rifle has been carefully designed so as to give the same weight and balance as the service rifle, and the same disposition of the sights; *in* fact a complete similarity from the shooter's point of view except, of course, as regards recoil which cannot be imitated. In the latter connection, however, it is urged that for boys learning to shoot an insignificant recoil is a great advantage, as the proper handling of the weapon should have become second nature when the time has arrived for firing full power cartridges. In favour of the military pattern air rifle for this specialised department of rifle shooting, it may be pointed out that the strong mechanical design, from which all weaknesses have been eliminated as a result of the experience gained after two years manufacture of the ordinary pattern rifle, is exceptionally well adapted for the immense amount of wear involved in teaching a number of boys to shoot with a comparatively limited supply of weapons. Ordinary air rifles are as a rule so light that the jump caused by the piston produces a disturbance of aim which varies with the firing position adopted. The military air rifle has a sufficient surplus of weight to make one sight adjustment applicable to shooting both in the standing and prone positions.

A very excellent object lesson in the suitability of the rifle under notice for the class of practice above outlined is to be found in a book entitled *The Complete Air Gunner*, the same having been published by Messrs. Upcott Gill at the price of one shilling net. This book contains a number of interesting illustrations showing the air rifle in use for teaching boys to shoot. The whole contents of the book is written in the same strain, the author, Mr. R. B. Townshend, being a private gentleman whose hobby it has been to give informal rifle shooting instruction to youngsters in the garden attached to his house. The whole book is written around the air rifle, and it constitutes a most convincing and eloquent testimonial concerning the suitability of this weapon for carrying rifle shooting instruction to a comparatively advanced stage. Gunmakers and others who study the side lines of their business will do well to secure copies of this book, not only for their own reading, but for sale amongst those of their customers who may be in a position to turn the lesson taught to practical account.

LECTURES TO YOUNG GUNMAKERS.

XLIV.—THE ACTION OF WIND ON RIFLE BULLETS.

Written with the collaboration of F. W. Jones.

THE above was the title of Lecture XXXIV. which appeared in the issue of May 1903. In that lecture the theory of wind deflection, as accepted by the English authorities on the subject, and known as Younghusband's method, was not given a whole-hearted support. This was because the explanation which is found in the various text-books did not readily appeal to the mind. It was, however, admitted that this method gave calculated results as close to practice as any other method of working. The subject of wind influence on the flight of bullets having been brought to the fore by the remarkable behaviour at the recent Bisley meeting of sharp-pointed projectiles, it is here proposed to review the whole question in its entirety. A different way of presenting the problem has now been found which makes it possible to appreciate much better than ever before the various happenings during a bullet's passage through cross currents of air.

Sitting at the firing point of a range on a windy day the observer is almost certain to conclude that the deflection of the bullet must in some way depend on the time of its flight and the amount of side surface presented to the wind. Obvious as this conclusion appears to be, it must be admitted that facts do not support any theory based thereon. Many illustrations prove the error of any such assumption: one however will suffice. Recent target experiments with the ·303 rifle, using alternately the ordinary service bullet and also the new sharp-pointed bullets of the same weight, both having the same muzzle velocity, it has been observed that the wind affects the sharp-pointed bullet very much less than the blunt-nose service pattern. Many marksmen hold that the difference amounts to as much as 50 per cent. Both bullets may have the usual weight of 215 grains and the Palma velocity of 2,300 f.-s.; but the sharp-pointed bullet, owing to its capacity of getting through the air better, has a time of flight 15 per cent. less than the service form: on the other hand it presents a greater side area. If, therefore, the time of flight and side area are the effective factors of wind deflection, the sharp-pointed bullet should have shown at Bisley an advantage over the service form of something less than a mere 15 per cent. It must, therefore, be admitted that the theory of wind deflection is far more subtle than rough and ready reasoning would suggest.

The Younghusband explanation asserts that the side area of a bullet is not a factor in wind deflection, and the first step in the elucidation of this problem is to enquire on what grounds this assumption is made. Rifle bullets are of a length greater than their diameter, and to make them shoot nose forward they must be given a rotation round their longer axis. The rotation must be properly adjusted for this purpose: if it is insufficient the bullet "key-holes," the axis assuming a position not coincident with the line of the bullet's motion. By the aid of mathematics it would be possible to set down the conditions which determine the stability of flight of a bullet; but this is unnecessary for the purpose in view, because the spinning top furnishes an illustration complete in every respect and having the advantage of forming a part of the experience of practically everyone. When a pear-shaped top is attached to its string and then thrown, it may alight on the ground with its axis at almost any angle with the vertical, but if the spin is sufficient, it will in a short time "go to sleep" with its axis vertical. Friction will in due course reduce the rotational velocity and eventually the top takes on a compound movement, the axis revolving around a vertical line drawn from the point of the top. The force acting on the top is that of gravity, and the direction of this force is the vertical. Consequently when the spin is sufficient, the position of stability is that where the axis lies in the direction of the force. When the spin becomes insufficient to maintain stability, the axis of the top revolves around the truly vertical line. A revolving bullet projected into the air behaves like the top: if it has sufficient spin it sets its axis in line with the force acting upon it, viz., the resistance of the air. Conversely if it has not an appropriate spin there is evidence at the target of unsteady flight by "key-holing." Therefore the stable bullet sets its axis to conform with the direction of the air movement which it encounters, and it is quite immaterial whether this is in part due to the wind or not. It is thus obvious that the bullet never presents its side to the moving air, and consequently the side area or length of a bullet in stable flight, is not a factor, except so far as skin friction may enter into the question. Air movement is always along the bullet, and this is Younghusband's reason for ignoring the side-area of a bullet when considering wind deflection.

The usual method of describing the action of a bullet, when lanced into air having a side movement, is to say that the bullet settles down with its nose "up wind." The idea intended to be conveyed is that the bullet behaves in much the same way as a pedestrian with an ill-fitting straw hat when walking along a road while a cross wind is blowing. He turns his head so as to keep his hat in place by partly meeting the wind. The amount he has to turn depends on his own rate of movement and that of the wind. He, in fact, unconsciously sets his head at such an angle that the air movement tends to keep his hat more firmly on his head. The same happens with a bullet, although on account of its great velocity, the angle through which it turns to face the wind is very small indeed.

The man at the firing point thinks of two air movements, one due to the bullet's own motion, and the other to the wind. Naturally the latter makes the greater impression on his mind, and he is therefore likely to give it the greater attention. Now with respect to the bullet there is only one air movement, and this is due to the combined effect of its own motion and the wind apparent at the firing point. To make this quite clear it might be well to consider the experience of a motorist, who is making a journey due north when a west wind of, say, 20 miles per hour is

blowing. If his car travels at the same rate as the wind, viz., 20 miles per hour, he will experience only one wind, and that will be coming from N.W., being the air movement produced by the combined effect of the motion of the car and the west wind. In this illustration the air movement with respect to the car makes an angle of 45° with the direction the motor is going. This, however, is out of all proportion to the effect a wind may have in changing the direction of the air movement from that of a bullet's course. A muzzle velocity of 2,000 f.-s. is not excessive, but this is 1,364 miles per hour. A cross wind of 20 miles per hour is practically what is called a gale; nevertheless the effect of the latter is to make a bullet with 2,000 f.-s. velocity turn its axis only 50 minutes of angle, viz., one in 71. This is the angle the air moving over the bullet makes with a straight line drawn from the muzzle to the target.

Having now established the above particulars, it is possible to look at wind deflection from an entirely new aspect. Instead of considering the bullet's movement from the point of view of a stationary situation, such as the firing point or the target, it is possible to follow it in its course from the muzzle. Assuming that an observer could be projected into the air at the same time and with the same velocity as the bullet, and further that the car or other vehicle in which he is supposed to travel offers no resistance to the air and retains its initial velocity throughout, then the motion of the bullet can be regarded from a highly instructive point of view. Let the bullet be a service ·303 with a muzzle velocity of 2,000 f.-s. At first let there be no wind. Our observer will notice that the gun leaves him, and retains a constant velocity of 2,000 f.-s. He will also observe that there is a head wind of 2,000 f.-s. This wind will appear to him to blow the bullet towards the gun, and at the end of a second the bullet will have dropped back 475 feet. This is because in one second the ·303 bullet, according to the ballistic tables, would have travelled only 1,525 feet. Thus in the accompanying diagram, if A is the

observer, at the end of one second the bullet will have appeared to be blown to B, and the gun will have passed to C, the wind from the observer's standpoint having the direction E A. To consider the effect of a cross wind, and at the same time to give it a fair dimension in the figure, let us assume a cross wind is blowing at the rate of 500 f.-s. or 341 miles per hour, i.e., one quarter of the assumed bullet velocity. When the observer is launched in the air under these new conditions the wind he experiences, being due to his own movement and that of the cross wind, will make an angle with the line joining his car and the gun. As a matter of fact, if A E is drawn to represent to scale 2,000, and E F is one-quarter of this, then the direction of the compound wind will be F A. What then will be the effect of this altered direction on the bullet? As the bullet leaves the muzzle its axis will lie in A B, and the air movement will make an angle with it. The bullet is thus in an unstable position. Its spin being sufficient for steady flight, the axis of the bullet will at once commence to revolve round the direction of the force or air movement, and in a very short time, like the top, it will spin "to sleep" with its axis lying in F A. The action on the bullet will be as before, only the direction will be different. At the end of a second the bullet will be blown to D, the distance A D being as much greater than A B as the compound wind is greater than 2,000.

Now it is obvious from the construction of the figure, the triangles A E F and A B D being similar, that if A B represents to scale the muzzle velocity V, then B D will represent to scale the wind velocity W, thus:—

$$\frac{B\,D}{A\,B} = \frac{W}{V}$$

therefore the wind deflection $B\,D = W\frac{A\,B}{V} = W\left(\frac{A\,C}{V} - \frac{C\,B}{V}\right)$

but C B equals the range R in feet, and $\frac{A\,C}{V}$ equals the time of flight t of the bullet. Therefore the wind deflection equals

$$W\left(t - \frac{R}{V}\right)$$

which is Younghusband's formula.

The time of flight for a range must be obtained from the ballistic tables, and thus the influence of the different factors on wind deflection is not at once seen. For all practical purposes the wind deflection is given by an empirical formula, obtained from the results of working with military small bore bullets and Younghusband's method, which shows at once the effect of the two factors velocity and the coefficient of reduction. The wind deflection in feet, for every 10 f.-s. cross wind, equals at 1,000 yards range

$$\frac{4\cdot1}{C} - \frac{V - 2{,}000}{400}$$

where V = the muzzle velocity and

C = the coefficient of reduction, viz., $\frac{w}{n\,d^2}$

The figures given by Younghusband's formula for ranges other than 1,000 yards bear approximately a very simple relation to one another. Thus if a wind requires 10 minutes of angle at 1,000 yards the same wind will require, at other nearer ranges, as many minutes of angle as there are hundreds of yards, viz., 2 minutes at 200 yards, 5 minutes 500 yards, and so on.

In conclusion an example may now be given of the working of the above empirical formula. The ·303 firing a 225 grains bullet at a velocity 2,300 f.-s., in one case the shape of the bullet being the usual service pattern and the other the sharp nose Spitzer shape. The value of n for the former is ·78, and the value for the latter may be taken at ·53; therefore the coefficients of reduction have respectively the values ·436 and ·641. Let us assume a cross wind of 10 f.-s. or 6·8 miles per hour, then this wind would deflect the service pattern 8·7 feet and the Spitzer 5·7 feet or 66 per cent. of the former. It is thus obvious that velocity has a small effect on wind deflection in comparison with the

capacity of the bullet to get through the air, and length of bullet counts only inasmuch as it affects this.

This lecture having already attained the limit of length which must be observed, a very few words must suffice to emphasise the points which have been made clear. A rational explanation for Younghusband's theory has been found by reasoning from known facts and conditions. His formula has been been applied to a large number of practical target shooting observations, whereby certain constants have been evolved, and a new formula constructed. Given the value of C for any bullet—that is its weight, diameter and the factor for its air piercing properties, all as dealt in the usual way—also its muzzle velocity, and a very simple sum in arithmetic will provide the amount of deflection at 1,000 yards for any given rate of movement of the cross wind. This formula provides a ready means of comparing the properties of all kinds of bullets in reference to their sensitiveness to cross winds. As practical application involves knowing not only the general rate of the air current prevailing at the moment, but also the mean rate of the air through which the bullet actually passes, the formula is chiefly useful for comparing bullets having different characteristics of shape and velocity. With a known deflection on the target the rate of the wind can be deduced. In fact by resolving wind deflection to a proper mathematic basis it is possible to tabulate many particulars which have hitherto depended too much upon erroneous personal observation.

The firm of Hunter & Warren, of Glasgow, have scored a notable success in that City by demolishing on behalf of the contractors, the City poorhouse by means of explosives. The operation was performed with perfect success and the heavy expense of erecting scaffolding was saved. The conditions were so carefully worked out that many householders in the immediate neighbourhood were unaware of anything unusual having taken place.

The local authority at Cardiff is seriously exercised in mind concerning the danger supposed to be incidental to the cartage of explosives through the streets during all hours of the day. The Home Secretary has been communicated with on the subject, and he declares that no action can be taken in the matter. The Home Office regulations concerning the transport of explosives secure a large measure of protection for the public, and the question seems to be one which could be better dealt with on the basis of an expert report by the Inspectors than by alarmist statements concerning the routine transactions of a large shipping port such as Cardiff.

A recent issue of the *Journal of the Royal United Service Institution* contains a very interesting article on gun deafness and its prevention. The article in question is a reprint of a lecture delivered on the 23rd January last by Mr. Arthur H. Cheatle, F.R.C.S. The first part of the lecture deals with the mechanism of the ear, which forms an introduction to a consideration of the reasons which account for this mechanism being thrown out of gear, or permanently disabled by the shock arising from gun fire. The lecturer showed that the effects produced vary as between individuals, but that no one can be considered immune from the severe strain which heavy gun fire produces. He also showed that when hearing deteriorates the sufferer may not be aware of the defect, and, therefore, that preventative measures should be adopted by all. On this subject he had some useful observations to offer, and recommended in place of cotton wool a special clay fibre which can be obtained at Hawkesley's, 357 Oxford Street. In the course of the debate which followed the lecture someone suggested that the reason why the person firing suffered less than those in the immediate vicinity arose from a sub-conscious preparation against the shock. As regards small arms at any rate this explanation seems much less probable than the alternative one that the sound wave is least powerful in a direction immediately behind the gun where the shooter's head is situated. The subject is evidently one which may repay further research, but there seems to be little hope of a medical remedy when ill effects have developed There is, however, a great opening for the improvement of preventative measures, and even if one ear differs from another to an extent requiring a special shape of plug, no one would begrudge the cost and time involved in its preparation. It would certainly be less of an ordeal than the preparation of a false set of teeth.

APPLICATIONS FOR PATENTS.

JULY 15—AUGUST 17, 1907.

16,332.* Projectile Fuses. S. D. Cushing.
16,444. Automatic Firearms. T. K. North.
16,467.* Telemeters. C. Zeiss (German application, June 1, 1907).
16,492. Nitrocellulose Explosives. G. H. Wadsworth.
16,607.* Gun Barrels. C. Puff (German application July 19, 1906).
16,805. Bullets. R. Macdonald.
16,852.* Fuse Setting Appliances. Fried Krupp, A.-G. (German application, October 31, 1906).
16,900.* Ordnance Breech Mechanism. H. C. L. Holden.
16,901.* Ordnance Breech Mechanism. H. C. L. Holden.
16,965. Mining Cartridge. S. Moore.
17,148.* Automatic Safety Appliances for Pistols. J. Tambour.
17,149.* Automatic Safety Device for Small Arms. J. Tambour.
17,213. Rifle Sights. J. B. Walker.
17,284. Testing Nitro Explosives. W. E. Martin and Kynoch Ld.
17,311. Sights for Small Arms. R. Wake.
17,479. Sighting Apparatus for Guns. A. Barr and W. Stroud.
17,521.* Nitro-Compounds. R. Wolffenstein and O. Boeters (German application, August 3, 1906).
17,608. Ordnance Sighting Apparatus. A. T. Dawson and J. Horne.
17,633. Dynamics of Gunnery and Projectiles. W. S. Simpson.
17,639. Cartridge Belt. M. Pedersen.
17,678. Small Arms Breech Mechanism. H. Borchardt (German application, February 27, 1907).
17,740. Bullets and Projectiles. H. V. Cuthbert-Keeson.
17,789. Deflection Indicator for Guns. F. H. Chaplin.
17,794.* Automatic Drop Targets. A. Müller (German application, August 17, 1906).
17,835. Shrapnel Shell. G. G. M. Hardingham.
17,852. Ordnance Shell Bodies. C. Finch-Hatton.
17,859. Disappearing Targets. F. Q. Gale and F. J. H. Phillips.
17,877. Explosives. A. C. Luck.
17,892.* Automatic Drop Target. A. Müller (German application, April 17, 1907).
17,910. Rifle Barrel Cleaning and Lubricating Composition. King's Norton Metal Co., Ld., T. A. Bayliss, H. M. Smith and H. W. Brownsdon.
17,944.* Percussion Fuses. Fried Krupp, A.-G. (German application, November 14, 1906).
18,178. Gun Carriages. A. F. Petch and H. Hellburg.
18,179. Ordnance Loading Apparatus. A. F. Petch and F. Duncan.
18,188.* Automatic Firearms. A. W. Schwarzlose.
18,302.* Hand Rammers for Ordnance. Fried Krupp, A.-G. (German application, December 15, 1906).
18,303.* Rammers for Ordnance. Fried Krupp, A.-G. (German application, November 29, 1906.
18,306. Cartridge Filling Machine. R. P. Myers.

18,360. Explosive Projectile. H. Warry.
18,381. Method of Setting Sighting Telescope. J. L. Sands.
18,447. Projectiles. A. Johnson.
18,490. Cartridge Holders. T. R. R. Ashton.
18,637. Loading Device for Breech Loading Guns. W. J. Seton.
18,638. Target Practice Apparatus. F. Mitchell.

*These applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

JULY 25—AUGUST 22, 1907.

COMPILED BY HENRY TARRANT.

15,877 (1906). **Automatic Aim Indicator.** A. J. Cuming, London. An improved device is described, by means of which the gyratory movements of the gun due to the directing of the aim are accurately reproduced by a gyratory marking needle. At the moment of pulling the trigger when firing at a distant object a miniature target is released by electro-magnetic devices to record the accuracy of the aim. This system gives results similar to the apparatus known as the sub-target machine. Accepted July 13, 1907.

15,905 (1906). **Cartridge Reloading Apparatus.** J. Olssen, Sweden. (*See Selected Patents*).

16,431 (1906). **Ordnance Training Instruction.** R. D. White, U.S.A. An improved form of apparatus for training gun-crews, provides means whereby the aim may be indicated although a projectile is not fired nor is a sub-calibre device mounted on or near the gun. The improvements allow of a variation of the firing interval caused say by hang-fires and the electrically operated marking device is correspondingly retarded. Accepted July 18, 1907.

16,588 (1906). **Range Finder.** M. G. Farquhar Aboyne, Aberdeenshire. Range finders having stationary reflectors and a moveable reflector are provided with a sliding stud guided in the base of the instrument and arranged so that its engagement with the reflector lever is made to indicate the angular movement of the reflector while bringing the images into coincidence at the eyepiece of the instrument. Accepted July 18, 1907.

19,215 (1906). **Increasing the Density of Explosives.** C. E. Bichel, Germany. The greater the density of an explosive nitro substance the larger the amount which can be placed in a shell, torpedo or bore hole. The patentee subjects the fused or molten explosive to the action of some inactive pressure medium such as compressed air to give the compound the desired increase in density. Air bubbles may previously be removed by suction. Accepted July 18, 1907.

21,525 (1906). **Air Rifle Target.** T. C. Ferrand and E. H. Coggins, Halifax. A card target is fixed by means of four pins so that the moveable bull's eye—consisting of a spring operated spindle—fits exactly in the centre. When the bull is struck it is forced rearwards against the spring to strike a bell; and pellets passing through the card target are caught and held by a thickness of lead. Accepted July 18, 1907.

24,240 (1906). **Ammonium Nitrate Explosives.** Dr. C. Claessen, Germany. As a proof against fire damp, alum or chrome ammonia alum is added to nitrate of ammonium explosive compounds. An example of such an explosive is quoted :- 66% ammonium nitrate, 14·5% potassium nitrate, 9% guncotton, 0·5% vaseline, 10% chrome ammonia alum. Accepted July 18, 1907.

24,270 (1906). **Electric Vent Sealing Tubes.** The King's Norton Metal Co., Ld., and T. A. Bayliss, London, and H. M. Smith, Abbey Wood. The metallic priming cup may be passed into the open end of the tubular body of the primer and is secured in position by a screwed ring. Other parts are arranged so that testing and adjusting of the primers of electric vent sealing tubes is facilitated. Accepted July 4, 1907.

25,524 (1906). **Ordnance Mountings.** A. F. Petch and R. Redpath, London (Both of Coventry Ordnance Works Ld.). The cradle of mountain guns whilst being of sufficient length to allow of the long recoil can be considerably reduced for transport. For this purpose the cradle is made in two sections, one sliding on top of the other. Accepted August 1, 1907.

25,664 (1906). **Air-Gun Target.** F. Field, Birmingham. The bull of this air-gun target is adapted when struck to release one of a series of steel balls from a vertical tube. The ball drops through another tube into a receptacle striking a bell in its progress. Accepted July 25, 1907.

26,903 (1906). **Small-Arm Cocking Mechanism.** W. Baker, Birmingham. A pivotted limb called the main spring box is elevated to compress the main spring by the cocking lever which is turned on its pivot during the closing of the gun by the barrel lump as is described in the selected patent appearing on the next page. Another spring depresses the main spring box after firing and also acts as a sear spring. Accepted July 25, 1907.

27,422 (1906). **Machine Gun Firing Mechanism.** A. G. Bloxam, London (agent for *Deutsche Waffen and M.-F., Germany*). In order to regulate the number of shots fired in a minute by a machine gun the trigger is provided with a brake. To reduce the number of shots the movement of the trigger is retarded. Accepted August 1, 1907.

28,208 (1906). **High Velocity Bullet.** A. Greenwood, Burley-in-Wharfedale. In order to secure length without upsetting the weight and balance of a high velocity bullet the core is composed of aluminium wire. The core is surrounded by a lead or lead alloy sleeve and this compound creation is inserted in the usual nickel envelope. The size of the central core of aluminium can of course be varied. Accepted August 1, 1907.

28,501 (1906). **Projectile for Smooth Bores.** Lt.-Col. J. A. Bon, France. This pointed projectile for smooth bore guns has greater length than those already known. The nose and body portion are quite of ordinary shape but the extended base is provided with vanes designed to hold the bullet steady during flight. Accepted July 25, 1907.

28,706 (1906). **Firing Mechanism of Ordnance.** E. Schneider, France. To "safe" the firing pin of ordnance, the breech block of which has interrupted screw threads, a device is provided by means of which the striker body or the whole of the striker may be moved out of alignment with the firing hole, the breech block remaining concentric. Accepted August 1, 1907.

2,001 (1907). **Range Finder.** J. M. Kauffmann, Germany. Two movable mirrors are adapted both to reflect an object, and from the degree of revolution of the ocular mirror the distance or angle of the object is measured. Accepted August 1, 1907.

2,221 (1907). **Sighting Apparatus of Ordnance.** Société Anonyme des Etablissements Hotchkiss & Co., France. Several improvements in ordnance sighting apparatus are dealt with in this specification. The movement of the index is amplified, the sights may be more rapidly adjusted, particularly laterally, and they are firmly held so as to be independent of the vibrations of the system. The telescope may be easily brought into or put out of use. Accepted August 1, 1907.

2,286 (1907). **Nitrate of Ammonium Explosives.** A method of rendering ammonium nitrate explosives with metallic ingredient easily detonizable when in the compressed condition, consisting of an addition and even distribution through the mass of nitrocellulose. This explosive is made up within the limits set out :—50–80% nitrate of ammonium, 5–20% ferrosilicon, 5–25% nitrocellulose, 0–10% organic or free carbon, 0–8% ammonium oxalate (chloride). Accepted July 4, 1907.

2,589 (1907). **Back Sight for Rifles.** R. E. Reardon, Ottawa. The back sight described in this patent is of the usual tangent form and the special feature of novelty is that the sighting bar carries within itself not only the lateral adjustment parts but also a fine vertical adjustment arrangement. Accepted July 4, 1907.

2,983 (1907). **Electrical Target Apparatus.** S. A. M. Rose and H. B. Crowle, Melbourne. The target apparatus dealt with in this patent is of the type in which sections of the target when struck close a circuit which in turn closes another circuit upon the resistance of which the indicator at the firing point depends for its information as to the part of the target struck. Various new features are described. Accepted July 18, 1907.

3,496 (1907). **Automatic Rifle Mechanism.** P Mauser, Germany. In a recoil operated rifle the breech block is locked by two locking levers pivoted to the breech frame. When the front ends of these levers are moved towards each other they lie directly behind and lock the breech bolt, but when moved away from each other, a space is provided through which the bolt may reciprocate in its automatic action. Accepted July 4, 1907.

4,131 (1907). **Recoil Apparatus for Ordnance.** Société Anonyme John Cockerill, Belgium. In Patent No. 6,426, 1902, E. J. Bousfield described mountings in which the hydraulic brake cylinder is in communication with a reserve tank containing liquid. The present patentee describes devices for adapting this apparatus for long recoils and for obviating shock and the tendency for the trail to rise when the gun returns. Accepted July 4, 1907.

5,628 (1907). **Ordnance Fluid Pressure Brakes.** Fried Krupp, A.-G., Germany. The passages for transit of the brake fluid from one side of the piston to the other are arranged between the counter rod and the wall of the hollow piston rod. This modification is applied to brakes of the type dealt with in Patent No. 19,434, 1905. Accepted July 25, 1907.

5,965 (1907). **Telescopic Sight for Ordnance.** P. M. Justice, London (Agent for *G. N. Saegmuller, U.S.A.*). An improved illuminating attachment for the telescope of ordnance sights adapted to illuminate a portion only of the cross lines drawn or etched on the surface of the glass of the compound cemented lens of the telescope. Accepted July 25, 1907.

6,004 (1907). **Spade for Trail of Ordnance.** Lt.-Col. Deport, France. Instead of the spade heretofore used which was gradually forced into the ground by the recoil, one at right angles to the trail is forced into the ground before firing. This prevents forward or backward movement of the carriage and two side spades stop lateral motion. Accepted July 11, 1907.

6,162 (1907). **Cocking Mechanism for Small-Arms.** W. Baker, Birmingham. (*See Selected Patents*).

6,222 (1907). **Ejector Mechanism for Small-Arms.** H. W. Holland, London and J. Woodward, Willesden. (*See Selected Patents*).

6,587 (1907). **Automatic Adjustment of Ordnance Recoil Brake.** Fried Krupp, A.-G., Germany. Barrel recoil ordnance with fluid pressure brake in which a part for the purpose of regulating the length of recoil is adjusted automatically on elevation of the barrel. A link rod is employed in the present case, and is pivoted by a ball and socket joint directly to an arm on a shaft mounted on the slide carrier and to the gun carriage respectively. Accepted July 4, 1907.

6,918 (1907). **Fluid Pressure Brakes for Ordnance.** Fried. Krupp, A.-G., Germany. A fluid pressure brake for barrel recoil ordnance capable of being adjusted for various lengths of recoil is dealt with in this patent. The special claim is the lack of sensitive, moveable constructional parts Accepted July 11, 1907.

9,175 (1907). **A Repeating Rifle.** E. E. Redfield, U.S.A. A repeating rifle working on the pump system has its tubular magazine lying, as usual, beneath the barrel. Certain novel features are described and are connected with the method of loading, the moveable breech block and the lock mechanism. The rifle is constructed to reduce the number of parts to a minimum. Accepted July 18, 1907.

9,770 (1907). **Miniature Target Apparatus.** H. Phillips, London. To facilitate the fixing of what are known as breakable "pool" targets a number of these pool balls are lightly secured on the periphery of a wheel at the butts. By means of a handwheel operating a shaft the pools ball may be turned so that one at a time is brought into view. Accepted July 18, 1907.

SELECTED PATENTS.

CARTRIDGE RELOADING APPARATUS.

15,905 (1906). J. Olssen, Sweden. The device we illustrate below is designed for decapping, recapping, resizing and inserting the projectile in a cartridge of the ·303 type. The point of special claim is that all these operations are performed through t e medium of one lever; and generally the apparatus is claimed to be more simple than any constructed for a similar purpose.

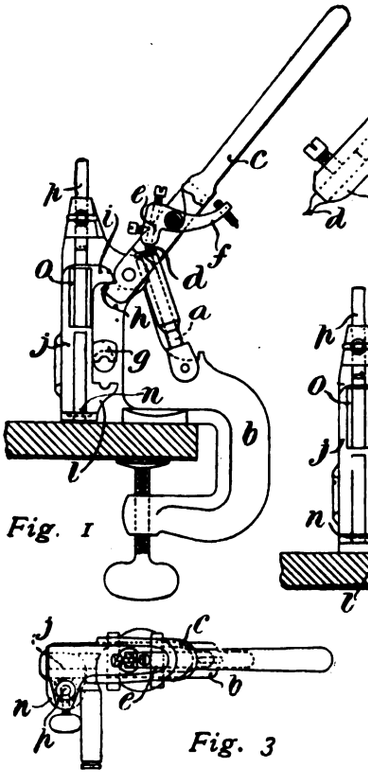


Fig. 1

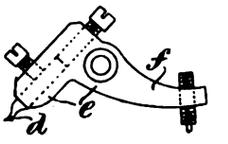


Fig. 2

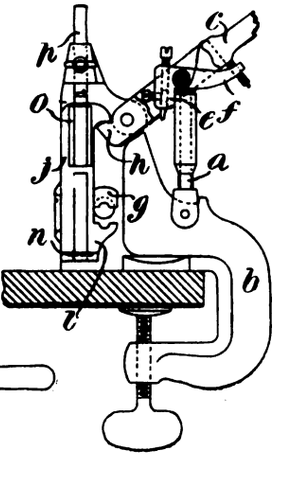


Fig. 3

Assuming that an empty case of the type mentioned is taken, it is placed over the pin *a*, which is pivoted on the frame *b*. The pin is pushed over so as to lie at the angle shown in Fig. 1. The lever *c* is then drawn down so that the sharp pointed end *d* of the two-armed lever *e-f* penetrates the cap and withdraws it when the lever *c* is raised again. The next operation is that of inserting a fresh cap, and this is performed when the cartridge case, still on the pin *a* is swung to the vertical position illustrated in Fig. 2. A cap is inserted by hand, and is forced home by the flat underside of the arm *f* when the lever *c* is again depressed.

The case is then removed, and to resize the neck it is placed in the semi-circular under part of the projection *g* (Fig. 3) The lever *c* is again operated, and through the engagement of the nose *h* with the projection *i* on the slide *j* the semi-circular groove in the part *l* is elevated so as to complete the circular collar round the neck of the case. To insert the projectile after the powder has been loaded the base of the case is seated in the recess *n* in the slide *j*, and when the lever *c* is pulled down the

case is raised by the slide until the bullet held by the hand in the guide *o* is forced sufficiently deeply in the resized neck. The bottom of the pin *p* is shaped to correspond with the nose of the bullet, and may be fixed by the fly nut at any convenient height in the frame *b*.

The apparatus may, as is illustrated, be clamped to the table by means of the screw shown. Accepted July 4, 1907.

COCKING MECHANISM FOR SMALL-ARMS.

6,162 (1907). W. Baker, Birmingham. The patentee states that in the usual form of break-down sporting gun lock the pressure of the main spring has a tendency to force the barrels off the breech face, but to produce friction and wear, which otherwise impair the perfect fit at the breech joint. To obviate these disadvantages he arranges the cocking lever (which carries the main spring pressure) in such a position that practically no pressure is exerted upwardly on the barrel, although the back lump retains the lever in the position to preserve the spring pressure upon the hammer.

The arrangement of the lever *a*, pivoted at *b* in relation with the back lump *c* on the barrels is clearly shown in the drawings reproduced. When the gun is in the broken down position the nose *j* of the cocking lever lies just beneath the lump as is illustrated in Fig. 1. During the closing of the gun the lump *c* is forced downwards and is caused to turn the lever *a* on its pivot *b*. The back end *d* of the lever forces the spring box *e* upwards on its pivot *f* and compresses the main spring *g* in order to place the hammer *h* in cock. The last named part is held in the cocked position by the nose of the sear *i*. The cocking operations described take the usual course, but it will be noticed by reference to Fig. 2 that when the gun is com-

Fig. 1

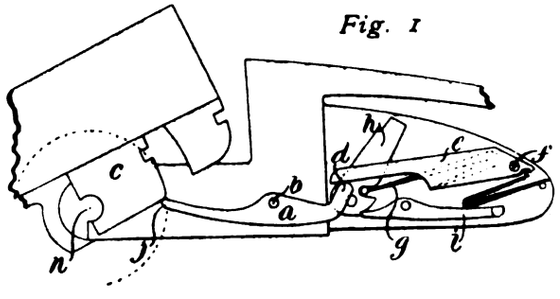
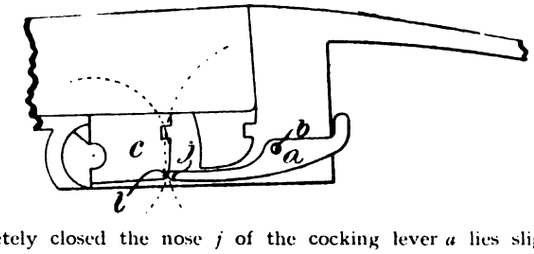


Fig. 2



pletely closed the nose *j* of the cocking lever *a* lies slightly behind the lump *l*. In this position of the cocking lever the spring cannot exert any direct upward pressure on the barrels, but acts through the lump *c* on the joint pin *n*. During the closing movement of the gun the circular path of the point *l* of the lump crosses that of the cocking lever nose *j*, as is indicated by the dotted lines in Fig. 2.

Various other arrangements embodying the same principle of construction are illustrated and described in the specification. Accepted July 18, 1907.

EJECTOR MECHANISM FOR SMALL-ARMS.

6,222 (1907). H. W. Holland, London, and T. Woodward, Willesden. The cartridge extracting and ejecting mechanism forming the subject of this patent contains a slotted part working in the fore-end. This part is provided with lugs through which the extractors are very forcibly pressed upwards when the gun is broken down, whilst the back of the slot of this part engages with the ejector kickers and recocks them during the closing of the gun after firing and reloading.

The arrangement is illustrated in the drawings reproduced, and it will be readily understood that the slotted part *a* is adapted to slide in guides in the fore-end iron *b*. The underside *a* has the projection *c*, the front of which is curved to

Fig. 1

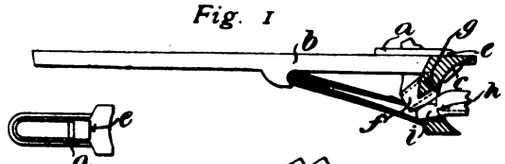


Fig. 3

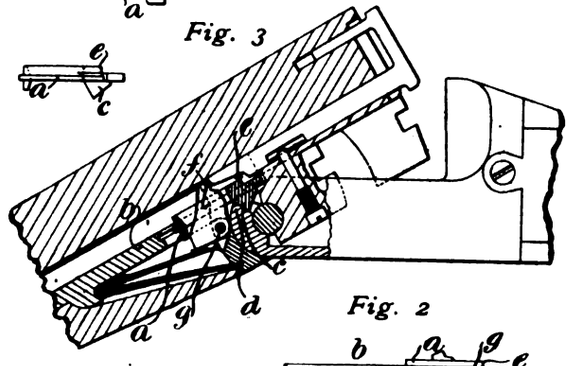
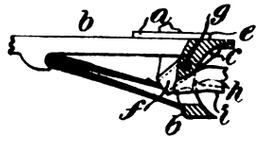


Fig. 2



engage the lug *d* on the action body, so that when the gun is broken down the lug *d* is caused very forcibly to push the slide *a* towards the breech end of the barrels. The nose *e* on the slide engages with the stems of the extractors and the latter are thus forced outwards from the barrels, carrying (through the extractor proper) the cartridges or cartridge cases out of the barrels.

Supposing the cartridges have been fired, the ejector hammers or kickers *f*, which work in the slot in the slide *a*, are forced gradually round on their pivot *g* by the projection *h* on inside of the cocking lever *i*, until the ejector spring ends pass over the lowest points on the kickers and force these parts suddenly upwards to hit the ends of the extractor stems (Fig. 3).

When the gun is not fired the noses *i* of the cocking levers lie in the depressed position illustrated in Fig. 1. If the unfired gun is opened the lugs *h* in the cocking lever noses are inoperative, and do not move the ejector hammers. When, however, the cartridges are discharged the cocking lever noses are raised as in Fig. 2, so that when the gun is broken down the lugs *h* bear hard against the backs of the ejector hammers and force them round until they are tripped by their springs to kick the extractors and throw the cartridge cases clear of the gun.

The breech end of the slot on the slide *a* contacts with the fallen ejector hammers during the closing of the gun and recocks them. Accepted July 4, 1907.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Mercuric Chloride in Western Australia.—The *West Australian* issues of July 27th and August 19th last, contain particulars of the prosecution of firms over there for storing explosives in an unauthorised place, the lack of authorisation resulting from the presence of mercuric chloride in some of the explosives under storage. The proceedings against Messrs. Guthrie & Co., of Fremantle were in respect to twenty cases of blasting gelatine which contained the ingredient complained of, but besides these there were 300 cases of other explosives in the magazine. The prosecution was conducted by the Assistant Crown Solicitor, who outlined the offence which had been committed on the now well known lines. The defendants, whilst pleading guilty, explained that the explosive complained of was made in Germany, and that their firm had dealt with it in the usual way, believing that the terms of the Explosives Act were complied with. It was further pointed out that the whole of the shipment would be sent out of the State, and would not be made available to the public. A fine of £100 with £31 10s. costs was imposed. In the latter prosecutions which took place in August the defendants were Richard and Paul Strelitz, trading as Strelitz Brothers, and the firm of Harris, Scarfe & Company. Both parties were fined the same amount as Messrs. Guthrie & Co., so that the total fines amount to £300 with nearly another hundred for costs. The proceedings against Messrs. Strelitz related to 746 cases of gelignite, 312 cases of geltine dynamite, and 485 cases of blasting gelatine, making up a total of 1,543 cases of explosives. Messrs. Harris, Scarfe & Company were concerned only in respect to 69 cases of blasting gelatine. It will be seen that the total amount of explosives involved in the three prosecutions amounted to 1,932 cases, making a total weight of 96,600 lb; and though the report is not clear concerning the fate of Messrs. Guthrie's 300 cases of other explosives, there is no doubt that the whole of the remainder of the explosives concerned have to be withdrawn from the State.

The Palma Match.—Although patriotic belief in the efficiency of the Bisley marksman has received a rude shock from the severe whipping which the British team received in the contest in Canada for the Palma Trophy, a certain amount of sporting satisfaction arises from the fact that the United States team have so handsomely wiped out the blot which marred their success on a former occasion. The very considerable gap between the scores of the American and British teams suggests other causes than can be accounted for by the personality of the shooters. The Canadian team was second, being 41 points behind the winners, Australia third with 59 points to the bad, and Great Britain fourth with a drop of 132. Such a falling away seems almost inconceivable in face of the relatively good intermediate scores made by Canada and Australia. If it had been merely a question as between the United States and Great Britain, one might exclude the personal factor to a great extent, since every member of the opposing teams was a tried rifleman who had carried the cultivation of shooting skill as far as it could go. The explanation would then be narrowed down to the rifles and ammunition used; for the Palma conditions provide that each competing team shall use the service rifle of its country and such ammunition as

it may think fit. The new American army rifle is known to be an extraordinarily handy little weapon, and the shooting element which exercises considerable influence in the States, has fostered the introduction of sundry target shooting refinements which might otherwise be condemned as unmilitary. Amongst these the presence of an aperture as an alternative to the notch in the backsight is of considerable importance, for although the peep hole is disadvantageously placed when so far from the eye, it still gives better definition than is ordinarily available. Another point to which a certain amount of attention should be given is the fact that the match was decided at the 800, 900 and 1,000 yards ranges. The bulk of the service rifle practice in this country is conducted at 200, 500 and 600 yards, and though a certain amount of shooting is carried on at the longer ranges the shooter has no real opportunity of accustoming himself to the effects of wind and the behaviour of his rifle at these distances. Generally speaking all Bisley shooters perform equally badly at the longer ranges, for they all use with the service rifle the stereotyped service ammunition which is hardly accurate enough for long range practice. To give such men more powerful cartridges is to place them in a strange position to which their previous practice is mainly inapplicable. To judge by past experience the American team entered the contest with every advantage which perfect rifles and ammunition could give, plus the experience which would warn them to use new barrels during the actual competition. The American Government adopted a pointed bullet some time back, and the merits of the new cartridge are by now, well known in that country, but nothing definite appears to have been accomplished on this side, judging by the recent announcement that pointed bullets would be disallowed in Army Rifle Association competitions as unmilitary. Persons of an excitable turn of mind may feel their blood boil when thinking these matters over, but those who have ceased to become excited concerning the things they cannot alter know well that technical small arms developments in the War Office are not in charge of any single individual with the power and the knowledge to co-ordinate rifle, cartridge, powder and bullet so that the best combination for the purpose in view shall be available.

Cessation of the Kynoch Journal.—The announcement which has been sent out with the latest issue of the *Kynoch Journal* to the effect that it has been decided not to continue its publication will not be received with any considerable amount of surprise. The proper business of the Kynoch Company is the manufacture of ammunition, with such sundry and incidental extras as have been developed by a pushing directorate. A Kynoch cartridge is a more effective missile to launch on the public than a Kynoch journal; and although this truth has taken long to learn conviction has at last arrived. The essence of successful journalism is that current events shall be reviewed by persons who have enjoyed a life's training in the capacity to adopt an impartial attitude and to view things with a right sense of proportion. Commercial surroundings are apt to breed the entirely opposite tendency to forward personal interests and belittle the accomplishments of others. When the *Kynoch Journal* was first issued the editor gave an undertaking that the journal should be conducted on impartial lines, but the issues which followed provided illustrations of the difficulty that was found in following the course laid down. The journal never attained far-reaching influence or authority and our own editorial attitude was naturally to ignore a paper which could not under any circumstances be accepted as speaking from a disinterested standpoint. These remarks do not of course cover the recent period of Captain Hardcastle's connection with the paper, but men of his calibre are hard to get and expensive to retain, so that Kynoch's have doubtless adopted a wise commercial policy in recognising that their wealth and influence are wastefully exhausted in dealing with a class of enterprise far removed from the proper business of a manufacturer. The possession of an up-to-date printing works is the smallest of the attributes which go to the making of a newspaper. Amateur writing for a purpose as a rule pleases the writer better than the reader, and though most newspapers contain interesting material contributed by experts, who are amateurs so far as writing is concerned, it must not be forgotten that trained editorship is always at work taming the natural exuberance of the contributor. The manufacturer who aims at producing a newspaper must either spoil it as a newspaper in trying to make it pay as an advertisement, or else he must deprive it of advertising value in the hope that he may some day make it a newspaper.

The Text Book of Gunnery.—This valuable War Office handbook, which is reviewed at length in another column, cannot very well be accepted for general circulation without emphasising its typographical defects. The work has been out of print for years; much valuable time has been spent on the preparation of the new edition, and yet at the finish the public receives for its money one of the most disorderly jumbles it is possible to imagine. For the country's credit, if for no other motive, the King's printer should at once receive instructions to turn out a proper rendering of the matter which has been placed in his hands. Block spaces which have been left vacant are replaced by inset leaves which are not marked in accordance with the text. Some parts of the book suggest the idea that rough printer's proofs have inadvertently been issued instead of the finished production which the reader has a right to expect. A Commission is said to be sitting on the whole question of Government publications, and the immense cost which is incurred in printing useless matter in blue books and elsewhere. The Commission might with advantage investigate the circumstances which make it possible to spend years on an edition which might be brought out in a few months, and at the finish to turn it out in a style which suggests that the editor was away on his holidays when the important stages of his work had been reached. A book brought out in such an unbusinesslike fashion is likely to cost more money than if the arrangement of the pages had been delayed until the final form of the matter had been decided.

THE PATENTS AND DESIGNS ACT, 1907.

The above Act of Parliament has now been published and can be obtained price 5½d. through the usual official booksellers. It must not be confounded with the Patents and Designs (Amendment) Act, 1907 which represents the amendments to patent law which were passed by the last Parliament. The position of the two Acts is at first sight a little mixed, but the explanation is simple enough, in that the alterations of law which are contained in the Amendment Act are incorporated in the Consolidation Act with the whole of the other law relating to patents and designs. The complete Act is entitled "The Patents and Designs Act, 1907." The Amendment Act ranks as stillborn, in so far that it was repealed on the 28th August last, on the same day that it became law. A good deal has already appeared in these columns concerning the purpose and effect of the new procedure which now governs the law of patents. Persons interested in patents of one kind or another will doubtless lose no time in securing a copy of the new Act. Its provisions are exceedingly clear, and as the whole of the the law on the subject being contained in a single document the reader will find no difficulty in appreciating the points of law which may govern his connection with patents.

The following extracts are amongst the new or important matter, to which special attention will doubtless be paid.

Revocation of patents worked outside the United Kingdom.

27.—(1) At any time not less than four years after the date of a patent and not less than one year after the passing of this Act, any person may apply to the comptroller for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom.

(2) The comptroller shall consider the application, and, if after enquiry he is satisfied that the allegations contained therein are correct, then, subject to the provisions of this section, and unless the patentee proves that the patented article or process is manufactured or carried on to an adequate extent in the United Kingdom, or gives satisfactory reasons why the article or process is not so manufactured or carried on, the comptroller may make an order revoking the patent either—(*a*) forthwith; or

(*b*) after such reasonable interval as may be specified in the order, unless in the meantime it is shown to his satisfaction that the patented article or process is manufactured or carried on within the United Kingdom to an adequate extent:

Provided that no such order shall be made which is at variance with any treaty, convention, arrangement, or engagement with any foreign country or British possession.

(3) If within the time limited in the order the patented article or process is not manufactured or carried on within the United Kingdom to an adequate extent, but the patentee gives satisfactory reasons why it is not so manufactured or carried on, the comptroller may extend the period mentioned in the previous order for such period not exceeding twelve months as may be specified in the subsequent order.

(4) Any decision of the comptroller under this section shall be subject to appeal to the court, and on any such appeal the law officer or such other counsel as he may oppoint shall be entitled to appear and be heard.

Exemption of innocent infringer from liability for damages.

33. A patentee shall not be entitled to recover any damages in respect of any infringement of a patent granted after the commencement of this Act from any defendant who proves that at the date of the infringement he was not aware, nor had reasonable means of making himself aware, of the existence of the patent, and the marking of an article with the word "patent," "patented," or any word or words expressing or implying that a patent has been obtained for the article, stamped, engraved, impressed on, or otherwise applied to the article, shall not be deemed to constitute notice of the existence of the patent unless the word or words are accompanied by the year and number of the patent:

Provided that nothing in this section shall affect any proceedings for an injunction.

Information as to existence of copyright.

57. On the request of any person furnishing such information as may enable the comptroller to identify the design, and on payment of the prescribed fee, the comptroller shall inform such person whether the registration still exists in respect of the design, and if so, in respect of what classes of goods, and shall state the date of registration, and the name and address of the registered proprietor.

Cancellation of registration of designs used wholly or mainly abroad.

58.—(1) At any time after the registration of a design any person may apply to the comptroller for the cancellation of the registration on the ground that the design is used for manufacture exclusively or mainly outside the United Kingdom, and where such an application is made the provisions of this Act with respect to the revocation of patents worked outside the United Kingdom (including those relating to costs) shall apply with the necessary modifications, except that there shall be no appeal from the decision of the comptroller.

(2) Such ground as aforesaid shall be available by way of a defence to an action or infringement of the copyright in the design.

Offences.

89.—(2) If any person falsely represents that any article sold by him is a patented article, or falsely describes any design applied to any article sold by him as registered he shall be liable for every offence, on conviction under the Summary Jurisdiction Acts, to a fine not exceeding five pounds.

(3) If any person sells an article having stamped, engraved, or impressed thereon or otherwise applied thereto the word "patent," "patented," "registered," or any other word expressing or implying that the article is patented or that the design applied thereto is registered, he shall be deemed for the purposes of this section to represent that the article is a patented article or that the design applied thereto is a registered design.

THE WINCHESTER ·351 SELF-LOADING RIFLE.

This is a weapon which has hardly received the attention that its technical importance seems to justify. The explanation for its apparent neglect may possibly rest in the circumstance that the public regard the production of well thought out rifle mechanism as a part of the ordinary routine business of the Winchester Arms Company. When they brought out their automatic ·22 calibre rifle some years ago they received full credit for the interesting departure

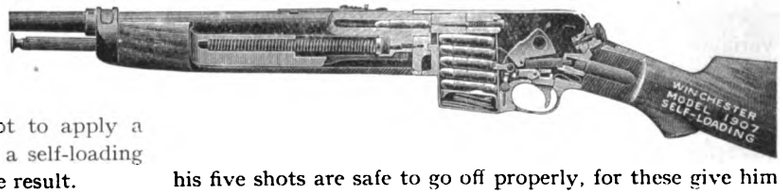
which had been registered, but the subsequent models firing more powerful cartridges on the same self-loading principle have been taken more for granted that the circumstances warrant. The recent Bisley Meeting afforded an excellent opportunity for demonstrating the extraordinary efficiency of the self-loading action. Eleven out of

Ten Shots at 40 Yards in 10 Seconds.

15 places in this competition were won with the Winchester Automatic Rifle, and no hitch occurred during any part of the shooting. Inconceivable as it may seem one of the competitors in the event which was open to all automatic rifles succeeded in the course of one minute in getting off 53 aimed shots, 47 of which hit the target. Some idea of the merit of this performance can be gained from our own humble attempt to apply a somewhat similar kind of test to the rifle as a self-loading arm, and the accompanying target shows the result.

It should be explained that Mr. Nelson, the winner of the Bisley competition, used the ·32 automatic, whereas our own test was conducted with the ·351 high-power rifle firing the cartridge here illustrated. Our test consisted in charging the magazine with five cartridges, and operating the plunger so as to pass No. 1 round into the chamber. Careful aim was taken from a gunmaker's table rest at the bullseye here reproduced, the distance being 40 yards. The first shot was aimed with due deliberation, and then four others were rattled off as quickly as the aim could be recovered after each shot had been fired. The time elapsing between the firing of the first and the fifth rounds was carefully noted, and the period occupied was in every instance ten seconds. At the third attempt familiarity with the somewhat unusual conditions had been gained, and the accompanying remarkably fine target was produced. The isolated shot was No. 1 round, and those making a single hole on the lower right-hand edge of the bull were fired during an average time interval of two-and-a-half seconds. So quickly was the rifle manipulated that it seemed inconceivable for any material gain in rapidity of aimed shooting to be registered, yet we are faced with the circumstance that Mr. Nelson fired ten times our number of shots in five times as long, with the added operation of substituting a full magazine for the exhausted one at the end of every five rounds. The aiming of the first shot from the full magazine, the time for which was excluded from our own record, must also be taken into account.

Where long strings of shots have to be fired under competitive conditions the shooter soon learns to avoid the delay incidental to the preliminary working of the spring plunger for seating the first cartridge in the chamber. This delay is obviated by inserting a spare cartridge in the chamber, afterwards introducing the filled magazine. The shooter then fires five shots, the sixth being left in the chamber in readiness for the next series, the empty magazine being replaced by a full one. The Bisley competition is of course of chief interest as showing the reliability of the mechanism and its capacity under military conditions of test. The sportsman is, however, only interested to know that



his five shots are safe to go off properly, for these give him the rapidity of manipulation of a double barrel gun, with the advantage of five rounds instead of two. The most enthusiastic advocates of ordinary magazine rifles for sporting use have always been forced to admit that the

two discharges in quick succession of a double barrel gun are of greater sporting value than five rounds from a magazine, with a time interval and disturbance of aim between the shots.

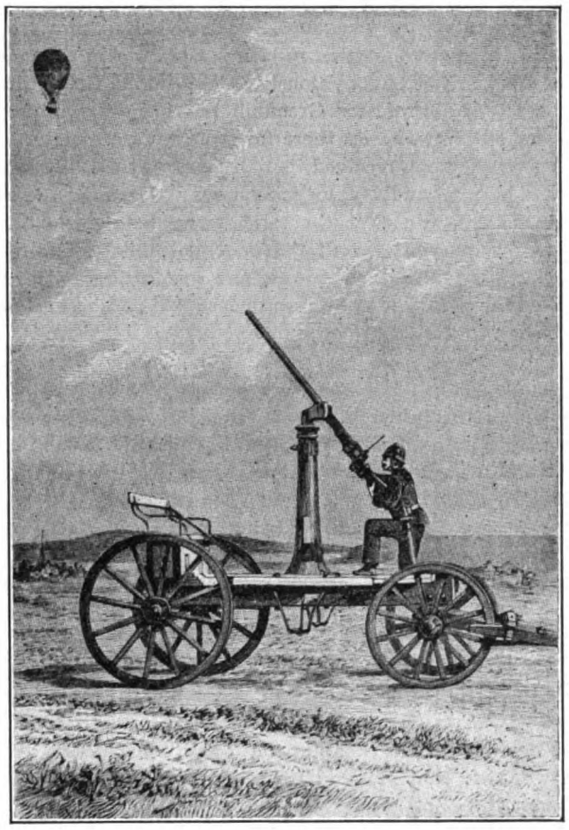
As regards ballistics the high-power Winchester self-loading rifle may be regarded as a practical weapon for game of the kind which can be dealt with by a 180-grain nickel-covered bullet having a muzzle velocity of 1800 odd feet-per-second. Its comparatively large calibre in proportion to the weight of the bullet gives it considerable stopping power, whilst the exposed lead nose gives the necessary expansion. The weapon is made to take down, and an examination of the parts shows them to be thoroughly sound and efficient from a mechanical standpoint. The over-all length is 38 inches, and as it can be fitted with the Lyman rear sight this length is ample for achieving a high standard of shooting accuracy. Our own test certainly suggests that the self-loading functions are not detrimental to a high quality of shooting.

AN ANTIDOTE FOR BALLOONS.

At a time when flying machines and dirigible balloons are very much in the air it is interesting to recall that upwards of thirty years ago Krupp designed a piece of mounted artillery for bringing them to earth. The extract, quoted below, from the *Scientific American* of September 30, 1876 may provide a few ideas on the subject of adding new elements of sport to the pastime of military aeronautics. Our still enterprising American contemporary wrote as follows in the year 1876:—

"Our illustration represents a curious weapon, made for the first time during the Franco-Prussian war, and devised by the celebrated German iron founder, Herr Krupp, at the request of Field-Marshal Von Moltke. It was intended to stop the balloon post, which it will be remembered was the only means of communication between Paris and the outer world during the protracted siege of that city. The weapon is an overgrown musket arranged and balanced on a standard so as to have free vertical as well as horizontal sweep, so that the artillerist can easily direct it toward any point in the sky. It was mounted on an artillery wagon, which was very strongly constructed, and to which two fast horses could be attached, so that the course of the air-ship which formed the target could be swiftly followed, or its path intercepted.

"All knowledge of this gun must have been carefully concealed from the French, for *La Nature* publishes the engraving as a curiosity, and mentions never having had any definite previous information of the weapon, although it appears that the Parisian aeronauts were often sorely puzzled to know what manner of fire-arm their enemies possessed which could throw huge bullets a height of 3200 feet into the air. The Germans, however, were better posted as to French affairs, for they knew the diameter of every balloon made in the city long before any were dispatched, probably through their elaborate secret spy system. Consequently the instant an air-ship was seen rising over the Parisian mansards, the Prussian vedettes noted the direction it was taking, also the name on the globe, and other points, and telegraphed the information to the rear. Immediately on the reception of the message, the balloon gun-carriage would start (the horses being constantly kept harnessed) at a tearing gallop across the country to



head off the balloon. As soon as the latter was sighted, the artillerist being informed of the diameter, could easily approximate its distance off, and so direct his piece with reasonable accuracy. The first intimation the aeronauts would have of the fact that their craft had excited interest in the Prussian camp would be a ball whizzing past them, followed by others. If ballast could be thrown out quickly enough, the balloon might rise out of range; if not, the moment a bullet went through the silk cover the adventurous voyage was ended, and a squad of mounted Uhlans would dash off to capture both balloon and aeronauts on their reaching *terra firma*. In this way quite a number of balloons toward the end of the siege were intercepted, and the balloon gun at the same time was brought to a remarkable state of perfection. Of the details of the weapon, our contemporary speaks not, probably because that information its German owners keep to themselves."

TEXT BOOK OF GUNNERY.

The fifth edition of this important Text Book differs from the earlier editions by being published in two parts, of which the second is yet to come. The first edition of 1883 and the second of 1887 were primarily intended for the use of the cadets at the Royal Military Academy but they were bought by the general public for the sake of the tables included, as well as for the somewhat elementary instruction contained in them. After 1887 the duty of preparation of the book was definitely transferred to the staff of the Artillery (or as it is now called the Ordnance) College and accordingly the third edition (1897) ceased to bear Major Mackinlay's name and was published anonymously as " revised at the Artillery College." As Professor Greenhill has been the professor of applied mathematics there for more than a quarter of a century, the book received its hall mark in this edition and ceased to be a handbook for schoolboys and became a serious scientific treatise. Whether or not the distinguished professor wrote every word, the general public not only in England but in all countries where science is studied, accepted the book and continues to accept it as a serious contribution to the science of gunnery.

The fourth edition " prepared at the Ordnance College " and published in 1902 was of the same high standard and continued the principle of dividing the subject into two portions, the first being for beginners and the second containing the more advanced mathematical investigations. The fifth edition (1907) "compiled at the Ordnance College" accentuates the division by being published in two completely separate parts, but by no means increases the reputation of the College or rather of the nation which pays for its publication, although its contents are still of the same high standard.

The volume under review has been set up in print at any rate in portions, for a couple of years, but it begins with a page of " Errata and additions." Of the errata, nine are concerned with the chapter on " gun construction " and show clearly that money has been grudged for the production of the book. Diagrams have been taken out of the text and better ones have been put in as insets, but the spaces whence the diagrams have been removed have been simply left naked, and there they stand grinning at the reader like a toothless hag. The 1902 edition had a page of " errata " also, chiefly concerned with the erroneous numerals in the tables, some forty in all. Tables of figures are expensive to set up and when once stereotyped they are difficult to alter, but in the case of a standard text book, the errors ought to be corrected, for very shame, or at any rate if the expense is too great, the " errata " ought to be repeated in each edition, yet this has not been done.

Our copy refers on page 126 to " figure 15 " and although pp. 127 and 128 have each a gaping blank, the figure has to be supplied by the imagination.

The part of the text-book now published is a revision of Part I. of the 1902 edition together with the gunnery tables, less table XII. (of British ordnance) but with the addition of an appendix on armour, which latter is a most welcome return to old traditions. Chapter I. and II. (1) are practically unaltered, but Chapter II. (2) on the application of the ballistic tables has been completely rewritten. As this section is the one of greatest interest to the public since it teaches them the application of the ballistic tables, its revision is fortunately timed. The trade is now face to face with a new problem of exterior ballistics, owing to the introduction of a novel shape of bullet and it is not too much to say that during the last few months and for the next few months, more computations dealing with the subject matter of this chapter will be performed in England than have been performed for years instead of months past. The new book follows the old one in its general lines but very much more attention is given to those apparently petty points of detail, such as the planning of the work and the ruling of columns and the general co-ordination of ideas, which in the past have been such pitfalls to young gunmakers. Arithmetic of the simplest sort is the basis of these computations and arithmetic is one of the hardest things to do correctly. Although most problems in this chapter are worked out for several guns in parallel columns, it would not be wrong to insist upon every gun being taken through its paces in two phases in parallel columns. In a simple time of flight problem such as Problem 6, there are some eight or ten computations to be done, none of which has any particular relation to the others, but in any one of which an error affects the result. By working the problem in parallel columns, inserting a small difference in the data, not only can arithmetical errors be observed, but actual printer's errors in the tables are discounted and noticed by reason of the sudden change in the differences.

The intelligent reader will note the great detail in the range of table work following this section, and possibly this publication will save the Ordnance Committee and other bodies responsible for range tables, much more work in the future. The answers to many of the questions which are asked in the House of Commons are to be found here.

The principles of gun construction are of interest to a very limited body of men and although thirty pages are devoted to the subject, it is difficult to see why fifteen if not twenty of them were not relegated to the second part. Two formulas and one example would satisfy most people, especially if the example was worked out in a schematic way.

On the matter of internal ballistics, little can be said. The editors know the subject—no people better—but they are not allowed to use their knowledge to the full. Every one knows that Colonel Holden and Major Mansell, Colonel Heffernan and others have written at length and almost exhaustively on this subject, practically and mathematically and that the Mathematical Referee to whom their writings are submitted before approval, is a professor in the Ordnance College. Yet the rules of the service lie in this man's hands and recourse has to be made to the communications of a War Office contractor to a scientific society.

Such things ought not to be. If it is worth Sir Andrew Noble's while to publish the results he obtains by his experiments in connection with the firm of Armstrong, our War Department experiments, when they deal with scientific matters should similarly be worth publishing.

ROUND THE TRADE.

The heartiest wishes for future success will be extended to Mr. A. R. Berry, who was recently offered, and has accepted, the post of Assistant Secretary to the New Explosives Company. A sentimental interest attaches itself to this appointment, for Mr. Berry is re-joining his old chief, Mr. L. G. Duff Grant. His new duties commence on the day this journal is published; and it represents a fresh page of Mr. Berry's career, who may justifiably be regarded as one with an important future in the explosives industry. Though only midway between thirty and forty he can look back on a few months short of twenty years' service in the explosives business. It was in March 1888 that he joined the Smokeless Powder Company, where he worked as junior member of the office staff under the late Mr. J. D. Dougall and Mr. Duff Grant. Mr. F. W. Jones joined the Company a year later, so that Mr. Berry's connection with "smoke," to use an office phrase, predates that of another member of the Company who has achieved fame on the technical side of explosives. Mr. Berry's career in the office was marked by steady promotion, for we find that in June 1891 he was appointed chief clerk and accountant, and in September of the following year he became acting secretary in the absence of Mr. Grant who went on tour in America. The Company was reconstructed in the year 1894, and Mr. Berry received the appointment of assistant secretary in September 1895. This entitled him to join the Institute of Secretaries, of which his chief was one of the leading spirits. So early as 1899 Mr. Berry was dispatched to America on a mission concerned with the interests of Rifleite. He first proceeded to Canada, and from thence he went to the United States for the purpose of meeting the officials of the American E.C. Company, on which concern he had occupied a staff position since the year 1897. A period of inter-regnum then followed, in which the Smokeless Company was absorbed by Schultze. Mr. Berry dividing his time between the two businesses. On the 1st of January 1905 he became assistant secretary to the Schultze Gunpowder Company, whilst in 1904 he became secretary of the American Company. This very brief summary of the incidents of a busy office life gives but an indirect idea of the vast amount of technical administrative work which has fallen to Mr. Berry's lot during the twenty years of his connection with explosives. That his labours have been largely technical is exemplified by our own personal knowledge that he is most expert in the handling of a sporting cartridge business, finance and technical knowledge being closely allied in the working of a cartridge department. No one knows better than Mr. Berry how to arrange purchases and specifications so that satisfaction to the shooter and profit to the loader are harmoniously combined. In advertising matters he has gained a large experience, and yet the departments here considered represent a mere fringe of the accountancy and company details which are for ever in course of treatment in an office with the reputation for doing things well. The New Explosives Company will find many openings for utilizing the active and well-directed energies of Mr. Berry, and Mr. Duff Grant has certainly done well to secure for assistant one who, in the light of past experience, is certain to prove an efficient *alter ego*.

Captain John Herschel Hardcastle, late R.A., has joined Nobel's Explosives Co., Ld., and the area of his duties will be such that his private address will remain 70, Burnt Ash Road, Lee, S.E., as before.

Messrs. Charles Osborne & Co., Ld., state that they have received a cable from the Union Metallic Cartridge Company announcing that the American team in the recent Palma match used only U.M.C. cartridges with pointed bullets.

In connection with the affairs of the late Mr. Robert Hamilton, explosives agent in Scotland, an offer has been made to the creditors in excess of the amount available from the deceased's estate, which allows for the payment of a dividend of 10s. in the pound.

Just as a barrister is advertised by association with a *cause célebre*, so an explosive gains fame from being used in historic blasts. With Roburite thus rests the distinction of having brought to earth the disembodied legs of the late Wembley tower, a tower which, built in imitation of the one at Paris, was not completed for want of funds.

The first meeting of creditors under the receiving order made against Mr. H. de M. Snell was held on the 16th ult. The debtor came to England at the end of 1903 with a free capital of £6,000, and became interested in the Rexer Machine gun. He formed the Rexer Arms Co., Ld., and entered into contracts for the manufacture of weapons. The Company is now in liquidation, and the debtor estimates that he has lost about £15,000 in connection with it.

On the eve of the opening of the shooting season, French sportsmen have vituperated their Government, which has the monopoly of powder, because they could not obtain all the ammunition they required. The director of the national powder mills at Sevran-Livry where the T and J smokeless powders are made, informed a *Matin* reporter that the department could satisfy everybody if the depositaries did not wait until the last moment before sending in their orders, probably because their depots are not suitable for keeping a large stock for any length of time. In order to deal with the season's rush of orders the Government is building a new magazine capable of containing 35 or 40 tons of powder. It will be ready next year, its erection having been necessitated by the great increase in the consumption of smokeless powders, from 39 tons in 1902 to 75 tons in 1906, and it is said that this year the figure will probably reach 85 or 90 tons.

The report and accounts of the Birmingham Small Arms Co., Ld., do not deal with the profits earned by the Eadie Company since the amalgamation, but the balance sheet takes account of the altered arrangement of the assets and liabilities. The profit for the year is £80,252 against £74,112 in the previous 12 months. With £11,363 brought forward there is an available surplus of £91,615 after allowance for depreciation. Massing the interim dividends with the final distribution now recommended this sum is allocated as follows:—Five per cent on the preference shares and ten per cent and an added five per cent. bonus on the ordinary shares, free of income tax £55,358; transfer to reserve fund (making it £100,000) £25,000; carry forward £11,256. The profits made by the Eadie business have been applied to paying an equivalent interest to the above on the shares issued in connection with the purchase, and to writing off depreciation on the assets taken over. The report contains a most hearty appreciation of the past services to the Company of Mr. Hubert Wallace who has retired from the managing directorship of the Company, but remains vice-chairman.

Acknowledgment has not yet been made of the receipt at this office of a publication entitled *La Technique du Ballon* by *M.* G. Espitallier, the publisher of which is Octave Dion, 8 Place de l'Odeon, Paris.

The Kynoch Company announced at the middle of last month that they had decided to reduce the price of their soaps to the level of other makers. It is understood that the break up of the trust resulted in a renewal of the competition, whereby prices have been reduced although the market rates for raw material do not justify the reduction which has been made.

In connection with the hooligan outrages in France strong complaints are being made that revolvers are sold at such low prices that undesirable persons possess them and so increase the difficulty of the authorities in dealing with disorder. Whilst our own Pistols Act has caused a good deal of inconvenience to persons desirous of purchasing pistols for legitimate use, statistics show that the trade in inferior weapons of a kind likely to be put to a wrong use has been greatly restricted.

The London Small Arms Co., Ld., have forwarded a sample of the new War Office miniature rifle, fitted with a top cover for holding down the extractor, together with a gas orifice, the object being to overcome the difficulties due to extractors blowing out, the same having formed the subject of previous comment. The efficiency of the new device can only be satisfactorily tested by firing excessive charges capable of bursting the cases at the rim and witnessing the effects produced. The experiments in question cannot be completed in time for the present issue, but it is hoped that definite results will be obtained in time for report in the next number.

A good deal of public attention has been devoted to the recent seizure of a quantity of percussion caps which had been illicitly placed on board the steamship "Morocco" by two members of the crew, one a German and the other a Spaniard. The seizure was made at Plymouth by the Dartmouth police who acted on instructions from the owners. Some 30,000 percussion caps were seized in the forecastle, and the two persons concerned were charged with being in unlawful possession of the same. The bench fined the men £21 each with the alternative of three months imprisonment. The action taken arises from the unsettled condition of affairs in Morocco, and the consequent need to restrict the dispatch of war supplies thereto.

Mr. F. C. Borer has recently undertaken the control of the newly-formed shooting department of our contemporary, *Farm Life*, and amongst one of his contributions is a most interesting article regarding spurious guns, from which the following extract has been taken :—"There is, again, the case of a man who, from various causes, has ceased to have business premises—perhaps has come upon evil days by bankruptcy or otherwise, or else bears the same name as that of an honoured firm. Whatever the reason, his name upon a gun gives it a value it would not possess were it not for the fact that upon a sporting weapon it had stood for many years as a guarantee for quality and workmanship. An unscrupulous manufacturer will give such a person five shillings or seven shillings and sixpence for the use of his name, and that gun goes out to the world to deceive. They are sold through auctions, pawned with country pawnbrokers, or sold as bargains through the medium of a private advertisement. They may be fair shooting guns, but stripped of the value carried by the name they bear, they are worth about as many shillings as they are supposed to be worth pounds."

The South British Trading Company, whose businesslike management of the Stevens and Savage rifle agencies has been a great boon to gunmakers dealing in these weapons, have still further extended their field of activity by commencing the sale of standard-dimension targets for miniature rifle shooting. Some twelve or more different kinds of targets are specified in the price list which has been issued. These cover the N.R.A. miniature standard targets for all distances up to 100 yards, also the 10-ring decimal, the double 10-ring decimal, whatever that may be, and the National Air Rifle Association's standard targets. These targets are priced for printing on paper, wood pulp and white card. The cost is reasonable, and subject to a ten per cent. trade discount. Yet another development of the Company is that they have been appointed sole agents for Lyman sights in this country. These useful accessories for miniature and other rifles have achieved a very large sale, the only drawback being that stocks are at times apt to run rather low in respect to particular forms of sights. Under the able direction of Mr. Dudley Wilson, who is manager of the gun section, there is no doubt that supplies will be carefully harmonised with the requirements of the trade by one who has enjoyed an unexampled experience in all that appertains to guns and rifles.

THE ACTION OF WIND ON RIFLE BULLETS.

SIR,—I read your 44th Lecture to Young Gunmakers with great pleasure and interest. For years I have been battling in favour of the solution of the wind problem which you now decide upon as correct. It is, however, really due to General Didion and ought to go out in his name, as I think I explained once before. Captain Younghusband only applied Didion's method to the special case of rifled projectiles and he did so because a rifled shot flies point first and therefore exposes at all times the same cross sectional area to the resistance of the medium through which it is travelling.

For the lateral deviation I think you will agree with me that Professor Greenhill's formula is preferable to your working rule, because it gives the result for any rifle at any range, directly in minutes instead of feet.

His formula is

$$\theta = \frac{W \times N}{c \times \frac{1320}{K}}$$

Where θ is the minutes or "degrees" of wind allowance due to a wind of W miles per hour at a range of N hundreds of yards with a bullet whose ballistic co-efficient $\left(\frac{w}{or\ n\ d^2}\right)$ is c.

For modern high velocity rifles K is about 70 for target work and n is about 0.8 for Metford or blunt bullets and about 0.5 for pointed bullets. For the ·303 service cartridge the rule reads :—Multiply the velocity of the wind in miles per hour by the hundreds of yards in the range and divide by 8 to get the "degrees" of wind at any range"

For the Swift or P.P. bullet of 225 grains divide by 14 and for the Velopex divide by 10.

A good working rule for the effect on range of a head wind is given by the same authority.

$$\text{correction in yards} = \Delta \times = \frac{5}{c} \frac{w}{v} N^2$$

where v is the muzzle velocity in f.-s.

J. H. HARDCASTLE,
Captain late R.A.

LECTURES TO YOUNG GUNMAKERS.

XLV.—CARTRIDGE LOADING MADE EASY.

In the lecture which was published in the last June issue particular pains were taken to describe an entirely new method of working out cartridge loads. The principle adopted was made clear with reference to a series of tabulated particulars relating to the 12-bore cartridge. In the interval the same idea has been applied to the remaining bores of shot gun in popular use, and the fresh experience which has been gained has resulted in considerably simplifying the arithmetical processes involved. The object of the new process of examining shot gun charges is to enable the gunmaker or loader, by reference to two tables, to decide whether any specified charge of powder and shot is a practical one for a given cartridge and what thickness of felt must be used to give a satisfactory result. When it is borne in mind that there are six well-known gauges of cartridge having a variety of lengths for each gauge, it will be seen that the variations due to the cartridge alone are considerable; but when these are multiplied by all the possible and impossible combinations of powder and shot for each size and length of cartridge it will be seen that the accompanying tables cover a seemingly infinite number of combinations. The extensiveness of the ground covered makes the solution on the ready-reckoner principle of so many cartridge loading problems appear impossible; but the explanation as to how this end has been achieved is fairly simple. The work involved in these numerous calculations has been performed once and for all in the preparation of the tables which are now put forward. The measurements have been carefully arrived at by the use of special gauges prepared for the purpose in view, and the space occupied by the components of the charge having once been tabulated there is no need to change them so long as cartridges continue to be made to a fairly uniform pattern. The first table, which now appears, is the one upon whose preparation all this attention has been lavished :—

TABLE I :—*Base of cartridge to face of powder (compressed ·12in.) plus two twelfth-inch cards.*

42-GRAIN POWDERS.

8	10	12	16	20	28
grs. in.	grs. in.	grs. in.	grs. in.	grs. in.	grs. in.
70 1·39	46 1·09	40 1·07	33 1·09	30 1·13	20 ·94
71 1·40	47 1·10	41 1·09	34 1·12	31 1·16	21 ·97
72 1·41	48 1·12	42 1·11	35 1·14	32 1·18	22 1·00
73 1·42	49 1·13	43 1·13	36 1·16	33 1·21	23 1·03
74 1·43	50 1·15	44 1·15	37 1·19	34 1·24	24 1·06
75 1·44	51 1·16	45 1·17	38 1·21	35 1·27	25 1·09
76 1·45	52 1·18	46 1·19	39 1·24	36 1·29	26 1·12
77 1·46	53 1·20	47 1·21	40 1·26	37 1·32	27 1·15
78 1·47	54 1·22	48 1·23	41 1·28	38 1·34	28 1·18
79 1·48	55 1·23	49 1·25	42 1·31	39 1·37	29 1·22
80 1·49	56 1·25	50 1·27	43 1·33	40 1·40	30 1·25
		51 1·29			
		52 1·31			
		53 1·33			
		54 1·35			
		55 1·37			

33-GRAIN POWDERS.

8	10	12	16	20	28
grs. in.	grs. in.	grs. in.	grs. in.	grs. in.	grs. in.
55 1·41	40 1·16	30 1·03	25 1·07	20 ·99	15 ·98
56 1·43	41 1·18	31 1·05	26 1·10	21 1·02	16 1·02
57 1·44	42 1·20	32 1·08	27 1·13	22 1·06	17 1·06
58 1·46	43 1·22	33 1·10	28 1·16	23 1·09	18 1·10
59 1·47	44 1·24	34 1·13	29 1·19	24 1·13	19 1·14
60 1·49	45 1·26	35 1·15	30 1·22	25 1·16	20 1·18
61 1·50	46 1·28	36 1·18	31 1·25	26 1·19	21 1·22
62 1·52	47 1·30	37 1·20	32 1·28	27 1·23	22 1·26
63 1·53	48 1·32	38 1·23	33 1·31	28 1·26	23 1·30
64 1·55	49 1·34	39 1·25	34 1·34	29 1·30	24 1·34
65 1·56	50 1·36	40 1·28	35 1·37	30 1·33	25 1·38
		41 1·30			
		42 1·33			
		43 1·35			
		44 1·38			
		45 1·40			

NOTE.—$\frac{3}{8}$ inch = ·37 in.; $\frac{7}{16}$ in. = ·43 in.; $\frac{1}{2}$ in. = ·50.

It shows with regard to 8-bore, 10-bore, 12-bore, 16-bore, 20-bore and 28-bore cartridges the particulars which were given in the lecture already referred to for 12-bore cartridges only. A wide range of charges was selected for each gauge of cartridge, these giving an ample variation on either side of the loads most commonly adopted. The exact space occupied is set down opposite each charge in grains. For practical reasons it was necessary to make the measurement from the base of the cartridge to the top surface of the powder charge. The original measurements were made with the powder in an uncompressed condition, but as a definite amount of compression is necessary in cartridge loading the application of the table to practical problems was simplified by deducting from the measured length what a large number of experiments and calculations have shown to be a reasonable amount of compression to apply. This mean compression—in practice it may be taken as a minimum compression—has been fixed at ·12 of an inch, which is as nearly as possible one-eighth in fractions. In order to add further simplicity to the working out of results from the table it was necessary to take account of the two twelfth-inch cards on either side of the felt. Their combined thickness is ·17 of an inch, so that the tabulated powder measurement includes the thickness of the cartridge head, the powder in a due state of compression and the two card wads. The remaining element to be decided before a cartridge load can be considered from an arithmetic point of view is the space required for the accommodation of the shot, the top wad and for making the turnover. These measurements were tabulated in a very early lecture, but the table is now reproduced because more recent examination of the subject has shown that whilst ·3 of an inch is a satisfactory allowance for a 12-bore turnover it must be increased for the larger bores and reduced somewhat for the smaller calibres of

cartridge. The following table accordingly shows the allowance which must be made for the amount of shot charge to be inserted in a cartridge :—

Table II.—*Distance from mouth of case to over-felt wad.*

(Turnover ·35 in.) 8		(·32 in.) 10		(30 in.) 12		(28 in.) 16		(25 in.) 20		(20 in.) 28	
1¾	1·25	1¼	1·07	1	·98	¾	·89	⅝	·84	½	·81
1⅞	1·30	1 5/16	1·10	1 1/16	1·02	13/16	·94	11/16	·90	9/16	·88
2	1·36	1⅜	1·14	1⅛	1·05	⅞	·98	¾	·95	⅝	·94
2⅛	1·43	1 7/16	1·17	1 3/16	1·09	15/16	1·03	13/16	1·01	11/16	1·01
2¼	1·49	1½	1·20	1¼	1·13	1	1·08	⅞	1·06	¾	1·07
		1 9/16	1·24	1 5/16	1·16	1 1/16	1·13	15/16	1·12		
		1⅝	1·27	1⅜	1·20	1⅛	1·18				
				1 7/16	1·24						
				1½	1·28						

Note.—⅜ in. = ·37 ; 7/16 in. = ·43 ; ½ in. = ·50.

It will be seen that the amount allowed for turnover has been noted in each one of the squares in which the bore of cartridge is specified. The idea of introducing this further refinement of the tabulated values of the charge is to give as nearly as possible a series of measurements which will reproduce actual working conditions. It does not positively follow that the results will be truly reproduced in every cartridge loaded. The thickness of the caulk in the cartridge base is apt to vary within certain limits. The size of shot used may also exercise a slight difference, which may need to be taken into account in fixing the thickness of the felt wadding employed. The present tables aim only at giving the nearest average result, and the figures have been so carefully checked that they will be true without modification for a very large percentage of any ordinary output of cartridges. Every element of the cartridge case, powder, shot, card wad and felt wad is liable to variation ; but the standard compression provided for in each instance will take up these variations so that a well-loaded cartridge should result.

Turning now to the actual employment of the tables, the loader in the ordinary course of his business will be asked to fill a certain quantity of powder and shot into a certain gauge and length of cartridge. Let us suppose for instance that he receives an order to fill 42 grains of Schultze and 1⅛oz. of shot into a 2¾-inch 16-bore cartridge. This is a 12-bore load ; and he wishes to know whether it is a practical charge for a long 16-bore case. Table I. tells him that the powder will occupy 1·31 inch, whilst Table II. gives the further information that the shot will occupy 1·18 inch. The two added together give a total length of 2·49 inches. The difference between this value and 2·75, the decimal equivalent for 2¾-inch, equals ·26, which means that there is enough room for a quarter-inch felt wad, but not for a ⅜-inch felt wad, which is the minimum thickness which can be used consistent with good loading. The *Sporting Goods Review* loading card specifies the charge for this cartridge as 39 grains and 1oz. These components leave the exact amount of space required for a 7/16-inch felt wad, and this thickness therefore, seems preferable to the ⅜-inch wad specified in the loading card. By examining a few other trial charges it soon becomes obvious that the best maximum charge for a 2¾-inch 16-bore cartridge is 40 grains of powder and 1 1/16oz. of shot. Using a ⅜-inch thickness of felt with this charge the standard compression is increased the hundredth of an inch, viz., ·01 of an inch, this being because the ⅜-inch felt wad has a decimal length of ·37, and the charge considered leaves only ·36 of an inch for its accomodation. The variety of charges which may be considered on this basis is very considerable, and the cartridge loader who will take the trouble to familiarise himself with the tables will rapidly acquire great facility in their use. The powder charge measurement for nearly all the loads specified is something over an inch, and the same applies to the majority of the shot charges. In considering for instance 25 grains of E.C. and 1 3/16oz. of shot in a 2½-inch 20-bore cartridge the whole numbers may be ignored, and the mental process for calculating the wad thickness resolves itself into adding 16 and 1, and deducting 17 from 56 when the answer becomes 39. The full working is 1·16 + 1·01 =2·17 . . . 2·56 -2·17 =·39. This represents two units of space (hundredths of an inch) more than the length of a ⅜-inch felt (·37), and it means that the standard compression of ·12 will become ·10 when this particular load is used with the most suitable size of felt wad. The resulting compression lies well within the allowable margin of variation. Examples, such as the above, might be multiplied indefinitely, but better than occupying space with the specification of solitary examples will be to reproduce the following table which shows a carefully selected series of charges for all bores applicable for use with 42-grain powders, such as Schultze and Amberite :—

Table III.—*Some standard 42-grain powder charges.*

Bore.	Length of Case.	Grains of Powder.	Oz. of Shot.	Combined Length compressed ·12 in.	Felt wad.			
	in.				in.		in.	
8	3¼ (3·25)	77	2	2·85	7/16	gives	·12	comp.
10	2⅞ (2·87)	52	1⅝	2·65	7/16	,,	·13	,,
,,	,, ,,	52	1 9/16	2·42	½	,,	·17	,,
,,	,, ,,	52	1½	2·38	½	,,	·13	,,
,,	2⅝ (2·62)	49	1 7/16	2·30	⅜	,,	·17	,,
,,	,, ,,	49	1⅜	2·27	⅜	,,	·14	,,
,,	,, ,,	49	1 5/16	2·23	7/16	,,	·16	,,
16	2¾ (2·75)	40	1 1/16	2·39	⅜	,,	·13	,,
,,	,, ,,	40	1	2·34	7/16	,,	·14	,,
,,	,, ,,	40	15/16	2·29	½	,,	·16	,,
,,	2½ (2·56)	36	15/16	2·19	⅜	,,	·12	,,
,,	,, ,,	36	⅞	2·14	7/16	,,	·13	,,
,,	,, ,,	36	13/16	2·10	½	,,	·16	,,
20	2¾ (2·75)	36	15/16	2·40	⅜	,,	·15	,,
,,	,, ,,	36	⅞	2·34	7/16	,,	·15	,,
,,	,, ,,	36	13/16	2·29	7/16	,,	·10	,,
,,	2½ (2·56)	33	13/16	2·22	⅜	,,	·15	,,
,,	,, ,,	33	¾	2·16	7/16	,,	·15	,,
,,	,, ,,	33	11/16	2·11	½	,,	·17	,,
28	2½ (2·50)	25	11/16	2·12	⅜	,,	·11	,,
,,	,, ,,	25	⅝	2·05	7/16	,,	·12	,,
,,	,, ,,	25	9/16	1·99	½	,,	·19	,,

Note.—⅜ in. = ·37 ; 7/16 in. = ·43 ; ½ in. = ·50.

The process of calculation is clearly shown by the method of tabulation adopted. The first essential details are the bore and length of the cartridge case; next follow the grains weight of the powder charge and the amount of shot in ounces. The corresponding measurements for these two items have been extracted from Tables I. and II., and their total is shown in the column entitled "Combined Length." The difference between this combined length and the decimal length of the cartridge case gives the space available for the felt wad, and the nearest size for the available space is set down in the last column. According to whether the difference is upwards or downwards so the standard compression of ·12 is varied one way or the other. A corresponding series of loads has been selected for 33-grain powders, of which E.C. and Smokeless Diamond are typical examples, and they are specified in detail in the following table:—

TABLE IV.—*Some standard 33-grain powder charges.*

Bore.	Length of Case.	Grains of Powder.	Oz. of Shot.	Combined Length compressed ·12 in.	Felt wad.
	in.				in. gives in. comp.
8	3¼ (3·25)	60	2	2·85	7/16 gives ·15 comp.
10	2⅞ (2·87)	44	1 9/16	2·48	7/16 ,, ·16 ,,
,,	,, ,,	,,	1½	2·44	7/16 ,, ·12 ,,
,,	,, ,,	,,	1 7/16	2·41	½ ,, ·16 ,,
,,	2⅝ (2·62)	40	1⅜	2·30	3/8 ,, ·17 ,,
,,	,, ,,	,,	1 5/16	2·26	3/8 ,, ·13 ,,
,,	,, ,,	,,	1¼	2·23	7/16 ,, ·16 ,,
16	2¾ (2·75)	33	1	2·39	3/8 ,, ·13 ,,
,,	,, ,,	,,	15/16	2·34	7/16 ,, ·14 ,,
,,	,, ,,	,,	⅞	2·29	½ ,, ·16 ,,
,,	2½ (2·56)	28	15/16	2·19	3/8 ,, ·12 ,,
,,	,, ,,	,,	⅞	2·14	7/16 ,, ·13 ,,
,,	,, ,,	,,	13/16	2·10	½ ,, ·16 ,,
,,	,, ,,	,,	¾	2·05	½ ,, ·11 ,,
20	2¾ (2·75)	28	15/16	2·38	½ ,, ·12 ,,
,,	,, ,,	,,	⅞	2·32	7/16 ,, ·12 ,,
,,	,, ,,	,,	13/16	2·27	½ ,, ·14 ,,
,,	2½ (2·56)	25	1 3/16	2·17	⅜ ,, ·10 ,,
,,	,, ,,	,,	¾	2·11	7/16 ,, ·14 ,,
,,	,, ,,	,,	11/16	2·06	½ ,, ·12 ,,
,,	,, ,,	,,	⅝	2·00	½ ,, ·06 ,,
28	2½ (2·50)	20	⅝	2·12	⅜ ,, ·11 ,,
,,	,, ,,	,,	9/16	2·06	7/16 ,, ·13 ,,
,,	,, ,,	,,	½	1·99	½ ,, ·11 ,,

NOTE.—⅜ in. = ·37; 7/16 in. = ·43; ½ in. = ·50.

If these figures are compared with the ordinary tables of cartridge loads it will be found that they correspond very closely with the recommendations there given; but being based on systematic treatment of average values our own figures are most likely to be right where differences occur. The above two tables will be found to contain many charges which are not specified in ordinary loading instructions. This doubtless arises from the vast amount of labour which is entailed by experiments to determine an entire range of charges for a given cartridge. By the arithmetic process the range of choice can be greatly extended, because when once experiments have determined the maximum charge of powder and shot for any given cartridge experience tells us that the same amount of powder with reduced shot charges will give satisfactory results, so long as no felt wad thicker than half an inch is used and a sufficient compression of the charge is maintained. Practically, therefore, the two last tables contain all probable and reasonable combinations of powder and shot for cartridges of from 10 to 12-bore. A large variety of 12-bore charges was specified in the previous lecture, so that the outside bores receive exclusive attention in this lecture. In conclusion it should be explained that anyone wishing to work only from the two last tables should bear in mind that where the powder charge varies by a small number of grains from the amount specified the following allowances must be made:—

EFFECT PRODUCED BY TWO GRAINS ALTERATION OF POWDER CHARGE.

	8-bore.	10-bore.	12 bore.	16-bore.	20-bore.	28-bore.
42-grain powders	·02	·03	·04	·05	·05	·06
33 ,, ,,	·03	·04	·05	·06	·07	·08

These differences mean that a couple of grains more or less than the charge specified alters the compression by the amount stated. Dealing for instance with 28 grains of powder and 13/16oz. of shot in a 2½-inch 16-bore cartridge the compression is shown in the last table to be ·16 of an inch. If 30 grains is the charge ordered the compression is increased by ·06 inch, viz., from ·16 to ·22. The former value is already a maximum amount. Therefore the half-inch wad specified must be reduced to 7/16-inch, this reduction representing 1/16-inch less compression, viz., ·06 from ·21 = ·16. Few persons realise that two grains of powder make so much difference to the amount of wadding required in a cartridge, but this is only one of the many things which can be learnt by careful manipulation of the tables presented.

A PROBLEM IN EXPLOSIVE STORAGE.—A correspondent writes:—"I am working a Quarry of Quartzite which requires a variation of blasting agents, but there are difficulties in getting the limits of distance, for a Magazine, so I simply built a small brick structure with match board lining and double doors to use temporarily as 'Registered Premises.' These premises require a Police Certificate and the local Authorities cannot refuse to give it, but the Superintendent insists that the name of the explosive to be used, must be inserted in the Certificate, *i.e.*, Dynamite or the distinctive names of the Agents; and none other can be stored on the premises. I have asked him to simply insert 'Mixed Explosive including Gunpowder,' as the explosive used depends upon the nature of the work to be done, as well as trade prices, and so long as only an authorised explosive is used and stored, in the quantity fixed by the Order in Council, it appears to me that the Act is satisfied; the Superintendent declines this, and limits me to a specific agent. I shall be much obliged if you will tell me whether my request is correct, and how I may obtain the liberty to store explosives as they are required for the Quarry and according to trade prices." [As the above difficulty may arise again it may be interesting to present the solution which has been forwarded to our correspondent. The wording of Order in Council No. 16, Part III., paragraph 1 (a) certainly requires that the explosives should be specified; but if the superintendent does not care to grant the certificate for Classes II. to IV. it is open for the applicant to present the superintendent with the printed list of authorised explosives, and to ask him to enter all the names contained in the above classes in the certificate. ED.]

APPLICATIONS FOR PATENTS.

AUGUST 19—SEPTEMBER 21, 1907.

5,666A.* Automatic Breech Actions. K. A. Bräuning.
4,823A.* Recoil Loading Firearms. P. Mauser.
4,823B.* Breech Loading Firearms. P. Mauser.
4,823C.* Recoil Loading Firearms. P. Mauser.
4,823D.* Ejector for Recoil Loading Firearms. P. Mauser.
4,823E.* Magazine Repeat-Loading Firearms. P. Mauser.
4,823F.* Recoil Loading Weapons with Sliding Barrels. P. Mauser.
18,657.* Gun Covers. W. Richards.
18,703. Apparatus for the Recovery of Volatile Solvents. Cotton Powder Co., Ld., G. E. Arnold, A. S. Fox and A. C. Scott.
18,724. Air-Gun Pellet. L. Jeffries.
18,831.* Targets. W. L. van R. Denton.
18,879.* Target Practice Apparatus. F. Mitchell.
18,941.* Automatic Quick Firing Guns. Rheinische Metallwaaren und Maschinenfabrik (German application August 25, 1906).
18,964. Ejecting Mechanism for Small Arms. C. Ryland.
19,061. Telemeters. J. Edwin.
19,081. Gun Range Apparatus. H. R. Crooke and W. J. Griffiths.
19,104. Caps for Armour-Piercing Projectiles. R. A. Hadfield.
19,160.* Shields of Wheeled Gun Carriages. J. A. Deport.
19,162. Apparatus for Teaching Rifle Shooting. B. Dukes.
19,254. Range Collectors for Ordnance Sights. J. T. Dreyer.
19,366. Ammunition. A. Bray.
19,390. Triggerless Firearm. K. Beresford.
19,437. Small Arms Cartridge. K. Beresford.
19,456. Spring Guns. T. H. Robson and H. Robson.
19,519. Small Arms Sights. A. H. Hill and W. F. Williams.
19,565.* Aromatic Nitro Compounds derived from Solvent Naphtha. G. Schultz.
19,619.* Ammunition. F. Werner.
19,635. Ammunition Hoists. A. F. Petch and W. Osborne.
19,688.* Firearms. R. Frommer.
19,710.* Locking Catch for Firearms. R. Frommer.
19,838. Bullets. T. H. Stringer.
19,874.* Apparatus for Operating upon Cartridge Cases. F. Werner.
19,941. Bolt-Action Rifles. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
19,993.* Explosive. V. Ansay and C. Namèche.
20,006.* Lock Mechanism for Automatic Firearms. A. W. Schwarzlose.
20,234. Ordnance Sighting Gear. A. F. Petch and F. Duncan.
20,270.* Fuse Setting Appliances for Projectiles. Fried Krupp, A.-G. (German application January 11, 1907).
20,282.* Sighting Devices. F. A. Schanz.
20,388.* Apparatus for Operating upon Cartridge Cases. F. Werner.
20,439.* Cartridge Cases. S. O. Cowper-Coles,
20,440.* Firearms Trigger Device. R. Frommer.
20,455.* Firearm for Hand or Automatic Action. R. Frommer.
20,524. Wind Gauge Slide Adjusters. A. G. Parker.
20,569.* Device for Automatically Loading Revolvers. W. Gruner.
20,572. Electrically Operated Firearms. K. Beresford.
20,578. Air-Rifles. H. A. C. Schobbert.
20,586.* Shooting Gallery Apparatus. J. Sutherland.
20,609. Electrical Transmitting Apparatus for Gun Sighting. A. T. Dawson and G. T. Buckham.
20,629. Revolvable Targets. H. L. Cole.
20,690. Armour-Piercing Projectiles. R. A. Hadfield.
20,710. Gas Check Arrangements for Firearms. T. Gilbert Russell.
20,719. Breech Loading Small Arms. C. Ryland.
20,889.* Bolt Guns. L. B. Taylor and E. H. Parsons.
20,914. Ordnance Firing Gear. A. T. Dawson and G. T. Buckham.
20,931.* Explosives. M. A. G. Himalaya.

*These applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

AUG. 29—SEPT. 19, 1907.

COMPILED BY HENRY TARRANT

18,410 (1906). **Sighting Apparatus of Ordnance.** C. P. E. Schneider and E. Rimailho, France. The patentees explain their improved method of correcting sighting apparatus to counteract the inclination of the axle, when the apparatus is carried by the cradle or carriage. They note that they are aware of the existence of similar apparatus such as is dealt with in Patent No. 22,811, 1904. Accepted August 16, 1907.

18,637 (1906). **Breech Mechanism of Ordnance.** C. P. E. Schneider and E. Rimailho, France. Breech mechanism of the type in which the block, with interrupted threads, is carried on a shutter in alignment with the gun and behind the breech, is adapted so as that it shall not interfere with long recoil when firing at high elevations. The support carrying the block is adapted to run in beneath the barrel, and special arrangements are made for turning the block. Accepted August 20, 1907.

18,937 (1906). **Mountings for Ordnance.** C. P. E. Schneider and E. Rimailho, France. A device for enabling the weight of a gun and its slideway to be balanced exactly at any moment in order to facilitate the pivoting of the system round its trunnions during aiming operations. This device applies to long recoil gun mountings firing at high angles of elevation, in which the trunnions of the gun are located behind the breech. The balancing means consist of a spring. Accepted August 22, 1907.

19,408 (1906). **The Deletion of Muzzle Flames.** C. Duttenhofer, Germany. This explosive compound is an improvement of that set out in Patent No. 24,782, 1904. To this compound originally vaseline and alkali bicarbonate were added to prevent the appearance of muzzle flames, but on account of the hygroscopic nature of the latter substance the patentee now adds small quantities of indifferent substances such as oils or fats with precise quantities, 1% to 2%, of salts of dibasic organic acids, such as tartaric, lactic or oxalic acids. Accepted August 15, 1907.

19,622 (1906). **Target Apparatus.** H. M. N. Milton, Cairo. The target apparatus set out in this patent is so arranged that each marksman has a disappearing target and a screen is arranged so that he can only shoot at his opponent's target when his own is exposed. If he hits his opponent's target the latter is prevented from shooting. The device is intended to teach accurate and quick shooting. Accepted August 29, 1907.

19,932 (1906). **Lock for Magazine Feeders of Automatic Arms.** Prof. C. Dencker, Germany. (*See Selected Patents*).

24,382 (1906). **Safety Device for Automatic Pistol.** T. Carter and F. T. Murray, Birmingham. The mechanism dealt with in this patent consists of a simplyfied form of safety and locking device adapted for use in the automatic pistol of the "Webley" type. This safety device besides preventing inadvertent discharges is operated by the magazine spring to indicate to the shooter when the last cartridge has been discharged. Accepted August 29, 1907.

25,830 (1906). **Cocking Lever of Air Rifles.** The Birmingham Small Arms Co., Ld., and A. H. M. Driver. (*See Selected Patents*).

26,948 (1906). **Loading Apparatus for Ordnance.** A. T. Dawson and G. T. Buckham, London. A loading derrick fits and turns in a socket on the gun carriage, and may readily be withdrawn for transport. A jib is hinged to the crane post carrying at its free end a shot tray. The jib is actuated by hand through a wire rope and the crane may be fixed in any position. Accepted August 15, 1907.

29,528 (1906). **Firing Apparatus of Ordnance.** Rheinische Metallwaaren und Mf., Germany. That type of firing mechanism arranged automatically to strike the detonator immediately the breech is closed is altered so that in case of a misfire the striker may be recocked. Accepted August 8, 1907.

289 (1907). **Hydraulic Brake for Ordnance.** Rheinische Metallwaaren und Mf., Germany. A hydraulic recoil brake of the type described in Patent 27,093, 1903 is arranged so that an annular slide mounted free to turn on the piston rod and to slide coaxially with regard to it, and at recoil to bring passages for the braking fluid in the piston into or out of register with corresponding passages on the piston rod and at the return to bring other passages in the piston into or out of register with other passages on the rod. Accepted August 15, 1907.

1,471 (1907). **Fluid Brake for Ordnance.** Rheinishe Metallwaaren und Mf., Germany. A part of the wall of the cylinder of the recoil brake is arranged so that it may yield under the action of a spring to compensate the expansion of the brake fluid due to increased temperature. Accepted August 15, 1907.

3,179 (1907). **Potassium Chlorate Explosive.** M. A. G. Himalaya, U.S.A. A potassium chlorate explosive in which this base is mixed to a batter with about one-third of its weight of water. An equivalent mass of batter of the same consistency, created by mixing starch and water, is added to the potassium chlorate batter at a temperature of 80°C, and a siccative oil such as linseed, or poppy seed is worked into the mass which is afterwards pressed and dried. It is claimed that the force and quickness of this compound is increased as compared with that of other similar explosives. Accepted August 22, 1907.

6,125 (1907). **Fore-sight Protector.** J. Lauber, Austria. A combined foresight protector and muzzle cover is held in position by the projecting end of the wedge holding the foresight. The muzzle cover is held in position by a spring and may be shifted to allow of the use of the bayonet without moving the protector part of the device. Accepted August 8, 1907.

7,031 (1907). **Detonator Shell Extractor for Ordnance.** Aktiebolaget Bofors-Gullspang, Sweden. An automatic extractor for withdrawing the spent detonating cartridge from the breech of big guns is dealt with in this patent. The extractor comes into operation when the breech is opened. Accepted August 8, 1907.

8,057 (1907). **Disappearing Gun Carriages.** Fried. Krupp, A.-G., Germany. The improvements dealt with in this patent relate to gun carriages, the platforms of which are connected to armour covers. Arrangements have been made so that the aperture in the armour cover necessary for the gun barrel is considerably shorter than heretofore. Accepted August 22, 1907.

8,258 (1907). **Combination Peep and Open Sight.** G. H. Conrad, U.S.A. A spring member is fixed to the barrel at one end and at the other carries a disc hinged longitudinally across the middle. When the disc is open a peep sight is presented in its centre but when it is folded half the peep sight forms an open sighting notch. The sight may be elevated in the usual way. Accepted August 29, 1907.

8,592 (1907). **Implement for Fixing Fuse Detonators.** Nobel's Explosives Co., Ld., Glasgow and W. Muir, Linlithgow. (*See Selected Patents*).

9,045 (1907). **Loading of Ordnance.** E. C. L. Marzari, Paris. Apparatus adapted to facilitate the work of loading ordnance consisting in the employment on the gun carriage of a loading device which derives its working energy from the recoil movement of the gun. Accepted August 15, 1907.

9,777 (1907). **Telescopic Sights for Ordnance.** P. M. Justice, London (Agent for G. N. Saegmuller, U.S.A.). This patent deals with an improved form of the illuminating device for telescopic sights illustrated and described in Specification No. 5,965, 1907. A very small portion of the cross lines on the lens is illuminated without producing in the telescope such caustics or luminous areas as would hinder the observer from distinguishing a dim target. Accepted August 29, 1907.

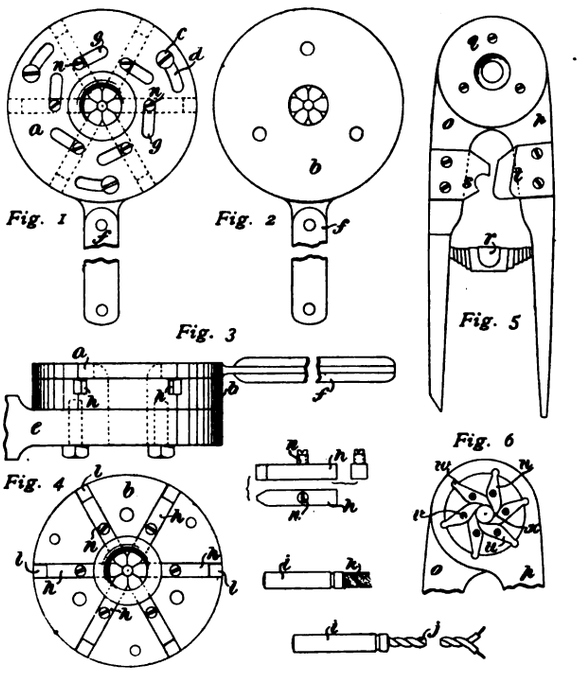
13,509 (1907). **Chain Rammers for Ordnance.** A. F. Petch and F. Duncan, London. Chain rammers for pushing home the projectiles for large ordnance are modified to be operated by a hydraulic cylinder carried on the gun slide instead of by a rotating hydraulic or electric motor. The vibration of the gun slide caused by the rotation of the motor is eliminated. Accepted August 22, 1907.

15,337 (1907). **Improvements in Automatic Fuse Setters.** Sir A. W. W. Barlow, Bart., W. Charlesworth, and W. J. Griffiths. (*This Specification is a Secret Document*).

SELECTED PATENTS.

IMPLEMENT FOR FIXING DETONATORS AND FUSES.

8,592 (1907). Nobel's Explosive Co., Ld., Glasgow, and W. Muir, Linlithgow. This implement, either for bench or hand use, is designed rapidly and effectually to fix a metallic detonator or similar tube upon an electric fuse or on the end of a safety fuse by a single closing movement.



The illustrations printed herewith show in Figs. 1 to 4 the implement adapted for bench use and Fig. 5 and 6 the hand tool. In the bench implement the two main parts *a* and *b* are held together by means of the screws *c* working in slots *d* which limit the rotary movement of the part *a* on the part *b*. The latter is rigidly fixed to the bracket *e* which is secured to the bench. The part *a* is turned by operating the handle *f* and the turning movement causes the slots *g* to force the sliding limbs *h* inwards (Fig. 4), so that their tapered jaws close round the detonator tube *i* into which the electric fuse *j* or safety fuse *k* has been inserted. In this way the tube is indented so that the fuse is firmly held in a water tight grip. The limbs *h* work in slots *l* in the main part *b*, and are forced inwards by the slot *g* through their rollers *n*.

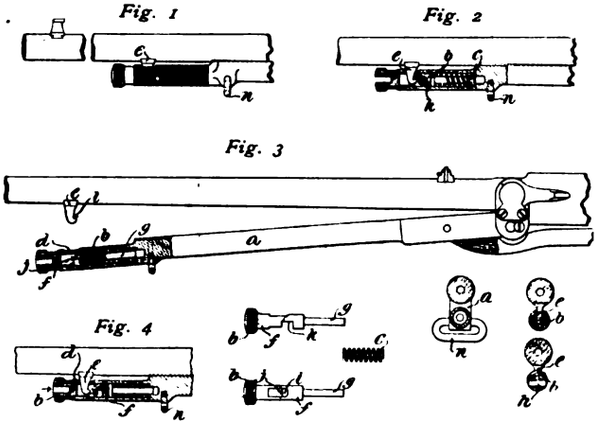
The hand implement works on a similar system. The body part *o* and the moving part *p* are held together by the cap plate *q*. These parts are provided with handles which are forced away from one another by the spring *r*. The fuse cutters *s* and *t* are provided. Upon the inner face of the part *o* the flat jaws *u* are pivotally fixed being attached by screws *v*, and their outer ends enter and work in circular recesses *w* in the movable part *p*.

The inner ends *x* of the jaws *u* are so shaped that when the legs of the device are pinched together in the hand the jaws are caused to close round detonator tube to indent it and secure the fuse.

The patentees state that they are aware of the "iris" type of shutter in cameras and of certain nippers having rotating jaws but do not claim such a movement of part *per se*. Accepted August 22, 1907.

IMPROVEMENTS IN B.S.A. PATTERN AIR RIFLE.

25,830 (1906). The Birmingham Small Arms Co., Ld., and A. H. M. Driver, Birmingham. This new arrangement of the fastening device adapted to hold the "cocking" lever of the B.S.A. type of air rifle in its closed position beneath the barrel is designed to obviate certain disadvantages of the snap action friction fastening now generally in use. The cocking lever of



the B.S.A. air rifle, as is well known, is used to compress the plunger spring and to force the plunger into engagement with the sear of the trigger mechanism. The old fastening for holding the lever to the underside of the barrel consists of a bevel ended spring bolt mounted on the end of the lever which is forced into engagement with a V-shaped groove cut in a projection on the underside of the barrel. The bolt first yields and then snaps into the groove, and when the lever is to be turned down again to compress the spring the bolt has to be forced out of its engagement by finger pressure or by pulling the lever away from the barrel.

The new fastening described in this patent and illustrated in the drawings reproduced provides a positive locking action besides facilitating the fitting of a sling swivel, and consists of a spring bolt piece mounted on and capable of movement in the longer direction of the lever. The lever may be automatically snapped into locking position, but to release it the spring bolt piece has to be pressed as indicated by the arrow in Fig. 4, to release the positive locking engagement of the bolt nose with the barrel hook.

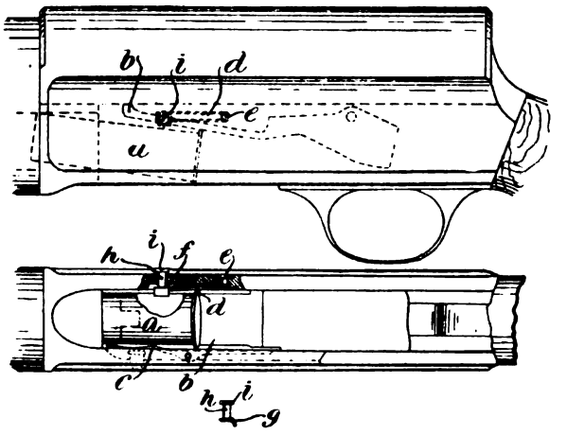
The forward end of the cocking lever *a* is hollowed out in tubular fashion to accommodate the bolt *b* and its spring *c*. The tubular part is provided with the slot *d* into which the hook *e* solidly attached to the barrel, may extend when the lever is "home." The body *f* of the bolt is made a sliding fit in the tubular portion of the lever *a* and its spring *c* works round the bolt stem *g*. In the position shown in Fig. 2 the bolt is forced to its highest point by the spring *c* and is held against further movement outwards from the lever *a* by the stop pin *h* shown as a white dot in Fig. 1. When the lever *a* is turned up to fasten it the inclined part *i* of the locking portion *j* of the bolt is made to slide easily over the rounded end of the barrel hook *e* until the spring *c* forces the bolt bodily upward so that it occupies the position illustrated in Fig. 3, the flat underside *k* of the bolt locking portion lying close in locking engagement against the flat part *l* of the barrel hook *e*. In order to disengage these locking surfaces the bolt has to be pushed downwards against the action of the spring *c* until the position in Fig. 4 is reached when the lever may be turned downwards on its fulcrum to "cock" the parts.

As will be seen from the drawings the sling swivel *n* may be fitted and used on the lever with this new form of fastening. The pull of the sling at an angle with the barrel and lever cannot disturb the fastening as it could if fitted in this position with the form of fastening heretofore used. The old friction snap fastening necessitated the fixing of the swivel on the barrel above the end of the lever and the sling was thus liable to interfere with the cocking action. Accepted August 22, 1907.

LOADING OF AUTOMATIC SMALL ARMS.

19,932 (1906). C. Deneker, Germany. The device illustrated below is an attachment for locking the feeder of Browning automatic small-arms in such a position that loading of fresh cartridges into the magazine is facilitated.

In the ordinary way the magazine is charged by slipping cartridges *a* singly into the magazine through the feeder hole which is covered by the feeder *b*. As each cartridge was inserted the feeder had to be forced upwards, but according to this patent the feeder is held in such a position that the cartridges may be dropped in, thereby much facilitating the loading operation.



On the side opposite to that containing the lock spring *c* is another spring *d* secured by means of a screw *e* in a recess *f* on the side of the feeder *b*. The spring is provided on its free end with an ear *g* which is bent over at right angles to the spring. The pin *h* enters through the wall of the lock plate and is secured on its inner side to the spring *d* and on the other end it is provided with the button *i*. When charging the rifle is held in the left hand with the charging hole upwards. The feeder is pressed inwards and is held in the raised position shown in Fig. 1 by the ear *g* attached to the spring *d*. This lip is forced under the feeder by pressing the button *i*. When the last of the cartridges has been dropped into the magazine the pressure is removed from the button *i* and the feeder released to allow it to resume its normal position. Accepted August 8, 1907.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Price of Explosives.—No more welcome piece of news can possibly be imagined than the information that the mutually destructive competition in the explosives trade has at last been brought to an end. What everyone regretted, no one appeared able to remedy, and although combination implies mutual understanding no one can help feeling a considerable debt of gratitude to the individual who risked the chances of an unfavourable reception and brought the warring elements into amicable conclave. It is generally understood that the arrangement, which has been drawn up in proper agreement form and signed by the contracting parties, covers a period of fifteen years. Also that the rules for standardising prices have been moulded on a system which gives every promise of working well in practice. The domestic arrangements of the explosives or any other trade do not form a proper subject for newspaper discussion; but there is no secret about the fact that prices have for a long time been so reduced by stress of competition as to be actually less than the prime factory cost. How such a state of affairs can have come about may be a surprise to ordinary business men, but to those who have witnessed the process stage by stage there is no marvel or mystery about it. Some particular manufacturer who sees his rivals doing a good business at remunerative prices thinks that he can secure a share of the trade by a cut in price which will still leave him with a profit in hand. This policy only works out well in practice if those in possession of the trade are too proud to take notice of a rival's efforts. The explosives trade is apparently free from the form of pride which ignores the efforts of the have-nots to acquire the business of those more fortunately situated. Bit by bit this see-saw process brought prices to an unremunerative level, but still there existed those who were willing to reduce still further in order to lessen the losses of an idle factory. Then it was that one company resolved that if the explosives business was to be run entirely for the benefit of the consumer things should not be done by halves. Prices were at once reduced to a ruinous level, and although the lesson was taught on drastic lines it has been learnt all the more thoroughly as a consequence, with the result that the preaching of sweet reasonableness fell upon receptive ears. One may look forward to better times for the whole of the trade concerned with mining explosives, for there is every prospect that the arrangement which has been made rests upon a sound and enduring basis.

The Air-Pistol Defined at Last.—The case against Messrs. Gamage for selling toy air-pistols without duly observing the provisions of the Pistols Act came up for re-hearing last month, and was naturally decided in accordance with the plain reading of the law. When the original proceedings took place it was impossible to understand the precise line of reasoning which led the magistrate to conclude that whilst an air-gun is admittedly a gun, an air-pistol is not a pistol. This may put the situation in an absurd light, but it is impossible to be serious when the Pistols Act most distinctly defines the pistol as a firearm or other weapon of any description in which any shot, bullet or other missile can be discharged, and of which the length of barrel, not including any revolving, detachable or magazine breech, does not exceed nine inches. Bows and arrows would be

included but for the mention of the barrel, and this clearly indicates that the definition is intended to cover everything having the semblance of a firearm, whatever method of propulsion may be adopted. More than this it is quite impossible to read into the Act any energy qualification for the missile which is discharged. The more toy-like the weapon may be, the more objectionable its promiscuous use, and although Mr. Gamage might be willing to stand up and be shot at by the particular weapon involved in the present proceedings it does not follow that he would be equally brave with every kind of toy pistol which might be sold had he succeeded in winning his case. Judging by the freedom with which firearms may be used by everyone anxious to become a marksman one cannot take any serious exception to the prohibition of dangerous toys having the semblance of firearms and to which every right-minded person must object. The Pistols Act undoubtedly bears hardly on the person who desires to possess one of these weapons for legitimate purposes, but the Act has certainly been highly successful in checking the sale of toys which are also weapons of a particularly offensive character.

Editorial Advertisements.—It is impossible to read without a keen sense of amusement the virtuous objections of the *Times* " to the reprehensible and growing practice of publishing, as though they were editorial comments, paid advertisements which have appeared in the columns of the press." The sentence quoted requires to be read about three times before it is understood that the reprehensible practice consists of quoting paid advertisements as editorial comment, and not of making advertisements read like an editorial article. The journalistic ability of our contemporary's advertising staff found a suitable vent in describing the merits and attractions of the " Encyclopædia Britannica." When this publication had been sold to great advantage, the same talent found a new occupation in writing advertisements for the paper's customers which aim at being every bit as interesting, and sometimes more interesting than an ordinary article. Under the heading for instance of " A Striking Powder " a most valuable literary essay on the good properties of Normal smokeless powder appeared in the *Times*. Mr. Roos was so pleased with this striking testimony to the merits of his Company's merchandise that he quoted extracts from the article as the opinion of the *Times*. He was forced to retract and apologise, and his letter was headed with the stinging comment already quoted. Mr. Roos, in reply, very fairly pointed out that he had received a visit from the *Times* representative, to whom he supplied the particulars for an article to be published in the form of an advertisement. The fact that Mr. Roos made modifications in the draft matter submitted was held by the *Times* to be positive proof that the matter could not represent editorial opinion. The *Times* further points out that the article was drawn up by advertisement clerks who prepare such matter on the basis of information supplied to them. The particular kind of clerk who can write first-class English in article form with a distinct literary flavour is obviously peculiar to the advertising world, and a certain amount of sympathy must extend to Mr. Roos for having mistaken this person for a literary gent having some connection with the editorial department. However there can be no doubt that the policy of framing advertisements in a manner calculated, not only to arrest the attention of the reader but to give him solid satisfying fare besides, is one which offers great opportunities for extension. Even so it is a mistake to suppose that the only paid advertisement matter which exists is of the kind properly so headed. The *Times*, however, draws a sharp distinction, and if anyone wishes to see these paid effusions by the advertisement clerks at their very best, they cannot do better than read the series of advertisements which our contemporary has published around the firm of Messrs. Nobel, with the history of the explosives trade for subject. No one really supposes these things are *Times* editorial opinion, but they are nevertheless exceedingly well put together and of decided literary merit.

Our Lecture on Rifle Barrels.—One of the most remarkable aspects of our series of lectures to young Gunmakers is that a subject which at first sight appears to provide but very inadequate material for a lecture, on further examination disclose a wide field for general demonstration and the sorting out of facts. What seems to be common knowledge and hardly worthy of analytical treatment proves in due course to be associated with a large number of related circumstances, so that when a lecture has been written it bears the character of a useful contemporary record of up-to-date information. This side of the policy of permitting oneself from time to time to write up a subject on an elementary basis is well exemplified by the latest contribution to the series. Common knowledge tells us that metallic fouling is a bad thing, and that a few shilling's worth of material bearing the mystic letters K.N.S., will suffice to remove it, just as one uses benzene for grease on gloves and something else to take ink stains from a table cloth. Looked at more closely the K.N.S. treatment involves abstruse chemical principles, and is also closely related to the entire question of the preservation of rifle barrels in a sound condition. In the old days of black powder the stitch in time policy was all that needed impressing on the mind of the young shooter. When Cordite and high power bullets came along the wisest were caught napping, and they were forced for a time to fall back upon another item of homely wisdom. If you don't succeed the first time try, try again is all very well for most things ; but in the case of rifle barrels, they are suffering injury during the whole time that inadequate measures for their preservation are being tried. The K.N.S. treatment seeks to get to the bottom of the mystery surrounding the perversity of the modern rifle in refusing to keep clean. No small boy shows more devilish ingenuity in procuring from the most unlikely places the wherewithal for becoming dirty, and the modern remedy for rifles aims at removing dirt from a hitherto unsuspected lurking place. How the matter in the wrong place gets there is no longer a mystery, and the present lecture discusses a few of the reasons why it should be removed as soon as possible.

THE 16-BORE GUN.

THE series of articles relating to the behaviour of 16-bore guns which are now running in our contemporary *The Field* have aptly appeared at a time when sportsmen are showing a renewal of interest in the smaller calibres of shot gun. The explanation for this alteration of sentiment towards a calibre which has hitherto been somewhat discouraged and neglected follows naturally from the progressive diminution of charges and gun weights which received their first impulse with the introduction of E.C. No. 3—a 33-grain smokeless powder giving low recoil and specially adapted for efficiently propelling the lighter shot charges. The other manufacturers who followed suit with 33-grain powders have had no cause to regret the step taken; for though they are tricky to make, and need an exceptional amount of checking and testing at all stages of manufacture, their efficiency is undeniable. Sportsmen were not long in finding out that the drop from 1¼oz. to 1$\frac{1}{16}$ oz., which produced such satisfactory effects on recoil with 42-grain powders, could be carried a stage further, viz., to one ounce with the more modern type of nitro. This is not to say that 42-grain powders were incapable of dealing with the one-ounce charge, but merely that the E. C. group of powders shot the one-ounce charge with exceedingly satisfactory results, a claim which could not always be sustained with the heavier bulk nitros. There have been many attempts to reduce the 12-bore charge below one ounce, and, although a considerable measure of success has been obtained in many quarters, there is always something to indicate a straining after extremes beyond the proper limits of recognised practice. The gunmaker is always regretting that the existing design of sporting gun is so little open to improvement that trade is checked, because even the wealthiest sportsmen have no reason for discarding their old equipment. Hitherto no one appears to have discovered in the 16-bore an alternative for existing guns, for which many claims of superior excellence can be put forward and sustained by sound argument. The 16-bore calibre of cartridge is at its best with the very charges which present so many difficulties of adaptation in the larger 12-bore. The largest charge of the 16-bore gun is $\frac{1}{8}$ oz., and this may be diminished sixteenth by sixteenth till the ¾oz. minimum load is reached.

The large proportion of sportsmen being men who, having lost the first vigour of youth, they are mostly anxious to husband their strength as far as possible to enable them to last out the severe exercise of a day's shooting. When the number of miles to be tramped over rough ground is reduced by driving the game over the guns, instead of the alternative process of the guns seeking the game, the diminished walking exercise is more than counter-balanced by the increased amount of shooting which driving provides. The effect on the system of a constant succession of shots is an even more exhausting form of fatigue than is produced by ordinary walking interspersed but occasionally with actual shooting. Complaints of undue fatigue are not limited to sufferers from gun headache, the demand for lessened recoil extending to all classes of sportsmen. The 16-bore gun seems admirably adapted for supplying pleasanter conditions of sport without any marked loss of efficiency. Guns of this calibre can be made in a more compact form, and weight and balance can be adjusted so as to give a marked lightening of the load to be carried. The amount of charge used is adjustable within such wide limits that recoil can be reduced to suit each individual's conception of the term minimum. The cartridge side of the question introduces many interesting considerations of a commercial kind. It seems hopeless to suppose that profits can be raised to an adequate extent for 12-bore ammunition; but there is no reason why the unremunerative prices of the 12-bore should not hold good for 16-bores. Though the ammunition makers' catalogues do not recognise a difference of cost between the three leading bores of sporting cartridge, the fact remains that the 16-bore to say nothing of the 20-bore, requires less powder, a reduced weight of wadding, and a diminished shot charge.

At the present time orders for 16-bore guns and cartridges are so few and far between as to necessitate an amount of exceptional supervision which practically balances any economy in the materials. The trade is, however, one which must be encouraged and pushed by those having a stake in the results produced, and when influential converts have been won over to the cause of the 16-bore it is possible that a new era of prosperity will arise. There is no particular magic about the 12-bore as a calibre, nor of the group of charges associated with this gauge of cartridge, but shooting conditions have changed and charges have been progressively reduced to the ultimate limit practicable for a 12-bore. There is still a cry for a further reduction, and the general adoption of 16-bores is the obvious development. Some say that if a change is needed 16-bores represent too small a margin of difference, and that 20-bores should be taken up in their place. This argument falls to the ground when the corresponding charges for each calibre are considered. The 16-bore begins where the 12 leaves off, and 16-bore charges can conveniently be extended so as to include what are commonly regarded as 20-bore loads. There are two arguments which finally condemn the 20-bore from the point of view of expediency. In the first place the dimensions of the 20-bore rim have never been settled upon a proper basis. The official sizes exist in theory alone, and no one dares to adopt them, whilst the sizes commonly in use create serious difficulties as regards the extraction of fired cases. The second point in condemnation of the 20-bore consists in the serious danger to sportsmen of any large increase in the use of a cartridge which when accidently dropped into a 12-bore chamber lodges in the exact position at the cone for causing an obstruction likely to maim the unfortunate victim for life. So great indeed is our objection to the 20-bore cartridge on this ground alone that we should welcome with the greatest enthusiasm legislation absolutely barring guns and cartridges of this calibre.

THE NEW PATENT ACT.

The home manufacturer is everywhere showing great interest in the probable effects of the new Patent Act as a means possibly of helping him in his business, and in any case of diminishing one of the inconveniences of carrying it on. The foreign manufacturer, having an interest in the British market, has similarly begun to concern himself in the effect which the new legislation is likely to exert on articles and processes protected by patent rights. The former aims at extending his trade, the latter wishes to protect something which he has hitherto regarded as his by unquestioned right. The advice given in our last issue to lose no time in purchasing copies of the new Act may now be supplemented by the further recommendation to order a new book which reached this office at the very moment when the present article was in course of preparation. It is entitled *The Patents and Designs Act, 1907, with Notes, and the Practice Thereunder*. The joint authors are Mr. James Roberts and Mr. H. Fletcher Moulton, both Barristers-at-law. It is published by Butterworth & Co. and four shillings will be well spent on its purchase. The benefit of reading a new Act of Parliament side by side with the expert comments of those trained in law, is that many unsuspected interpretations are brought into prominence and can be considered with regard to their effect on the particular problems in which the reader is personally interested.

One point not covered by last month's article provided a special justification for taking the subject up afresh. It is well known that the essence of the new Act is that patented articles or processes which are manufactured or carried on exclusively or mainly outside the United Kingdom may be shorn of the protection provided by a patent following an application to the Comptroller setting out the circumstances of the case and requiring that the patent be annulled. It is, however, not quite so clear whether such patents may conveniently be treated as dead without proceeding with the formalities of execution. Section 25 states that every ground on which a patent may be revoked under this Act, either by the Comptroller or as an alternative to the grant of a compulsory licence, shall be available by way of defence to an action of infringement. This means that a person may treat a patent covering goods wholly made abroad as non-existent, knowing that he can set up an unanswerable defence to any action for infringement. Roberts and Moulton apparently treat the meaning of this clause as so self-evident that it needs no enlargement or explanation. It is, however, a question which must be discussed and considered in detail by those who are called upon to choose between ignoring a patent whose revocation can be demanded, or of pursuing the alternative course of applying for its revocation. The policy of disregarding such patents appears on the face of it to possess the disadvantage that the delay in taking definite action might give the foreign manufacturer an additional period in which to complete arrangements for British manufacture before taking the steps necessary for restoring his lapsed rights. This would remove the only valid defence in any proceedings which might follow, and would leave the defendant open to a claim for damages as well as an injunction for infringement.

With respect to patents granted after the commencement of the new Act, special precautions must be taken for conveying information of the rights that exist, either by the marking of goods sold or by other means when no sales have been effected. Unless these precautions are taken no damages can be claimed in respect of infringement. The whole question seems to turn on what may be held reasonable notice of the existence of a patent. This point is discussed in great detail, and the following quoted paragraph shows that patent digests of the kind published by this journal may constitute reasonable notice :—"It is submitted that the defendant may be fixed with reasonable means of knowledge, apart from the marking of the articles. The section in fact does not give any special value to the marking of articles as notice, but merely says that certain forms of marking shall not be notice. It is thought, for example, that if the recognised paper of a trade, generally circulated amongst manufacturers in that trade, was in the habit of publishing notices of patents affecting such trade, one of such manufacturers would be held to have had reasonable means of making himself aware of the existence of a patent of which such a notice had been published. Of course, in all cases the onus of proving the absence of knowledge or reasonable means of knowledge is on the defendant, who can be interrogated as to his knowledge."

On the subject of offences it is laid down, as in the previous enactments, that if any person falsely represents that any article sold by him is a patented article he shall be liable to a fine not exceeding £5 for every offence. The Act is somewhat vague as to the definition of patented article, viz., whether the term can be applied only to articles for the time being protected by an existing patent, or whether the description may continue after the patent has expired. The first rendering seems most in accordance with the general spirit of the Act, but this clause will apply to the new conditions, in so far that the practice of marking goods as patented will become much more general than at present, for the purpose of giving possible infringers reasonable notice that exclusive rights are claimed. The practical necessity, as the authors point out, of marking articles as patented to preserve the right to sue for damages may in the case where the interpretation of the claims of a patent is doubtful bring many persons within subsection 2 of the Offences clause. Punishment in cases where the defendant honestly believed at the time that his patent was sound in the direction claimed would at the most be but nominal in amount. The subsection is obviously directed against persons who deliberately claim a protection which does not exist.

An official publication recently issued contains the notification of the accession of the United Kingdom to the declarations signed at The Hague in 1899, by which "the contracting Powers agree to abstain from the use of bullets which expand or flatten easily in the human body, such as bullets with a hard envelope which do not entirely cover the core or are pierced with incisions"; and by which "the contracting Powers agree to abstain from the use of projectiles the object of which is the diffusion of asphyxiating or deleterious gases."

THE ROBERTSON SINGLE TRIGGER PATENT.

In respect to the letters patent No. 22,894 (1894) granted to John Robertson, trading as Boss & Co., application has been made by the patentee to amend his specification on the grounds that he is advised that the amendments which it is proposed to make are necessary by way of correction and explanation, and in order distinctly to avoid the inclusion of that which forms no part of his "claims." The advice referred to doubtless arises from the action before the Court in which the patentee sought to restrain Messrs. Purdey from committing an alleged infringement and in which the plaintiff lost his case, the patent being pronounced bad because of anticipation. The chief distinction between the present claim for amendment following an unsuccessful lawsuit and another historic case on the same lines is that in the first the "claims" were seriously curtailed, whereas in the present instance they are numerically increased. The alterations throughout the final specification are so complex as to defy ordinary analysis; but their general effect is to restrict the area of the patent from the original comprehensiveness which made it cover a principle, to the more compact form involved in treating with a single form of mechanism. The wording of the claims before and after amendment is given herewith :—

Before Amendment.

1. The combination with a single trigger, two sears and a movable part which by the action of firing one barrel is shifted to the position for acting on the sear which retains the hammer of the second barrel, of an interceptor acting in conjunction with such movable part which prevents the latter from assuming the position necessary to act on the second sear, until after the involuntary pull on the trigger has occurred, all substantially as specified.

2. The combination with a single trigger, two sears, a movable part which by the action of firing one barrel is shifted to the position for acting on the sear which retains the hammer of the second barrel, and an interceptor acting in conjunction with such movable which prevents the latter from assuming the position necessary to act on the second sear, until after the involuntary pull on the trigger has occurred, of a locking arm or projection on the movable part, which prevents the second sear from being actuated until such movable part has moved to the position requisite for effecting this, all substantially as specified.

After Amendment.

1. The combination with a single trigger and two sears of a movable part in the form of a rotary tumbler mounted on a post and capable of vertical movement thereon which tumbler by the action of firing one barrel is permitted to rotate in a direction towards the position in which it puts the sear retaining the hammer of the second barrel into operative connection with the trigger and an interceptor acting in conjunction with the rotary tumbler to prevent the latter from assuming the said position until after the involuntary pull on the trigger has occurred, all substantially as specified.

2. In mechanism in single trigger guns to prevent the involuntary pull discharging the second barrel, a rotary tumbler and an interceptor to operate as described and constructed as illustrated in Figs. 1 to 14.

3. Ditto, ditto as illustrated in Figs. 27 to 39.

4. Ditto, ditto as illustrated in Figs. 40 to 56.

5. Same as No. 2 in the original specification.

THE WAR OFFICE MINIATURE RIFLE.

The London Small Arms Company, as mentioned last month, have submitted for notice a model of the War Office miniature rifle fitted with a magazine and containing the improvements for preventing the blowing out of extractors. The magazine is of the box type, as found on ordinary military rifles, and is designed to take five cartridges. It is removed from the rifle for filling, and is pressed into place, being retained by a spring. It has been ingeniously designed and takes the form of a steel stamping with a sliding base, the platform being elevated by a zig-zag spring.

The chief interest of the new rifle necessarily consists in the means which have been devised for preventing accidents due to burst cases. In the original model, as designed by the War Office experts at Enfield, no vent was provided for the gases liberated by burst cases. They accordingly found their way under the extractor and snapped it off, projecting the broken piece violently into the air. The new arrangement consists of a bridge on the body of the rifle, which stands over the forward part of the extractor and prevents it from lifting unduly from the slot in which it lies. To test the efficacy of this arrangement the kind collaboration of the King's Norton Metal Company was invited, and they provided us in due course with a number of primed ·22 calibre cases and bullets. A sample of revolver powder suitable for the purpose in view was obtained from another source, and starting with a one-grain charge and increasing progressively a quarter of a grain at a time each successive load showed visible evidence of the rise of pressure which was taking place.

The King's Norton ·22 cartridge case with its cupped base afforded a particularly valuable means of judging the relative gas pressure of the charges employed. A low pressure fails to flatten out the cup, whilst the ordinary run of service pressure shows a tendency towards flattening, without any very close moulding of the case metal against the breech of the rifle. At 2¼ grains of powder the progressive increase of charge was stopped, because at this point the case burst. The same loading was repeated, and a succession of burst cases followed. At No. 2 burst some of the gas must have escaped into the magazine, for this was pushed out of place and fell to the ground. The firing was continued until six cases had been burst, after which two non-bursting charges were fired and the rifle behaved quite satisfactorily. The extractor was slightly displaced each time a burst occurred, so that it needed to be pressed downwards before the bolt would open. A piece of paper laid over the gas vent was blown to fragments. A similar piece of paper held upright one and a half inches to the rear of the breech and in line with the shooter's face was blown aside and slightly torn at the place of fastening but it showed no marks of flying splinters.

These experiments go to show that the pressure which is just sufficient to burst a well-made case is not likely to injure the rifle or produce any hurtful effects on the shooter.

This gives a high measure of security for bursts due to bad cases, but it does not follow as a matter of course that a very violent cartridge would prove equally inoffensive. Given sufficient pressure, and assuming the gases to pass beneath the extractor, it is possible that the latter, being held at each end, would lift at the middle and eventually break, possibly into fragments. The hood also might be blown away. There is of course a limit to the endurance of every rifle, but as no definition of this limit exists in respect to ·22 rim-fire ammunition no attempt was made to carry the tests to the point of destroying a rifle which had successfully withstood a prolonged course of severe treatment. An interesting aspect of the experiments was that the initial injury to the cartridge case invariably occurred beneath the extractor, so showing that this is the point where the greatest precautions for the safety of the shooter should be observed.

LISSAK ON ORDNANCE AND GUNNERY.

The author of this treatise is to be congratulated on the performance of a useful task well accomplished. It has been written by Lieut-Col. O. M. Lissak, Ordnance Department U. S. Army, professor of ordnance and the science of gunnery at the U. S. Military Academy. His style of treatment and the subjects dealt with follow the same lines as Bruff's book of a similar title. The latter publication was issued in the year 1896, and the author was Lissak's predecessor in the same office. Both books were written especially for the use of students at the Military Academy, and the later publication is more than justified by the new matters which have arisen in the ordinary course of scientific developments and by the equally obvious circumstance that practical experience in the professorial use of a text book emphasises every possible opening for improvement. In the sense, therefore, that Lissak began where Bruff left off, the later contribution contains valuable improvements and new matter worthy of the attention of all who study gunnery as a science. The price of the volume is 21s. net, and Chapman & Hall are the London publishers; Wiley & Sons of New York holding the American rights.

The reading of such a text book is necessarily a stiff exercise, because of the immense amount of ground covered and the condensed mathematical treatment which results. Each chapter could be expanded to a text book by itself, and although this would give space for more explanation and demonstration the first purpose of the present volume would disappear. It must stand as the text of a series of professorial lectures to students, the demonstrations and explanations being delivered extempore. As a notebook, and a compendious notebook at that, the book must be recognised as a monument of labour by the one person best fitted to write it. That the treatment of subjects is not confined to mere statements of abstruse principles is shown by the multiplicity of concrete examples which are worked out in detail, each aiming at reproducing the kind of problem encountered in practice. The preface follows the valuable principle of setting forth the general contents of the volume and the methods of treatment used. We cannot, therefore, do better than conclude this notice by quoting the following extracts from the preface, subject to the observation that the ballistic tables in general use by artillerists have not been reprinted as an appendix to the volume. The author writes under date May 24, 1907:—

"The purpose held in view in the preparation of the text has been to present, in order, the theories that apply in the use of explosives and in the construction of ordnance material, the methods pursued in the construction of the material, descriptions of the material, and the principles of its use.

"In the chapter on interior ballistics, which is taken principally from the writings of Colonel James M. Ingalls, United States Army, the deductions and application of Colonel Ingalls' latest interior ballistic formulas are fully set forth. The determinations from these formulas have been found in practice to be more closely in accord with the actual results obtained in firings, than determinations from any ballistic formulas hitherto in use.

In the chapter on explosives the theoretical determination of the results from explosions, including the quantity of heat, the volume of the gases, the temperature, the pressure, etc., is explained and illustrated by examples. This demonstration has not hitherto been available in English. A simplification has been introduced, by the author of the text, into the gun construction formulas of Clavarino. The simplification materially shortens these extended formulas and reduces the labour required in their application.

"The graphic system of representing the pressures and shrinkages in cannon, devised by Lieut. Commander Louis M. Nulton, United States Navy, is also explained in connection with the deduction and application of the formulas of gun construction. The graphic system is a material help towards a ready understanding of the subject.

"In the subject of interior ballistics sufficient problems are introduced and fully worked out to illustrate the processes followed in the solutions of the principal problems of gunnery. This course has been adopted with the purpose of removing to a large extent the difficulties usually encountered in the practical application of the formulas of interior ballistics.

"An appendix to the chapter on interior ballistics contains the deduction of the author's formulas for double interpolation. The formulas are more accurate and more convenient in application than the interpolation formulas previously in use. Explanation of the use of the ballistic tables to which the interpolation formulas apply, follows the deduction of the formulas. The chapter on armour contains information as to the general arrangement and thickness of the armour on ships of war, the expected targets of the heavy artillery. A chapter on submarine mines, torpedoes, and submarine torpedo boats concludes the text."

ROUND THE TRADE.

Mr. William Watson writes from the Wimbledon Shooting Ground, Worcester Park, Surrey, asking us to mention that they have succeeded in securing telephonic connection, their number being 14 P.O. Malden.

The Russo-Belgian (Favier) Chemicals Production Co.'s explosives factory and offices in Tchugugol near the station of Baclaya on the Ekaterinburg Railway made a loss of £124 in its seventh (1906) working year. The capital is £37,500.

According to *Soloto y Platina* the application of the Russian Dynamite Manufacturers to have foreign dynamite excluded or a prohibitive duty levied on it is likely to be resultless in view of the united protests of the general mining community and that on the contrary the importation of foreign dynamite is likely to be facilitated.

According to the newspaper reports a serious explosion occurred at one of the Dupont powder mills in the United States. The reports indicate that the factory was devoted to the manufacture of black powder explosives, which would account for the serious nature of the explosion by which the nieghbouring town of Fontanet, Indiana, about two miles away, was wrecked, most of the inhabitants suffering injury of a more or less serious nature by the fall of houses.

The Illustrated Official Journal for patents contains in the issue of the 16th ult., a detailed report of the proceedings under an application by the B. S. A. Company to have a trade mark hitherto used for small arms registered without association in another class, viz., cycles and automobiles. The objections of the registrar made under Section 24 of the Act were held to have no application to precisely similar marks sought to be registered by the same firm for entirely different goods.

Capt. J. H. Thomson, chief inspector of explosives recently conferred with the Mayor and town clerk of Cardiff concerning the conveyance of explosives by road through the streets of that city. Among those interested in the matters discussed who were present at the meeting were the following :—Mr. C. Cross, Mr. L. Evans, Mr. G. Leyshon, Mr. Major, Mr. F. Lyall (representing Nobel's Explosives Co., Ld.), Mr. Ealdon (Curtis's & Harvey, Ld.), Mr. J. S. Williams (New Explosives Co., Ld.), and Mr. J. P. Charles (Cotton Powder Co., Ld.). The object of Capt. Thomson's visit was to "enquire into the alleged special danger of the conveyance of explosives by road" through the city. The Town Clerk explained that the council asked that the conveyance of explosives through the city be prohibited, or that an order be made that no person should convey explosives exceeding 100lbs. through the city unless he had given 24 hours notice, that no carriage containing explosives exceeding 100lbs. should go through Cardiff between eight a.m. and twelve midnight, and the harness, carriage and the animal attached to the carriage be in good condition. Mr. Charles Cross said he had been in the business for 35 years, and never had an accident. Capt. Thomson remarked that there was no record of a single death by road or rail for the past 30 years. The Town Clerk urged that the corporation were supported by the rate-payers in their application. Another gentleman spoke as an owner of property. It was admitted that Mr. Cross and Mr. L. Evans had always given prompt notice to the Cardiff inspector. Capt. Thomson elicited the views of the importers present,and it was arranged that any person who wrote him on the matter should send a copy of his letter to the Town Clerk. It was explained that certain quantities of explosives were brought into Cardiff from the magazines, and that the suggestions of the council might be modified.

A notice has been issued cancelling the announcement that the N.R.A. will hold a miniature Bisley at the Bunhill Row Drill Hall during the present month, and stating that the gathering will take place in the early part of next year.

Those who have purchased copies of the book *Ballistique Exterieure Rationelle* should be made aware that the publishers have issued an erratum note dealing with the problem of earth rotation. A confusion of notation on page 143 led to certain errors of calculation which are now made clear as also are the errors of deduction following from the first mistake.

Mr. W. R. Leeson has written calling our attention to the fact that he has just succeeded in winning the championship of the Ashford Service Rifle Club, also the N. R. A. bronze medal and the silver cup presented by the president, Mr. Walter Winans. It will be remembered that in another branch of shooting, Mr. Leeson was equally successful, for at one of the Wembley Park meetings he carried off the clay bird shooting championship.

In reference to last month's reference to the use of Roburite for blasting the last remaining leg of the late Wembley Tower a correspondent has written to say that the first three legs were removed with explosives supplied by Curtis's & Harvey, Ld., and that the results were perfectly satisfactory. It was not, however, till the Roburite Company got the order for the last leg that some ceremonial was observed and the papers got to hear of what was going on.

Dr. W. G. Hudson, M.D., the well-known rifle enthusiast, in America has contributed to *Arms and the Man* an interesting account of the trials and experiments which led up to the adoption of a sharp pointed bullet by the United States team for the recent Palma match. The only point in which the report is somewhat vague is in the avoidance of a positive statement whether or not the Americans obtained the idea of a pointed match bullet of full military weight from the successful application in England of the point to the Match cartridge with the 225-grain bullet. The report rather leads the reader to suppose that the author working in collaboration with Mr. Thomas of the U. M. C. Company independently arrived at the idea ; but the fact remains that their decision was arrived at on August 5, which suggests to the reader on this side that these wide-awake gentlemen had read the very full accounts of the new bullet which had appeared at the time of the Bisley Meeting in the English sporting journals to which they regularly subscribe

Messrs. A. W. Gamage Ld., appeared on an adjourned summons on the 15th ult. before the Clerkenwell Court for selling a pistol without duly observing the provisions of the Pistols Act. The case was referred from the High Court for the magistrate's decision as to whether the "air gun" in question was, or was not, in his opinion, a weapon, and on this question argument took place. Mr. Barker appeared for the police, Mr. George Elliott for the defendants, and Mr. Gilbert Thorn watched the case for the Gunmakers' Association. Mr. Elliott said the defendants claimed that the air pistol in dispute was a mere toy. He was prepared to place Mr. A. W. Gamage before him, and he would fire at him at a distance of three feet. At greater length he was afraid he could not hit him. Expert gunmakers and toy manufacturers were called to say that this "air pistol" was a toy, and not a weapon. The magistrate said the fact remained that street gangs of boys got these "toys," and at close quarters used them with serious results. He decided that the article was a weapon capable of discharging a shot, and coming within the statute for the control of the sale of firearms, etc., particularly to young people under 18, who were the greatest trouble to the police. He therefore convicted the defendants, and imposed a fine of 40s., with 42s. costs.

Mr. F. Marten Hale has issued a notice from the offices of the Cotton Powder Company referring to an earlier letter and stating that he has now entered into an agreement with this Company to perpetuate the business and negotiations in which he was interrupted by the recent failure of the National Explosives Company, Ld. He further states that he will continue to give his personal attention and supervision to the important work with which his name has so long been associated and that orders and enquiries addressed to the Cotton Powder Company will receive prompt attention.

The British and South African Export Gazette published the following interesting tables showing respectively the increased importation of explosives into the South African market last year and the division of trade between Cape Colony and oversea manufacturers.

Imports of	1905.	1906
	£	£
Blasting Compounds, etc. :—		
Collodion, Guncotton, etc. ..	196,590	46,423
Dynamite		175,215
Detonators and Fuse ..		119,552
Gunpowder	7,472	8,949
Cartridges	20,594	51,769
Caps, percussion		245
Totals	**224,656**	**402,153**

Imports of	From Oversea.	From Cape Colony.
	Cases.	Cases.
Dynamite (Guhr.)	50	—
Dynamite Lig.-Dyn.	7,650	—
Gelignite ⅞	11,110	24,143
Gelignite 1¼	8,909	30,295
Gelagtine ⅞	7,735	29,594
Gelagtine 1¼	20,898	74,713
Blasting Powder	595	—
Miscellaneous	55	12
Totals	**57,002**	**158,757**

These statistics are made the text of comments suggesting that our own manufacturers are not sufficiently alive to the opportunities of trade, apart from the competition of the local factory at Modderfontein on the Rand itself, and the factory laid down at Somerset West, Cape Colony, by the De Beers Company. In point of fact one English Company has erected a factory in South Africa, and another important concern is on the point of so doing.

Birmingham air rifle shooters are very much interested in the arrangements which are being made for holding a club and individual championship with a phenominal list of prizes. The B. S. A. Company and Mr. Lincoln Jeffries started the ball rolling with duplicate donations of £100, and Kynoch's have since increased the fund available by a like amount. The conditions of the contest are being arranged by an influential committee, acting under the auspices of the leading rifle shooting associations in the Kingdom. Communications should be addressed to Mr. W. Norton, 34 and 35 Imperial Arcade, Dale End, Birmingham.

A correspondent writes :—" Regarding the problem in explosive storage on page 137 of your last issue your solution of the difficulty is an ingenious one and would rather puzzle the Superintendent, but would it not be well to tell your correspondent that he can keep 200 lbs. of gunpowder without any certificate by registering the premises, which registration cannot be refused. On the other hand he cannot keep any high explosive such as dynamite without a certificate, which certificate may be refused. No option rests with the Local Authorities as to registration, but a chief constable may decline to grant a certificate and, therefore, prevent the keeping of a high explosive such as dynamite, gelignite or detonators. A chief constable is acting quite within his rights, although I do not think that he would be acting wrongly were he to enter in the Form of Certificate (*a*) and after the word ' namely ' any authorised explosive classes 2 to 4."

LECTURES TO YOUNG GUNMAKERS.

XLVI.—REMOVING METALLIC FOULING FROM RIFLE BARRELS.

THE above is a process so essentially scientific in all its bearings that it seems desirable to include it in the series of lectures, which have for object the instruction of the young gunmaker in the more technical aspects of his business. There is all the more reason for the present further ventilation of the subject in the fact that a tendency has developed to regard the removal of metallic fouling by means of a solvent as one of the cranky follies of the Bisley marksman. In point of fact the whole question dives far more profoundly into the science of the rifle than casual examination would indicate.

In the first place it cannot but appeal as somewhat of a mystery to the thoughtful young gunmaker that whilst his rifle is more scrupulously and immaculately cleaned than any other piece of hardware, actual experience indicates that it possesses a predisposition to develop rust far and away greater than the sundry tools and implements which lie about the bench and are casually stored for months on end without one tithe of the attention which the bore of the rifle barrel receives. The latter commences its existence as a perfectly polished hole in a piece of steel. The metal is of the best, but the conditions of manufacture necessitate a mild and easily worked brand of steel which may be less capable of resisting rust than the hardened metal tools which are comparatively immune from deterioration under storage and use. However that may be the troubles incidental to the preservation of a rifle barrel commence from the moment when it is first fired. The Proof House authorities profess to give weapons submitted to test some kind of a clean, but the gunmaker knows full well that vigorous preservative treatment must be applied immediately after return from proof if the rifle is to be delivered into the customer's hands in perfect condition. Many of the cheaper small-bore American rifles which are sold by dealers receive less of this kind of attention than they appear to require ; for in many instances a rub out with a dry rag discloses slight discolourations of the polished surface, which upon being regarded with a magnifying glass are found to arise from a peculiar and characteristic pitting and honeycombing of the bore. No matter what may be the subsequent care which is taken of the rifle, these defects of surface deepen and extend, so that in due course of time the weapon must be discarded, with its shooting under suspicion by reason of a condition of the bore which cannot be regarded otherwise than detrimental to first-class behaviour.

The natural inclination is to seek for an explanation of these troubles in the powder employed in the cartridge, and though chemical knowledge may suggest that the fouling deposit is of an inoffensive character, the fact remains that rust develops far more rapidly than can be accounted for by the natural oxidation of iron or steel. It should be possible by thoroughly cleaning the bore of the rifle, that is to say by vigorously scrubbing with a tight-fitting patch on a suitable form of rifle rod, to remove foreign matter from the barrel, and so cleanse the surface of the bore that nothing but iron remains to be protected by the simple process of

a coating of mineral oil. Practical experience is, however, emphatic in showing that mere mechanical treatment of the bore is ineffective as a means of limiting the rusting tendency to that of an ordinary piece of polished iron. Delicate tools, such as micrometers and steel rules, which are constantly handled, and are put away for weeks at a time without troubling to remove the saline deposits left by the hand, show up better after a period of use than a rifle barrel which has been alternately scrubbed and oiled with periodic repetitions of the process. The obvious assumption is that the fact of firing leaves in the barrel materials which supply the wherewithal for rust formation. Clearly the rag rubbing process is incapable of mechanically removing the whole of these objectionable materials, and the question that remains to be answered is whether their evil properties arise from their active chemical properties, or from the presence of a metal electrically different from the iron of the barrel. American experts have lately given a considerable amount of attention to this particular point, and they have arrived at the conclusion that the real cause of rust in rifle barrels is a galvanic action between the metal of the barrel and the electrically different metal scoured from the bullet.

Even this explanation does not entirely dispose of the chemical materials as an auxiliary to the galvanic action, for one knows that every kind of primary battery must be charged with chemicals in addition to the substances composing the positive and negative elements. There can be no doubt that some of the special cordite oils, which have been put upon the market during recent years, provide a most valuable temporary remedy for the evils of corrosion. These oils derive their special properties from the presence of an alkaline ingredient. It is an exceedingly abstruse chemical problem to load an oil with an alkali so that the latter remains active and, therefore, capable of restraining the hurtful properties of the fouling residue. An alkali lessens all oxidisation processes in its vicinity, and when the alkali takes the form of a suitable soap it possesses the useful property of combining with the water which necessarily remains in the barrel as one of the products of powder combustion. The grease is thereby enabled to spread smoothly over the whole of the bore, a characteristic in marked contrast to the ordinary appearance which one associates with attempts to oil a moist surface, or conversely to moisten on oiled surface. Alkaline oils, nevertheless, still leave untouched the possibility that objectionable matter may lie underneath the metallic fouling, where it may continue its ravages on the bore unaffected by the correcting influences which exist elsewhere. Metallic fouling is only seriously objectionable when it takes the form of cupro-nickel or its equivalent on hard jacketted bullets. The nickel rather than the cordite is evidently the prime cause of the trouble, if one may judge by the circumstance that cordite is regularly used in combination with lead bullets and gives practically no more trouble than ordinary black powder. Lead, on the other hand, is undoubtedly an objectionable material if it lodges in any quantities in rifle barrels or even shot gun tubes. In the former it promotes irregularity of shooting, and in the presence of black powder tends to accentuate the deposit of hard dry fouling. It also prolongs the cleaning process and detracts from its thoroughness. In shot guns the smooth bore presents but few difficulties in the way of cleaning by means of a gauze or wire brush, but these mechanical processes are never so thorough but that they leave a doubt as to whether a sufficient film of lead has not been left to promote further deposits. One may therefore conclude that whilst lead is not so objectionable as nickel, both are bad and, are therefore, only to be counteracted by thoroughly complete methods of chemical treatment.

In a rifle barrel lead undoubtedly tends to fill the small pores and cavities due to previous rust formation, and its periodic removal is desirable, if only to lay bare the true surface of the bore as a precautionary treatment preceding a long period of storage. This in fact is the whole gist and essence of the new science of metallic fouling solvents. No rifle is safe under storage when it contains any of the fouling last left in the barrel. Frequent wiping out may please the eye, because it merely removes the rust growth and gives a deceptive appearance of polish. If a barrel shows visible evidence of growths, whether in specks or covering the entire surface, there is no doubt that chemical action is taking place, the bore most likely providing the material upon which the chemicals are feeding.

Captain Hardcastle must be recognised as the discoverer of the importance of regarding metallic fouling as the prime

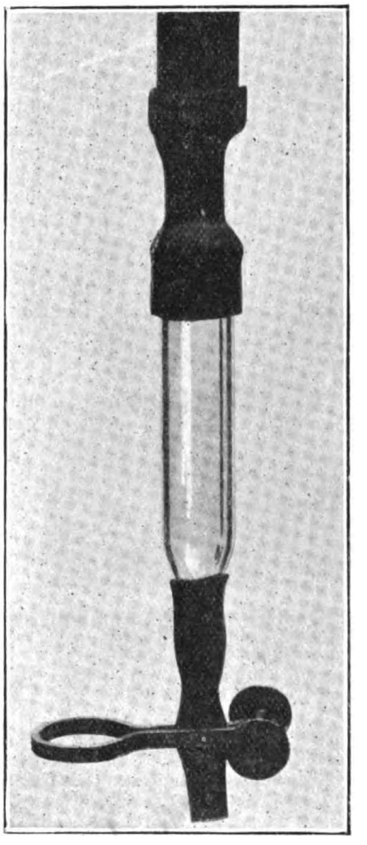


FIG. 1.—KING'S NORTON APPARATUS FIXED TO RIFLE MUZZLE.

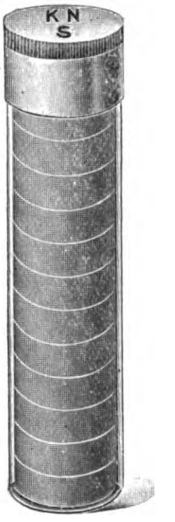


FIG. 2.—FULL SIZE VIEW OF A TUBE OF K.N.S. TABLOIDS.

source of rust formation in rifle barrels, and as an element affecting their accuracy at long ranges. In collaboration with Dr. Hodgkinson he devised a solvent material which is filled into the barrel and which entirely removes the whole of the cupro-nickel solvent lodged therein. Mr. Melville Smith and Dr. Brownsdon on behalf of the King's Norton Company effected a very important improvement on the Cunicide process, whereby other chemicals were employed so that water whiteness turned to rich blue colour when copper was present. These two processes were so intimately associated with one another that interests have been merged, and the King's Norton Metal Company holds the entire rights in respect to both processes. The King's Norton solvent is, however, the article commercially used, because of the great value of the visible change which takes place

when metallic fouling is dissolved. A later patent has been taken out for the removal of lead fouling, and the King's Norton Company propose in the early future to bring to the notice of miniature riflemen the vast importance of employing this auxilliary method of keeping rifles in perfect condition. Kynoch's have taken out a patent covering the use of other chemicals which possess the advantage of being highly portable. That is to say the material can be taken about in a solid form, whereas the King's Norton solvent necessitates a supply of liquid ammonia, in addition to the special tabloids which are dissolved just before use. One may, however, dismiss the Kynoch process until it has been proved a commercial success. Captain Hardcastle and Dr. Hodgkinson have taken out a further patent covering a process for the treatment of big guns. Here the fouling exists relatively in the form of a solid plate which can be peeled off with a knife, the flakes having the appearance of sheets of solid copper bearing the honeycomb imprints of the bore on one side and the smooth rubbed surface on the other, which denotes contact with the driving bands of the shell. This process consists in filling the bore with liquids which convert it into a galvanic bath, current being passed from the walls of the gun through the liquid to an iron pole centred in the bore, the metallic fouling passing into solution under the electrical action and being redeposited on the rod. The King's Norton Company have the handling of this process. The various patents referred to in this short summary are now briefly specified in due order. The whole subject is one of great scientific interest, and where it is pleasant to note that English chemists have led the world in their researches :—

February 16, 1905, *No.* 3,225.

Dr. Hodkinson's Patent (Cunicide). Application of an amide of an acid or an ammonium salt of an acid, preferably an organic one, with ammonia in water or glycerine solution or in a saccharine liquid.

Cunicide 375 c.c's Formic acid.
1875 ,, Strong ammonia 0·880 sp. gr.
6000 ,, Water.
60 grams Copper chloride (Cu_2 Cl_2).

June 28, 1905, *No.* 13,297.

K.N.S. Patent. Use of persulphates in solutions of ammonia.
Solid 5 parts Ammonium Persulphate NH_4 SO_4.
1 part Ammonium Carbonate $(NH_4)_2$ CO_3.
Liquid equal parts water and ammonia sp. gr. 0·880.
Solution one part solid in 10 parts liquid.

February 1, 1906, *No.* 2,506.

P.B.S. Patent. King's Norton Lead Solvent. Same as K.N.S. except liquid consisting of 25 grams. Caustic soda (NaOH) in 100 c.c's water.

July 3, 1906, *No.* 15,081.

"Kysol." Kynoch's Patent. A bichromate alone has no action on copper, nickel or iron, but when this is oxidised with chromic acid or chromic anhydride, a body is prepared which will dissolve copper and nickel, but has no action on iron. They propose a mixture of 54 % potassium bichromate (K_2 CrO_4 CrO_3) and 46 % chromic anhydride (CrO_3) as the solid, and 6 grams of this in 40 c.c's water as the solution for removing metallic fouling. They say a considerable increase in the anhydride would cause the solution to act on the steel.

All the above proposals depend on a substance which will oxidise the metallic fouling and a liquid which dissolves the product.

January 10, 1906, *No.* 717.

Hardcastle and Hodgkinson's Electrolytical Method. Liquid may be composed of the amide of an acid or of an ammonium salt of an acid (preferably an organic acid) in solution with an appropriate quantity of uncombined ammonia.

An example 2 % acetic acid.
15 % ammonia ·880 sp. gr.
83 % water.

Current sent from gun walls through liquid to pole of iron and in a 15 c.m. gun they say 100 amps. at 5 to 10 volts are needed.

As regards the practical application of the King's Norton process, which is the only one of any real importance at the present time, it is interesting to notice how ingeniously a seemingly messy process has been reduced to a chemical operation which can be conducted without dirt and disturbance on an ordinary bench, or even with no more special fitting than a peg attached to a wall or piece of furniture.

The first *desideratum* is to provide a means for sealing the muzzle of the rifle so that no fluid can escape. This is most easily effected in the case of a single barrel rifle by the apparatus illustrated in Fig. 1. It consists of an ordinary rubber tube which is sprung over the muzzle of the rifle and terminates in a glass tube for inspecting the progress of the operation. The glass tube is connected with a further piece of rubber tubing which is sealed water-tight

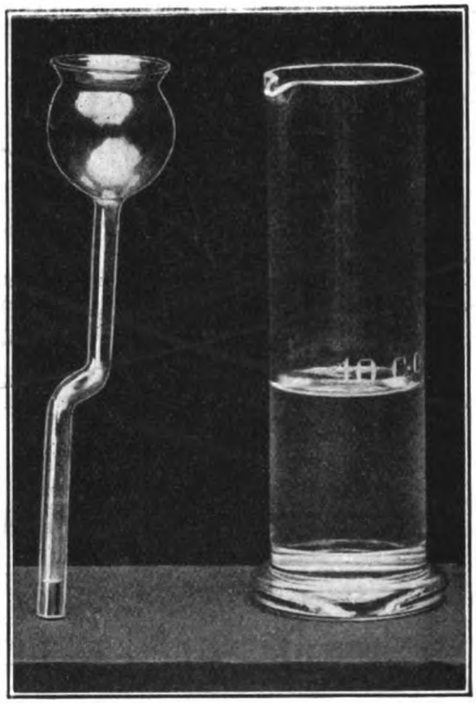


FIG. 3.—FUNNEL AND MEASURING GLASS FOR K.N. TREATMENT.

by what is known as a pinch cock. This is a steel instrument which serves exactly the same purpose as pinching a tube with the fingers to stop the passage of water through the same.

The pouring of the necessary amount of solution into the barrel requires great care, but no particular skill. The King's Norton Metal Company supply measuring glasses of the kind here illustrated with a scratched line denoting the capacity of a ·303 barrel of the ordinary 30 inches length. The measuring glass is filled up to the line with ammonia solution, and two tabloids are crushed by laying them between a folded sheet of paper and powdering them up with a hammer. The powdered tabloids are then poured into the liquid ammonia, and after a few moments shaking they are entirely dissolved. A special funnel of the kind illustrated is then placed in the chamber orifice, and the solution is poured into the barrel. If there is any

nickel fouling present the solution immediately shows blue in the underneath tube, and a constant stream of blue matter intensifies the colour according to the amount of the fouling present in the barrel. In addition to the blue solution a certain amount of dirt also seems to fall, even when the barrel has been scrubbed clean previous to the operation. . This dirt, therefore, seems to owe its origin to filth lodged amongst the fouling which comes away when the latter is dissolved. This detritus, as it is called, is doubtless some of the solid matter worn from the barrel by the passage of the bullet along the bore, but which has become mixed up with the fouling so as not to be removable by ordinary cleaning processes.

However, to return to the actual process of removing the metallic fouling the operator will find in the course of a very few minutes that the action has practically ceased. By pinching the cock the charged solution can be removed and clean water may be filled into the barrel in its place. One or two fillings of water will remove all remains of the chemical, and this without having splashed a single spot during the whole process. The chemical solvent should immediately after use be poured down the sink in opposition to the natural tendency to leave it about on the bench where, should it be accidentally spilled, fresh chemical knowledge will be gained at the expense of the bench and any wood or leather articles it may touch. It is interesting to repeat the treatment from the start to ascertain whether the dissolving properties of the solution have been sufficient to remove the whole of the fouling present in the barrel. If it emerges the same colour as it enters the treatment is shown to be complete, and the barrel may be washed out and wiped dry, following which the ordinary oil dressing should be applied. A barrel so cleaned may then be put away with an easy conscience, whether the period of storage be a week or a year. It has been conclusively shown that the solvent does not attack the iron of the barrel.

The lead treatment is precisely similar, except that the chemicals are as specified for patent No. 2506 (1906) quoted above. The methods here described can best be examined by sending direct to the King's Norton Metal Company and ordering a complete outfit. A little ingenuity may be necessary for extending the treatment to double-barrelled and other guns with a different style of muzzle from the service or War Office miniature for which ready prepared apparatus is available. In the case of rifles with muzzles of large diameter, such as the Stevens, a larger size of rubber tube is desirable, but not an observation tube as in Fig. 1 because the lead solvent does not show a colour change. For double-barrelled guns an entirely different procedure must be adopted. The necessary apparatus for such weapons will doubtless in due course take the form of a solid rubber block carrying glass tubes, to which will be fitted the rubber tube and pinch cock of the ordinary apparatus. Means would have to be devised for pressing the surface of the rubber block tightly against the face of the muzzle, so as to prevent all escape. The barrel should first be carefully filled with ordinary water, and the amount used should be drawn off into the measuring glass, a file cut being made to denote the amount of solution thus shown to be required. No greater mistake can be made than to fill an unmeasured quantity of liquid into the barrel, trusting to stop when the solution is seen to have reached the chamber. No fluid should be allowed to escape, and the only means of definitely preventing a mistake is to measure beforehand the exact capacity of the barrel.

When gunmakers have given proper attention to the new process of treatment they will find at once that it provides a valuable means of ensuring the perfect preservation of all cordite rifles after they have passed the usual target tests. The hot water treatment with soda is crude by comparison, and it certainly does not remove any of the metallic fouling. Considering that this frequently gathers in the barrel, so that chips of it can be removed with a knife at the muzzle, it is quite clear that the scientific chemical treatment here outlined should be adopted in preference to the hot water treatment. The drastic and objectionable practice of lapping out the fouling can then be entirely dispensed with, and the rifle may be delivered to the customer in the same condition of bore as when it was tested at the target. Altogether the K. N. S. treatment of rifle barrels has provided the material for a most interesting lecture, and even if the information given lacks novelty there must still be many, outside rifle shooting circles, who have not studied the process as a necessary operation for the skilled gunmaker to be capable of applying. Some shooters have already been educated to refuse to buy rifles unless the bore proves to be in perfect condition after treatment with lead or nickel solvent as the case may be. If the practice becomes general the gunmaker will be forced to anticipate this exceptional test of a barrel's real newness. That the precaution is a necessary one from the shooter's point of view may be demonstrated by anyone who cares to take a number of seemingly perfect barrels, and test whether they are as free from imperfections in the bore as on the day when they left the rifling machine.

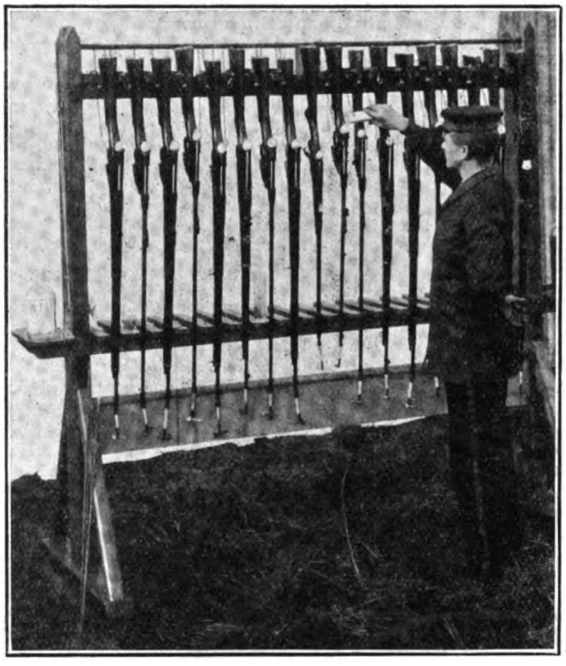


FIG. 4.—THE RACK USED WHEN LARGE QUANTITIES OF RIFLES REQUIRE TREATING.

APPLICATIONS FOR PATENTS.

SEPTEMBER 23—OCTOBER 19, 1907.

21,217.* Automatic Firearms. R. Frommer.
21,237. Ordnance. W. Beardmore & Co., Ld., and A. Bremberg.
21,264.* Detachable Wheels for Ordnance. Fried Krupp, A.-G. (German application January 2, 1907).
21,278.* Locking Device for Firearms. R. Frommer.
21,298. Rifle Foresights. E. J. D. Newitt.
21,358. Ordnance. H. C. Woltereck.

21,403. Combined Electric and Percussion Primers for Ordnance. S. A. de Castilho.
21,414. Electrical Transmitting Apparatus for Gun Sighting. A. T. Dawson and G. T. Buckham.
21,463. Target Practice Apparatus. J. B. Bolitho.
21,502. Blank Cartridges. H. J. Blanch and C. W. Andrews.
21,596. Ordnance Breech Mechanism. A. F. Petch and F. Duncan.
21,597. Ordnance Ammunition Supply. A. F. Petch and F. Duncan.
21,598. Ordnance Ammunition Supply. A. F. Petch and F. Duncan.
21,676. Loading Tray for Ordnance. A. F. Petch and C. J. Young.
21,685. Spring Air Rifles. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Horman.
21,777.* Running-out Gear for Ordnance. Fried Krupp, A.-G. (German application January 28, 1907.)
21,778.* Projectiles. Fried. Krupp, A.-G. (German application February 2, 1907).
21,883.* Gun Sighting Apparatus. E. Schnieder.
21,926. Back Sight for Small Arms. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
22,282.* Automatic Pistol. B. Clarus.
22,288.* Revolver Support to Aid Firing. H. Refors.
22,354. Target Practice Apparatus. F. Mitchell.
22,393. Armour Piercing Projectiles. R. A. Hadfield.
22,428. Targets. R. Ramsbottom and T. N. Fletcher.
22,431. Projectiles and Guns. F. W. Lanchester.
22,551. Wheels for Ordnance Carriages. D. Laffan and H. E. Cross.
22,765. Drop-down Small Arms. J. Rogers.
22,865.* Automatic Guns. L. Christophe.
22,875. Sliding Breech Bolt Rifles. A. J. Parker and A. G. Parker & Co., Ld.
22,876. Artillery Safety Wad. R. S. M. de Ricci.
22,880. Air Rifle Targets. G. Norman.
22,946.* Firearms. W. Fairweather.
23,112. Apparatus for Dividing Gelatinous Gunpowder into Grains. G. H. Wadsworth.

*These applications were accompanied by complete specifications

SPECIFICATIONS PUBLISHED.

SEPTEMBER 26—OCTOBER 24, 1907.

COMPILED BY HENRY TARRANT.

14,194 (1906). **Magazines for Small Arms.** Capt. A. B. Carey, R.E., Hythe. This improved magazine for small arms or machine guns is arranged to take almost any number of clips each containing five cartridges. The magazine box extends sideways from the rifles. The loaded clips are pushed forward to the ultimate position beneath the bolt by springs. Accepted September 20, 1907.

14,217 (1906). **Military Automatic Rifle.** P. Frère, Holland. Automatic military rifle breech mechanism is operated by the gases of combustion but the barrel is fixed. The breech is locked by a fork-shaped device which is released either by means of a hand-operated lever or through a double lever operated by the trigger when it is pulled. Accepted September 21st, 1907.

18,734 (1906). **Sighting of Ordnance.** A. T. Dawson, London, and J. Horne, Barrow-in-Furness. The auxiliary sight dealt with in this patent consists of a telescope mounted in a support on the revolving platform of turret ordnance. It is designed for directing the gun on a horizontal plane and means are provided for effecting its adjustment to compensate speed of ship, wind pressure and drift of projectile. Accepted September 21, 1907.

19,441 (1906). **Mountain Gun Equipment.** W. Beardmore & Co., Ld., and A. Banks, Glasgow. An implement for facilitating the loading of mountain guns on to the backs of horses consisting of a pair of jawed tongs fitted with handles through which a man on either side of the horse may easily lift the gun into position. Accepted September 30, 1907.

19,928 (1906). **Ammunition Hoists for Heavy Ordnance.** A. F. Petch, R. H. Carpmael and W. Osborne, London. Ammunition hoists are constructed so that the projectile and charge shall arrive at the gun at the same moment although they have different distances to travel. They are raised by the same hydraulic or other motor and differential winding drums regulate the respective speeds. Accepted September 5, 1907.

20,049 (1906) **Loading of Turret Ordnance.** A. T. Dawson, London, and J. Horne, Barrow-in-Furness. To facilitate the loading of turret ordnance when the trunk through which the projectiles and explosive is passed to the gun is stationary, the trunk is made to open out into a chamber which revolves with the turret. This chamber is also provided with a rotary top. Accepted October 3, 1907.

20,053 (1906). **Howitzer Elevating and Recoil Gear.** A. T. Dawson and G. T. Buckham, London. The apparatus through which the coarse and fine elevation movements of high angle ordnance are made is improved; and the regulation of the length of recoil to suit different angles of elevation is also modified to facilitate its action. Accepted September 7, 1907.

20,786 (1906). **A Shooting Glove.** Captain D. S. A. Crosby, Bournemouth. (*See Selected Patents*).

21,324 (1906). **Loading Plug of Fixed Barrel Air Rifle.** Lincoln Jeffries and F. G. Urry, Birmingham. (*See Selected Patents*).

23,932 (1906). **Bolt Action Rifles.** L. B. Taylor and E. H. Parsons, Birmingham. The breech end of the barrel is according to this invention extended into the breech shoe in which the bolt works. The extended portion of the barrel is fitted with lugs adapted to engage with locking lugs on the reduced end of the sliding bolt head. Accepted October 3, 1907.

24,493 (1906). **Ball Bearing Handle for Rifle Cleaning Rods.** F. Hirst, Birmingham. (*See Selected Patents*).

24,534 (1906). **Firing Apparatus for Ordnance.** Sir A. Noble, K.C.B., and Sir W. G. Armstrong, Whitworth & Co., Ld., Newcastle-on-Tyne. To make for increased safety the patentees arrange that the fired primer shall remain in the vent of the gun until the breech threads have been interlocked on the charge succeeding that which was discharged by the fired primer. Accepted October 3, 1907.

25,226 (1906). **Elevating Gear for Ordnance.** A. F. Petch, and R. Redpath, London. The double handed elevating gear for ordnance described in Patent No. 18,898, 1904, is so arranged that the hand wheels and shoulder pieces and the sights remain always in the same position relatively to one another. When working on a rolling ship elevation may be performed conveniently. Accepted September 19, 1907.

25,685 (1906). **Fuse Heads for Electric Blasting.** F. Render, Manchester. An improved form of the electric fuse head described in Patent No. 26,434, 1905, is dealt with in the present specification. The modified fuse head is constructed so that the electrodes shall be capable of very fine adjustment to ensure the least possible resistance to the current, and to be rigidly fixed so as to avoid any movement of their ends in the powder chamber. Accepted September 5, 1907.

27,295 (1906). **Ordnance Sights.** A. F. Petch and R. Redpath, London. The kind of gun sight having a range indicator adapted to move across the face of the rotating range dial by the engagement of a pin on the indicator with a spiral slot in the dial is provided with a series of curved cam grooves corresponding with different muzzle velocities. Accepted September 12, 1907.

27,342 (1906). **Bullet with Low Specific Gravity.** G. Hookham, and Kynoch Ld., Birmingham. (*See Selected Patents*).

28,503 (1906). **Coating for Explosive Grains.** The King's Norton Metal Co., Ld., T. A. Bayliss, London, H. M. Smith, Abbey Wood, and H. W. Brownsdon, London. To retard the rate of combustion and to give greater regularity to explosion the grains of an explosive are coated with finely powdered aluminium treated with a small quantity of oil. Accepted October 3, 1907.

29,388 (1906). **Adjustment of Coupled Ordnance.** A. F. Petch and F. W. Harding, London. The elevating gear of two or more guns is connected so that the guns can be sighted simultaneously, but it is also arranged that the difference in muzzle velocities may be compensated by apparatus allowing of an independent adjustment. Accepted September 12, 1907.

29,389 (1906). **Ordnance Sights.** A. F. Petch, R. Redpath, and J. R. James, London. The range indicator adapted to move in a radial direction across the face of the dial or drum of a certain type of sight is arranged so that it may have a movement independent of the dial to facilitate the working of the index. Accepted September 12, 1907.

273 (1907). **Ordnance Sighting Apparatus.** A. T. Dawson, and G. T. Buckham, London. The type of sighting apparatus in which the sights on each side of the mounting are cross connected, the parts are so arranged that by the removal of bolts the whole apparatus together with the return spring casing may be removed bodily from the mounting. Accepted October 3, 1907.

3,676 (1907). **Machine Gun Mechanism.** T. K. North (of The Colt Gun and Carriage Co., Ld.,) London. In order to allow an automatic gun to be worked by hand the breech and cartridge feed mechanism are arranged so that they may readily be detached from the automatic driving gear. The gun slide is for this purpose made in two parts which are locked together by a link. Accepted September 12, 1907.

4,396 (1907). **Gun Bore Sighting Telescope.** A. König, Germany. For the purpose of testing the adjustment of the sighting device proper a gun bore sighting telescope is introduced into the barrel of a small arm. A refracting prism is so arranged that the point from which the eye looks through the telescope corresponds with the point at which it is situated when looking along the sights proper in alignment. Accepted September 26, 1907.

4,631 (1907). **Ordnance Recoil Diminisher.** Lieut.-Gen. G. Bellati, Italy. A shield, provided with a hole through which the projectile may pass is fixed to the gun so that its position is some little distance in front of the muzzle. The gases of combustion strike hard against this shield and so press the gun forward against the backward movement caused by recoil. Accepted September 26, 1907.

4,823 (1907). **Automatic Small Arm Mechanism.** P. Mauser Germany. A spring controlled stud is introduced to act in the double capacity of an arrester for the sliding barrel and as a locking device to adapt the arm for single loading. By means of one lever this device is removed to either of its positions and the safety mechanism is also put into operation. Accepted October 3, 1907.

5,970 (1907). **Indicating Positions of Ordnance.** W. D. Kilroy and Evershed & Vignoles, Ld., Chiswick. By means of an electrical apparatus each gunner is warned of the relative position of other guns on his own ship, so that he shall not train his gun out of the danger zone. The patentee quotes Patent No. 20,540 in connection with this apparatus. Accepted October 3, 1907.

6,277 (1907). **Laying and Firing of Ordnance.** P. M. Justice, London. (Agent for *Bethlehem Steel Co., U.S.A.*). Improved means for firing ordnance at the exact moment when the adjustment is right, consisting in a combination with the sighting and laying devices of an improved electrical apparatus of the type dealt with in patent No. 18,898, 1904. Accepted October 3, 1907.

9,170 (1907). **Metallic Explosive Compound.** Gen. G. Cornako, Italy. The patentee has discovered that an explosive, considerably more powerful than the best nitrogen compounds, is to be obtained by using a mixture of metals with a highly oxidised salt. Aluminium and antimony with such a salt produce in the first phase of the explosion oxide of antimony Sb_2O_4, and the heat of formation assists and accelerates the formation of aluminium oxide Al_2O_4. The heat of formation of the latter added to that of the antimony oxide raises the temperature still further until it reaches that at which antimonious anhydride Sb_2O_5. is formed, and this compound in turn raises the temperature to that at which a peroxide of aluminium is formed which may, it is stated, be the hitherto unobtainable anhydride Al_2O_5. These highly heated gases are gaseous on explosion but with expansion they condense and form thick smoke. Accepted September 5, 1907.

9,870 (1907). **Cartridge Construction.** Capt. U. Marga, Belgium, The construction of the type of cartridge in which the bullet is first started by a small feeble charge is improved. The bullet is also modified in shape and is fitted with a packing of non-metallic material to engage the rifling. Accepted September 5, 1907.

10,014 (1907). **Ejector Device for Small Arms.** W. H. Lake, London. (Agent for *Winchester Repeating Arms Co., U.S.A.*). For guns in which the cartridge ejector hole is at the top of the action and which are telescopically sighted, a deflecting arrangement is fitted, adapted to direct the spent shells in a lateral direction. Accepted October 3, 1907.

10,104 (1907). **Safety Mechanism for Automatic Pistols.** J. Carter and F. T. Murray, Birmingham. In patent No. 24,382, 1906, a safety locking arrangement for automatic pistols is dealt with. The present patent concerns improved means for moving the sear operating bar of the firing mechanism, and it is arranged that this bar is automatically disengaged when the parts are disconnected prior to taking down. Accepted October 3, 1907.

10,779 (1907). **Small-Arm Breech Mechanism.** F. Standebach, Germany. A breech arrangement for small-arms with drop down barrels, the distinguishing feature of which is the moveable part of the breech containing the striker. This is pivoted in the action body so that the barrels can force it backward into the body when they are turned down to open the gun. Accepted September 26, 1907.

10,964 (1907). **Travelling Targets.** G. Buxton, London. The target holder consists of two heavy wheels from which are suspended two standards carrying the cross bar slotted to receive the target. The holder is adapted to travel by its own weight over inclined wires. Accepted September 5, 1907.

11,880 (1907). **Projectile Construction.** S. Hoffmann, Switzerland. This projectile carries a portion arranged to burst after the main shell has been exploded. The nose portion of the shell carries the dynamite bursting charge and the shrapnel shot is distributed around. The back portion contains the first charge. Accepted September 19, 1907.

13,935 (1907). **Barrel Recoil Ordnance.** Fried. Krupp. Germany. This invention provides for the rapid mounting of spring running out gear such as is applied to barrel recoil ordnance. A rope windlass overcomes the strong initial tension of the spring. Accepted October 3, 1907.

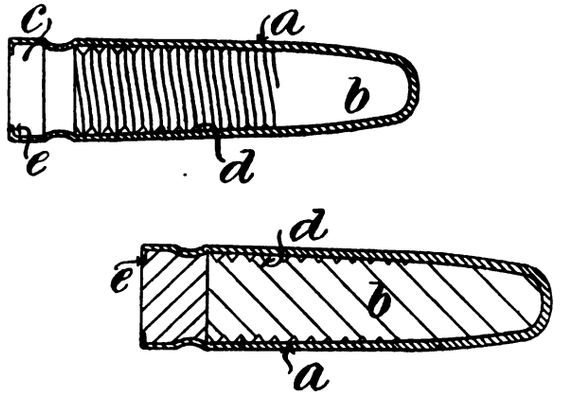
16,467 (1907). **Telemeters.** Carl. Zeiss, Germany. An appliance is connected with telemeters of certain construction to indicate derangement of parts due to displacements which are at present influenced by change of temperature. Accepted September 26, 1907.

SELECTED PATENTS.

RIFLE BULLET OF LOW SPECIFIC GRAVITY.

27,342 (1906). G. Hookham and Kynoch, Ld., Birmingham. For certain reasons a bullet of lower specific gravity than that in which lead is mainly used is sometimes required. Other metals of lower specific gravity than lead are however much harder and it is the present patentees' idea to make such a metal as zinc serviceable for rifle bullets. The zinc is enclosed within a cupro-nickel envelope as is the lead of an ordinary ·303 bullet, but to lessen the force which would be required to make the bullet take the rifling properly the outside of the zinc core is grooved circumferentially in a fashion similar to the threads of a metal screw. The surface to be compressed when the envelope is forced into the rifling is by this means lessened. At the base of such a bullet a disc or plug of lead is inserted to serve the double purpose of preventing the gases of combustion inserting themselves between the envelope and core and to enable the base of the bullet more easily to be " set up " by the explosion.

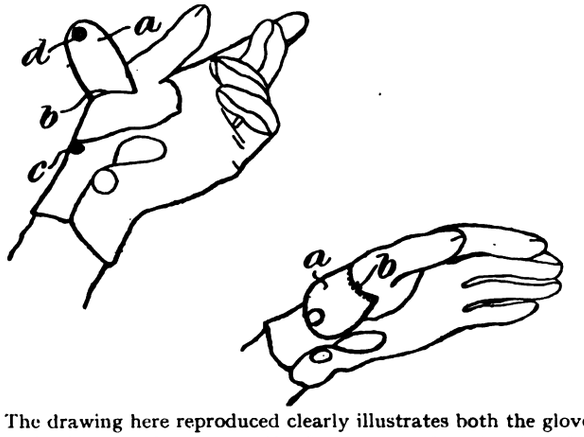
This new form of bullet is illustrated below. The envelope *a* of cupro nickel encloses the core, the top portion *b* of which is composed of zinc and the bottom part *c* of lead. To enable the bullet to take the rifling at an ordinary pressure the zinc portion



b is grooved on the outside at *d* as is shown. These grooves may be of any convenient form. The lower part *c* of the core into which the turnover *e* of the envelope embeds itself prevents gas entering between envelope and core and allows the base to be easily set up by the impact of the gases on firing. Accepted September 19, 1907.

A SHOOTING GLOVE.

20,786 (1906). Capt. D. S. A. Crosby, Bournemouth. The glove described in this patent is fitted in a novel fashion with an attachment adapted to be turned up when the wearer is shooting so that a view of the object is obliterated to the left eye—supposing this is the master eye. When not in use the attachment is folded down and clip fastened to the body of the glove.

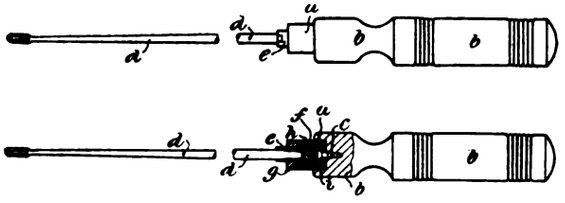


The drawing here reproduced clearly illustrates both the glove and the flap attachment *a*. The flap is secured to the glove by stitches near to the second joint of the thumb so as to form a hinge *b*. When the flap is in the raised position it is adapted to remain there, until it is folded down to lie flat on the thumb of the glove. In the folded position the flap is held by the engagement of the spring button *c* with the hole *d*.

The advantages of this flap are stated to be, first, the interception of the sight of the master eye to allow the shooter to aim with a straight stocked gun with both eyes open ; second, unlike other devices this one does not affect the balance of the gun ; and third, the device besides being handy and simple, dispenses altogether with the necessity for a cross-eyed gun. Accepted September 19, 1907.

CLEANING ROD FOR RIFLED BARRELS.

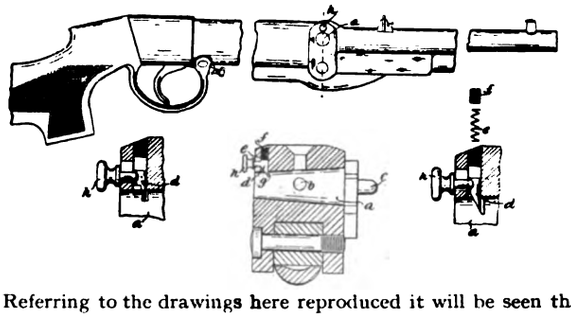
24,493 (1906). F. Hurst, Birmingham. The cleaning rod dealt with in this patent is adapted to revolve with the rifling when cleaning a barrel. To facilitate the movement of the rod in the handle the improved ball bearing arrangement described is designed.



The illustrations reproduced impart a clear idea first of the thimble *a* of hardened steel which is fixed to the handle *b* by means of the screw *c*. The rod *d* is screwed into the socket *e* which carries the flange *f*. The socket is held in the thimble *a* by means of the plug *g*, the exterior screw threads of which engage the screw threads on the interior of the socket. Between top and bottom of the flange *f* of the socket *e* and the bottom of the plug *g* and thimble *c* respectively, ball races *h* and *i* are interposed so that as much friction as possible is eliminated during the relative movements of the rod and its handle. Accepted September 5, 1907.

IMPROVED ROTARY LOADING PLUG FOR FIXED BARREL AIR RIFLES.

21,324 (1906). Lincoln Jeffries and G. F. Urry, Birmingham. The rotary loading plug fitted to air rifles of the well-known "fixed barrel" type is provided with a spring retained device. which not only holds the plug in position so that it may be removed without the aid of tools but it also automatically compensates any wear and so preserves the air tight fit of the plug.



Referring to the drawings here reproduced it will be seen that the rotary loading plug *a* is made taper shape and is provided with the usual pellet chamber *b* which may be turned through the handle *c* to the vertical position to receive the pellet, and also into the horizontal position to place the pellet in direct communication with the cylinder and barrel. The wedge shaped device *d* forms the subject of this patent and is held in position by the spring *e* and its tension adjusting screw *f*. The device *d* is adapted to engage within the recess *g* in the rotary plug *a* so that the spring *e* constantly holds the inclined face of the device hard up against the inclined wall of the groove *g*. The device *d* is, therefore, adapted to exert a wedge-like influence on the plug *a* so that any wear of the latter is automatically compensated.

The device *a* has the knob *h* attached, through which the nose of the part *d* may be quickly disengaged by finger pressure from the groove *g* to allow of the removal of the plug *a* from its seating in the solid part of the breech behind the fixed barrel. Accepted September 5, 1907

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CONTENTS.

CURRENT TOPICS.

Aperture Sights on Military Rifles.—The success of the American team against our own representatives has confirmed the view that no matter how unfavourably an aperture sight may be located it is at all times a better means of aligning a rifle than the open notch backsight. With Mr. E. J. D Newitt rests the credit of having preached this faith not only in season, but at times apparently out of season. One of the recognised tests for astigmatism of the eye is to look through an aperture held at arm's length. The orifice, instead of being enlarged into the appearance of a blurred hole resembling the round speckled spots on sunlight which one sees under a tree, assumes a star-shaped image reproducing the irregular formation of the eye lens. With persons whose eyes project an unsymmetrical image some arms of the star are unduly enlarged, whilst the opposite ones are reduced in like proportion. Such a phenomenon would undoubtedly be disconcerting to the shooter who uses an aperture at an arm's length distance, but the soldier is usually at an age when these troubles have not begun to manifest themselves. Moreover he does few things to strain the eyesight and bring on premature changes of vision. One may, therefore adopt Mr. Newitt's proposition, which is also the proposition of many practical shooters including those who were responsible for adopting the aperture on the United States service rifle. But in adopting it one may reasonably point out that whilst the exergencies of the bolt action rifle debar the aperture backsight from being placed within three inches of the eye, there is no reason whatsoever why it should be placed at the very considerable distance of the existing backsight, a position which is determined by the requirements of the open notch. There is moreover no reason why a military rifle designed *de novo* should not be made capable of accomodating a aperture backsight in the best possible optical position, viz., two or three inches in advance of the shooter's eye. This, however, is a matter which needs positive demonstration, and it is possible that many British teams will travel round the world before they come into contact with properly sighted military rifles in the hands of their antagonists.

The 16-bore Gun.—A good many indications go to show that gunmakers are seriously taking up the idea of advocating the 16-bore gun as a substitute for the twelve. Some amongst them are moreover specialising its construction and testing the behaviour on the range of various systems of boring. Now that detailed consideration has been given to the subject it has already been found that the rough and ready assumption that the 12-bore proportion between weight of gun and charge of shot can be retained in the 16-bore needs examination. Those who handle tools and implements of any description find cause at times to complain that the manufacturer frequently forgets when shaping the handle that however small the working edge of the implement may be the human hand remains a constant size, and cannot accommodate itself to a handle slender in proportion to the work to be done. In just the same way the 16-bore gun must not follow the bad example of a fifteen shilling miniature rifle, and lessen all the dimensions as though small guns were necessarily to be handled by small people. The sportsman who will handle the 16-bore gun is the same individual who has freely spent large sums

of money and has practised assiduously for years in the effort to secure a shot gun of perfect dimensions to suit his bodily development. This argument implies that whatever may be the weight reducing possibilities of a 16-bore cartridge, from the point of view of recoil, practical conditions suggest that the weight must be largely controlled by the necessary dimensions of the parts that cannot be altered. For instance a 16-bore should have practically the same size and the same weight of stock as a 12-bore. The same applies to the triggers, guard, safety mechanism, top lever, cocking mechanism, tail pipe and fore-end fastener, fore-end strap, springs, etc. The only parts where weight can be properly saved is in the barrels and in the bulk and substance of the action. It would not be desirable, at any rate for a start, to reduce the strength and holding power of 16-bore actions below what is ordinary in good quality 12-bore guns. More than this it has never been finally settled whether the smaller calibres of gun are not inclined to jump more in the hand than 12-bores. These arguments go to show that the wisest policy for a start is to build 16-bore guns with a liberal margin of weight, relying upon practical experience and the natural wish of sportsmen for light-handling weapons to evolve in due course the most satisfactory methods of further diminishing the weight. These are the opinions of the highest authorities in the gun trade, which makes it all the easier to adopt the view that 6 lbs. should be regarded as the standard weight for a 16-bore gun. Such a weight will ensure a low recoil with the maximum charges of powder and shot recommended in the official loading instructions. The *Field* test of recoil showed 5 lbs. 13oz. as the appropriate weight of gun to use with the maximum 16-bore load. This gives a margin of three ounces for lessening the velocity of recoil below that commonly experienced with 12-bores.

The Misnaming of Guns.—A good deal of dissatisfaction is rife amongst reputable firms of gunmakers regarding a practice which is nearly as hurtful in its way to legitimate trade as the fraudulent marking of shot guns which was so effectively checked some few years ago. The demand for second-hand guns continues to exceed the supply, and the deficit is made up by designating as second-hand perfectly new guns which are sold with a generous retail profit. These make-believe bargains are mostly sold by so-called dealers in second-hand weapons, whose own name on a gun would disprove the suggestion that it was of second-hand origin. The penny wise purchaser is satisfied that things are what they seem if the guns submitted for selection are named with sufficient diversity to suggest that they are the product of many firms. This simple requirement is easily met without taking the risky course of applying fictitious names. Such guns usually bear the names of firms and individuals who have either ceased to carry on business, or are mere garret workers who do not name guns in the ordinary course of their occupation. A fee of a few shillings per gun is frequently paid to such persons for the use of their name on guns which are not properly speaking the goods or merchandise of the individuals or firms whose inscriptions they bear. Such a transaction seems on the face of it to savour of fraudulent practice; and the fact that legitimate traders lose legitimate business, whilst the purchaser obtains something different from what he supposes is being supplied, seems to bring the guilty parties within the provisions of the Merchandise Marks Act. The only way of forcing the question to an issue is to collect evidence concerning a specially flagrant case, and to test the law by bringing an action in the Courts. The Gunmakers' Association is by precedent and standing the body which might reasonably be expected to institute the necessary proceedings. It is even probable that the matter has already been under consideration, and if this is so it may be hoped that no obstacle will be allowed to stand in the way of prompt action.

The Empire Rifle Match.—The announcement that the English team of riflemen has continued in Australia its career of non-success shows that something is radically wrong with the methods adopted at the Bisley rifle meeting. The cause of the team's mishaps no doubt arises from the slavish stereotyping of the 200, 500 and 600 yards King's first stage conditions of shooting. The service rifle and cartridge are absurdly inadequate for shooting at the longer ranges over which the contests were shot. Following the wisdom of Mahomet the shooting practice of our volunteer marksmen continues to be carried on at the ranges where the limitations of the rifle and cartridge are least apparent. It is all very well to excuse the bad performances of our picked team of marksmen by pointing out that they are shooting over unaccustomed distances with ammunition which they have never before tried. The long ranges at Bisley are mainly utilised by match rifle shooters who are perfectly free to choose whatever rifles, ammunition and sighting, within a fairly wide specification, will conduce to high scoring. The result is that 800, 900 and 1,000 yards shooting is the pet hobby of a few enthusiasts, whose connection with military rifle shooting if it exists at all is accidental. There is no doubt that at 900 and 1,000 yards the service cartridge is entirely unfitted for maintaining a respectable angle at the size of target, whose dimensions are fixed mainly with reference to the accuracy standard of match rifles and ammunition. The service cartridge might easily be improved sufficiently to make long range practice reasonably effective, but the real seat of the trouble lies in the weakness of the bolt action in the service rifle. The authorities at the War Office are afraid to sanction any change of ammunition which might diminish the slender margin of safety which now exists. Even if a cartridge showed a fair prospect of being reasonably safe when used freshly loaded in temperate latitudes, there is always the danger that it might go seriously wrong in the tropical dependencies. M.D. cordite, by diminishing the increase of pressure due to high temperature, provides one way out of the difficulty; but a parsimonious Government refuses to sanction the expenditure involved in making a change. The pointed bullet provides another and an additional means of ensuring greater efficiency, but here again our own Government takes several years to accomplish a few months work.

THE NEW N.R.A. RIFLE DEFINITIONS.

The advance programme of the N.R.A. miniature meeting which is to be held at the Bunhill Row drill hall on the 21st to the 25th of January inclusive, needs to be read with a certain amount of intelligence before the full meaning of the document is clear. To express the whole of the facts in a nutshell, it is the intention of the National Rifle Association to boycott the War Office miniature rifle, and to use in its place the job lot of Martini rifles which were bought for eighteenpence apiece from the War Office, and which are now being converted to shoot ·22 calibre ammunition. It should be understood from the very start that no legitimate objection can be taken to the policy of the National Rifle Association in securing for the benefit of rifle clubs a supply of efficient and accurate weapons at the low cost at which these converted Martinis can be supplied. The success of the rifle club movement largely depends upon a plentiful supply of cheap rifles, and the N.R.A. with the help of the War Office have certainly tackled the problem on business lines. Nothing but the high standing of the National Rifle Association and of the individuals who compose its Council, will protect them from charges of bad faith with manufacturers and rifle clubs for having barred the very rifle which they were chiefly instrumental in producing. At last year's meeting the War Office miniature rifle was almost exclusively used by the competitors. It was authorised under the regulations, and a large number of rifle clubs have purchased these weapons under direct encouragement from the Association. The same influence was exerted to force the two firms who manufacture the service rifle to lay out large sums of money in turning out the new weapon. The companies referred to spent thousands of pounds in the preparation of tools and fixtures for the manufacture of the service pattern of miniature rifle, and they did this without any financial guarantee other than confidence in the good faith of the War Office and the National Rifle Association that the weapon would become the officially recognised arm for target practice at miniature ranges.

Through no fault of the manufacturers the rifles gave a good deal of trouble on account of defects of design, for which the War Office alone was responsible. Serious financial losses resulted from cessation of sales between the discovery of these defects and the adoption of an altered design to overcome them. Articles in this issue and the previous one show that success has been attained, and ordinary business ethics should permit the sale of the new model to proceed without hindrance. But this will not be allowed. The N.R.A. have laid down that no rifle is to be used in the single entry competitions at the forthcoming meeting unless the weight exceeds 8 lbs.; and it is evidently a case of cause and effect that this extraordinary proviso, or which there is no precedent in past rules and regulations, should be adopted at a time when the first deliveries of the converted rifles are being received. No one could possibly have objected to the action of our National Rifle Association had they allowed their own offspring, or rather their latest offspring, to compete on equal terms with the diminutive elder brother. Given equal accuracy a heavy rifle will always beat a light one in open competition; and although the War Office miniature rifle is unduly light it must be remembered that the National Rifle Association were the parties mainly responsible for the specification of its weight. The generous support which the National Rifle Association has invariably received from every class of shooter has been largely built up by reason of the freedom it has enjoyed from the taint of trading motives.

Now that the Association has become a gun jobber on a large scale, and takes trade discounts and sells for a profit in competition with the retailer whose business is not subsidised by donations, the situation is changed for the worse. Mr. Tippins sounded a note of warning at the last general meeting of members, when he earnestly begged the Association to consider the pitfalls incidental to being mixed up with trade. Everyone must echo his exclusion of the possibility that the N.R.A. would be inspired by bad motives; but he nevertheless gently and kindly insisted that the carrying on of trade would detract from the capacity to act with independent judgment. The present case shows that Mr. Tippins' worst fears were soon to be justified. N.R.A. rules should always reflect the policy of just, but not necessarily well-informed, private gentlemen. The motive of trade gain which now exists strikes a harsh note of discordance, and decisions which may be right in themselves are apt to be unjustly regarded as the outcome of interested motives. Nobody for a moment supposes that the officials of the National Rifle Association have anything to gain from buying and selling rifles; but the fact remains that in their corporate capacity they have rifles to sell, and whether these rifles are or are not the best for the purpose in view the shooter is prevented from using something which a couple of years ago was specially designed to fulfil the same function. It is also a fact that service rifles carrying small bore barrels were ineligible for N.R.A. miniature competitions a few years ago. This shows that the Association is far from infallible as a judge of the best class of rifle to employ for miniature shooting. Fortunately the small meeting in the Bunhill Row drill hall does not govern miniature rifle shooting as a sport or exercise, in the way that Bisley conditions rule military rifle shooting throughout English speaking countries. The club member may continue to use the weapon which pleases him best, but no one can deny that the state of chaos and disorganisation which exists with regard to dimensions of targets, systems of scoring and weapons used, emphasises the shortcomings of a governing body lacking the authority which intelligent regulations alone can supply. The N.R.A. have signally failed to show consistency and good judgment in their efforts to systematise miniature rifle shooting, and the latest set of rules suggests that they are drifting further than ever from the capacity to gather into harmonious concordance the army of miniature riflemen who have responded to Lord Robert's patriotic call.

LECTURES TO YOUNG GUNMAKERS.

No. XLVII.—THE INTELLIGENT APPRECIATION OF SHOT GUN PATTERNS.

To the young gunmaker there is probably no test which seems more easily made, and the results of which are so intelligible, as the taking of patterns with a shot gun. When the matter is regarded more closely the surrounding issues are at once found to be so complex that the subject assumes an entirely different aspect. At the risk of again covering ground which has already been dealt with, an effort will be made in the present lecture to set out in clear and easily understandable language some of the points which should be borne in mind when testing guns or cartridges to ascertain their behaviour on the whitewashed iron plate.

The simplest test of all is naturally to ascertain whether a gun which has been bored to give cylinder, half-choke or full-choke patterns behaves in accordance with the well-known requirements. Granting properly loaded cartridges, the test consists in shooting a certain number of rounds at 40 yards, and counting the number of pellets which fall within a 30-inch circle scribed around the selected centre of the pattern. The results obtained are then set down in series, and the arithmetical average is worked out, the resulting pattern standing for the behaviour of the gun. Even when the test is reduced to this, its simplest form, there are many openings for serious error, and sundry questions are apt to arise which only experienced judgment can settle in a truly scientific spirit. In the first place it is necessary that no doubt should exist concerning the distance over which the shooting is conducted. One is apt to trust far too much to the general belief that such and such a mark is distant 40 yards from the plate, whereas it may be short of the true amount, as the following extract from a letter recently written by a well-known gunmaker shows :—

"I believe you were informed that my people had made much heavier patterns than those produced by either yourself or Mr. * * *. I, therefore, inquired into that discrepancy, and on sending a tape measure down to a range where half the gunmakers in London have in common with ourselves tried their guns, we find the usual firing point is some two or two and a half yards short of 40 yards, so you can imagine the number of guns now in use with perhaps fictitious records of 40 yards performances."

The best way for defining the 40 yards firing mark is to erect at exactly that distance from the face of the plate a small table built upon legs sunk into the ground, and to fasten on to the face of the table an enamelled iron number plate such as can be purchased from a builder's ironmonger for use in the numbering of houses. The shooter takes his stand to the rear of this table and the 40 yards distance thus becomes 40 yards from a barrier, beyond which the barrel of the gun may project so far as is convenient for a natural shooting position. A charge of shot opens out so rapidly, especially with full-choke guns, that an error of a yard or two in the distance exercises an extraordinary effect on the number of pellets finding their way into the circle.

If scrupulous accuracy is important in the matter of distance it is equally so in regard to the charge of shot inserted into the cartridge, The standard charge is 1⅛oz. of No. 6 shot, and counting trowels are clearly marked so that the 304 pellets of the charge mentioned can be measured off in the usual manner. For a test of pattern an exact number of pellets is far more important than a precise weight. An ordinary commercial sample of shot is liable to vary within wide limits of the nominal size marked on the bag. A charge true to weight may easily contain a surplus or deficiency of twenty pellets, and if to this is added possible errors in the balance and weights used the discrepancy may be still greater. The proper plan is to select from a delivery of shot a bag true to size, and to load all cartridges for pattern tests from that bag. The counting trowel gives the most accurate loading for pattern testing, but weighing is practically as effective it due care is observed in securing a sample of shot true to size.

Pattern tests conducted with ordinary commercial cartridges are likely to give misleading results unless the correct loads have been hit off by chance. Really accurate tests of pattern should be conducted with hand-loaded cartridges, of which the powder charges are separately weighed in an accurate balance from a tin set aside for that purpose alone. Best wadding should in every instance be employed, and as a further safeguard the cases used should be Eley's "Lab" brand, which are specially manufactured to standard specification for use by powder makers in their factory experiments. The turnover should be formed in a proper machine worked by power or treadle. This definition of the words "granting properly loaded cartridges," shows that pattern testing on scientific lines cannot be conducted unless the operator has satisfied himself by loading the actual cartridges to be used that they are what they profess to be.

When it comes to counting the number of pellet marks in the 30-inch circle further precautions are necessary to ensure accurate results. When tests of any importance are carried on it is a mistake to allow an assistant to wipe out the marks with the end of a fired cartridge case with the lightening rapidity which long practice produces, and then to write down a number. The record cannot be disputed, because the evidence has been obliterated. The safest and in the long run the quickest plan for counting the pellets marks on the plate is one which enables some kind of check to be applied to the counting after it has been performed. No one could count up to a hundred so quickly as from one to twenty repeated five times over. Therefore in counting shot gun patterns no plan is so good as to wipe out the pellet marks one at a time till the number twenty has been reached. A stroke should then be made on the whitewash outside the circle, and the next twenty should be similarly recorded. When 80 pellets have been marked out four vertical strokes count as a record of what has been done. The stroke implying the final twenty of the first hundred should be made diagonally across the preceding four, and the counting should continue on a similar basis till the last twenty has been marked up. The odd pellets are then

added to the total shown by the strokes on the plate, and a degree of accuracy has been achieved which leaves but little opening for doubt, at the same time being as quick as the alternative process of wiping out the whole of the pellets and then writing down a number. Even in the matter of recording the results some ways are better than others. None is, however, better than to use an ordinary school slate and write on it with white crayon, this making a better impression than blackboard chalk. The advantage of a slate is that it cannot be blown away by the wind, and the results can be copied down at ease in a permanent form. The temptation to postpone the copying does not exist, for a record on a slate cannot, like a scrap of paper, be slipped into the pocket with the intention of dealing with it later on. The slate record is certain to be promptly and regularly entered up, with all details while they are fresh in the mind, and it possesses the surpassing merit of being convenient to use on the range and visible to onlookers.

Having thus laid down the essentials for preparing the cartridges and taking a record of the patterns produced, attention may next be devoted to considering what latitude may be legitimately adopted in regard to any abnormal results that may occur. The most important rule to adopt as an invariable practice is to set out in full detail the true result of every shot fired. It may be different from what was expected, or it may confirm some preconceived theory which has been formed before commencing the experiment. None of these contingencies must however, be allowed to interfere with the due carrying out of a predetermined test and duly recording the result.

If only one charge is to be used for testing the behaviour of a gun not less than ten shots should be fired. Five will suffice for each series if two or more powders or charges are to be used. If the programme of tests includes so many rounds with a 42-grain powder, and a similar number with a 33-grain powder it is better with 12-bore guns for example to use $1\frac{1}{16}$oz. in both instances than to shoot the 42-grain powder with the full $1\frac{1}{8}$oz. charge and the 33-grain powder with the usual sixteenth-ounce less shot. When the test includes a comparison of the behaviour of different sizes of shot, or different quantities, the proportional relation of the charges used should be carefully borne in mind. Curtis's and Harvey's card of proportional gun patterns contains full details of all variations; and it is possible by reference thereto to determine at once whether the behaviour of two charges, or the same charge with different shot sizes, displays the same or nearly similar results on the percentage basis of examination. It is only during recent years that gunmakers have begun to classify patterns according to percentages, instead of by the number of pellets in the circle, using an arbitrary standard load. Whether the size of shot be No. 4 or No .7, and whether the charge be one ounce or $1\frac{1}{8}$oz. the number of pellets in the circle should be a uniform percentage of the total in the entire charge. An improved cylinder pattern, using the standard charge is 140 pellets in the 30-inch circle; a half-choke 180; and a full-choke 220. These patterns represent 46, 59 and 72 per cent. respectively of the total pellets in the $1\frac{1}{8}$oz. charge of No. 6 shot. Rough and ready approximate figures are provided by regarding the improved cylinder as giving 50 per cent. patterns, the half-choke as 60 per cent. patterns, and the full-choke 70 per cent.

If it is desired to find the exact percentage for any pattern which has been obtained the arithmetic involved may be expressed by the following simple rule:—Add two noughts to the pattern and divide by the number of pellets in the charge, ignoring any remainder that may occur. This system of reducing pattern results to percentage values is exceedingly useful. If for instance a test of pattern is being made with commercial cartridges containing an inexact load having an odd total of pellets, the counting of a few extracted charges will give the average number in the cartridge. The patterns obtained may then be reduced to a percentage basis in the manner above described, so providing an idea of what the behaviour of the gun would be with properly loaded cartridges, or giving whatever other information is desired.

Up to this point no more has been done than to lay down the precautions that are necessary for ensuring that a pattern test shall disclose as nearly as possible the true behaviour of the gun which is being tried. The results obtained in most instances form the text of a report or instructions which are conveyed to the man who bores the barrels, giving particulars of any changes that are necessary by way of further regulating the shooting of the barrels. Many stories are current concerning the lack of sympathy and collaboration which exists between the testing ground and the barrel boring department, most of which go to show that each party distrusts the other, with the result that proper co-working is checked. The differences of opinion which constantly crop up are mainly due to the vagaries of behaviour which inevitably occur when guns are tested for pattern. For his own protection, and to save needless alterations of the barrel when nothing is wrong, the pattern tester should always have available a gun which has been set aside as giving good all-round patterns and being generally efficient. Such a gun should in no sense of the word be of freak boring. The chamber, the cone, the parallel bore and the choke should be as far as possible normal in all respects, and, therefore, adapted for serving as a model to regulate current manufacture.

When abnormal results are experienced the tests should be repeated, using the same cartridges from the model gun, and the report sent home must be governed by the behaviour of both guns. Experience alone will show what limits must be adopted for governing the acceptance or rejection of guns sent for test. If small differences are made the subject of complaint the barrel borer is apt to retaliate by returning the gun a few days later under the pretence that the changes asked for have been made. If the accident of gun testing leads to a satisfactory result at the second trial confidence disappears, and the barrel department will in future exercise its own discretion and so be deprived of the assistance which properly conducted and above all properly interpreted tests should convey. the pattern tester can protect himself to a great exttent by delaying a final opinion till the first tests have been checked by employing such sundry variations of charge as his

ingenuity will suggest. He must also cultivate a certain amount of familiarity with the work of the barrel borer. He must realise for instance that the quality as distinguished from the density of a gun's patterns is even more affected by the dimensions of the chamber, cone and lead than by the parallel of the barrel. The barrel borer is responsible for the parallel and the choke, but the actioner may spoil the very best boring by tight chambering or by unduly lengthening the lead. These and many other elements of pattern testing go to show that the test is easy if the purpose for which it is made is ignored, but it is elevated into a highly scientific operation if carried out with due regard to the practical consequences that ensue.

THE IMPROVED W.O.M. RIFLE.

THE Birmingham Small Arms Co., Ld., have forwarded a new model of the War Office miniature rifle containing improvements which have been authorised by the War Office for getting rid of the liability of the extractor spring to blow out of the rifle in the event of cases bursting. The War Office's own arrangement for overcoming this defect consists of a hood which covers the front of the bolt head and holds down the front of the extractor should the gases endeavour to lift it out of place. A model built according to this description was noticed in our last issue, and it successfully withstood a severe course of ill-treatment in the form of repeated firing of overcharged cartridges bursting at the rim every time. The London Small Arms Company submitted the rifle in question and it was pleasant to be able to issue so satisfactory a report. It was, however, pointed out that the escaping gases might conceivably get under the extractor and lift it with such violence in the middle that the holding down of the two ends would cease to be effective, the extractor being liable to fly to pieces.

Both companies have made the rifle with the new hood, and the B.S.A. Company report that the rifle is not entirely free from danger so long as any part of the extractor remains unsupported. They have accordingly secured the War Office approval for a new pattern of bolt head which provides for completely covering the extractor throughout the whole of its length, the War Office safety hood being also employed. The company report that they have submitted one of the rifles with the new bolt head to a severe test, cartridges with double charges having been fired therefrom. Beyond a slight bulge in the cover of the extractor hole, and a slight bending of the right-hand side of the back of the action body, nothing was shifted. The back of the action body was forced slightly round by the back of the bolt handle, the bolt having been pushed forcibly to the rear by the explosion of the bursts. This happened only when the rifle was shot without the wood. The support of the wood was found to prevent any bending at all of this part of the body. The officials at Enfield are giving three rifles with the new form of bolt head with a covered-in extractor and guide ribs a thorough test before again considering the advisability of embodying this form in the specification.

In the meantime our own tests with the new mechanism enable us to give an entirely satisfactory report. Following the practice adopted in the previous experiments ·22 cartridge cases and bullets of King's Norton manufacture were loaded with progressive increases of charge till a burst was obtained. This occurred with 2·2 grains of powder, which is practically the same as the 2¼ grains which caused burst cases on the previous occasion. Two cartridges so loaded were fired in the rifle, and no disturbance of the mechanism was apparent. The charge was then increased to 2·5 grains of powder, and four cartridges so loaded were fired, still without showing any injury to the rifle due to the escape of gases. The last named charges can certainly be accepted as giving much higher pressures than could be obtained by service cartridges of a violent nature. Our own tests for deciding whether the mechanism had been strained were of course not so delicate as those which a manufacturing company could apply, but they were unnecessary in our case, because the sole point to be elucidated was the possibility of injury to the shooter.

The gas vent provided for the escape of the discharged gases was on one occasion covered with a piece of strawboard target. A hole through which the finger could be passed was blown out by the escaping gases, yet when a vertical piece of target was disposed one inch to the rear of the gas vent the sole result was a slight shifting of the screen and a slight discolouration due to the deposit of fouling. This exceedingly important test showed that the whole of the gases escaped upwards, and that none of the products of combustion were discharged in the direction of the shooter's face, the sole inconvenience being an increase above the normal noise of discharge. These tests indicate with absolute certainty that the War Office miniature rifle when fitted with the latest improvements can be passed as absolutely safe in the presence of bursting cartridge cases. The shooter would of course in his own interests avoid using a brand of ammunition frequently subject to these mishaps. The bursting of a cartridge is in itself an unpleasant experience liable to make the ears tingle. The discharge of gas into the breech, with its almost inevitable accompaniment of partly burnt powder grains, is liable to foul the action and necessitate its taking apart for the removal of accumulated matter liable to prevent the proper working of the mechanism. If by any chance the hot gases impinge on the firing pin spring there is a liability that the temper of the steel may be lowered, so reducing its resiliency, and giving rise to misfires. The same may of course happen to the extractor.

These possibilities are of course quite apart from the far more urgent requirement that the shooter shall be duly safeguarded from personal mishaps. This the improved model of rifle undoubtedly achieves, and that the weapon itself is not unduly affected by burst cases was shown in our own experiments by the fact that after the conclusion of the bursting tests a number of ordinary cartridges were fired with perfect success. It will be an advantage if the altered models of the War Office rifle are made o the same design by whomsoever manufactured, and it may accordingly be hoped that the authorities will officially adopt the system of wholly covering the extractor.

ROUND THE TRADE.

One of the London evening papers makes mention of a visit which Sir Charles Ross is paying to Russia for the purpose of demonstrating the Ross rifle and it capabilities.

Mr. Charles Lancaster has been successful in securing first notice in the *Field* of a rifle firing the Ross-Eley ·280 cartridge. The barrel was rifled on the oval-bore system and two seven-shot groups were published showing that the shots fell within a rectangle of about 1½in. square.

The three leading makers of cartridges have sent out a notice in practically identical terms to the effect that ammunition prices have been advanced and that particulars will be sent out in due course. In the meantime orders can only be accepted on the understanding that the prices will be governed by the new lists

Messrs. Du Pont write from America advising us that the recent disastrous explosion at their Fontanet, Ind. mills will in no way affect the manufacture of their sporting powders, either black or smokeless. The Fontanet mill manufactured only black blasting or mining powder, while all their smokeless powders are made at Carney's Point, Haskell, and Oakland, New Jersey. The note which appeared last month left no doubt that the explosion could only have occurred in a black powder mills.

The official announcement by the National Rifle Association that the targets used at 200, 300, 500 and 600 yards will be round instead of square as formerly will be received with consternation in rifle shooting circles. The uninformed public may be justified in supposing that because the bull's-eye is the object to be struck it is also the object aimed at. The rifleman knows better, for it is at the target that he aims in most instances, opinions being divided as to which part of it best defines the sights. The top and bottom edges have greater visibility in an optical sense than the bull, and each marksman aligns at the particular part which his eyes see best. So long as the rifle is uniformly held round by round it is merely a question of adjusting the sights to ensure a group in the region of the bull. The round target will introduce new conditions, and it will be left to the ingenuity of the shooter to find out what is the next best objective for his sights.

The advance notice of the Miniature Bisley Meeting, to be held at the Bunhill Row Drill Hall, in the City of London, from the 21st to 25th January inclusive, states that shooting will be carried on from 1 p.m. till 10 p.m. on the first four days, but will commence at 10 a.m. and conclude at 1 p.m. on the last day. Prizes have been presented by the following amongst others :—B.S.A. Co., Ld., W. W. Greener, L.S.A. Co., Ld., Re-Loading Miniature Ammunition Co., and the London Armoury Co., Ld. The 25 yards shooting will be conducted at a 6 in. square target, having a black disc in the centre of 1½ in. diameter. The bull will consist of a ¾-in. central circle inside the black, and the inner will extend beyond the black, being bounded by a circle 1⅞ in. diameter. The dimensions of the 50 yards target are exactly double the above, both representing a proportional reduction of the Bisley 200 yards target. It seems a great pity that the "inner" portion of the target will not be coincident with the black area outside the bull. The squadded competitions are open to "military miniature rifles" as defined in the R.A. regulations, but subject to the further proviso that the weight of the rifle must exceed 8 lbs. The unsquadded, i.e., unlimited entry, competitions are open to any miniature rifle. Entries close on the 8th of January, and programmes may be obtained, price 3d., post free, on application to Col. Crosse, Secretary, N.R.A., Bisley Camp, Brookwood, Surrey.

Mr. G. A. Battcock, who was so well known as Secretary to the Gun Club and of the Field Sports Protection Association and of the Gamekeepers Benefit Society, died on the 25th ult., aged 67 years. His health had been indifferent for some time past.

A recent return of the dynamite consumption in the Northern Steppe mining district of Russia shows that 1,000 lbs. was used in 1902, 3,038 lbs. in 1903, 7,140 lbs. in 1904, 6,228 lbs. in 1905 and 14,877 lbs. last year. The consumption of fuse and detonators has progressed in similar proportions.

A party of distinguished guests visited the works of the Cotton Powder Co., Ld., on the 13th ult. for the purpose of witnessing a demonstration of Hale's hand-thrown Shrapnel grenade. The experiments were designed to show the value of this new item of equipment, the first modern use of a hand grenade having been made in the recent Russo-Japanese war.

Extraordinary general meetings of the shareholders of Walkers, Parker & Co., Ld., were held on the 20th ult., for the purpose of considering a scheme for the re-arrangement of the Company's capital. The arrears of preference dividend, and the fact that the ordinary shareholders received only one dividend, viz., in March 1890, has rendered some kind of rearrangement necessary. The directors proposed, and the majority of the shareholders agreed to, a scheme, by which the present preference shares become entitled to 54–55ths of future profits, the ordinary shares receiving the remaining 55th. This works out existing arrears and practically converts the present preference shares into ordinary capital, the holders of ordinary shares being assured some slight return for their capital.

The general purposes committee of the Birmingham Chamber of Commerce, having instituted an inquiry relative to the proposed compulsory adoption of the metric system, reports that opinion is divided on the question. The strongest opposition to compulsory adoption so far as the Birmingham and Midland district is concerned is to be found in the engineering trades. "It is stated," the committee reports, "that practically all engineering standards are based upon the inch, and it follows that all British-made ships, rolling stock, machinery, gauges, and tools, etc., are constructed according to these standards, the equivalent of which it is impossible to specify accurately in metrical measure. English-made machinery now in use in every part of the world made to our standard gauges on the interchangeable principle can have spare parts sent out of stock, but if any other standard is set up it would be necessary for the user of such machinery when ordering spare parts to specify whether the machinery was made before the passing of the proposed Act, and would cause endless confusion and annoyance with customers at home and abroad." Whilst recognising that the metric system is now much more widely used by traders in foreign transactions than was the case a few years ago, the committee seriously urge every trader interested in foreign trade to make use of the metric system wherever it may appear to be to his interest to do so. They are convinced that the commercial interests of the country will be much better served by gradual and voluntary adaptation than by legislation of a compulsory character. The above which appeared in the *Times* of the 22nd ult. exactly expresses the opinions which have constantly been urged in these columns when criticising the efforts of the Decimal Association to promote a change which would cause incalculable harm. The general opposition to metric measurements received a severe blow when it was announced about a year ago that Kynoch's had voluntarily adopted the system inside their factory. The matter was discussed at length in all the newspapers, but no notice was given to the fact that after a very short period of trial the metric system was voluntarily abandoned.

Diana is the name of a sporting journal published in Italy which gives great prominence to shooting matters. A recent number just received contains many excellent illustrations, and from the amount of support accorded by English houses to the advertisement columns it must be assumed that our enterprising contemporary is widely circulated amongst Italian sportsmen. It has been awarded the Vermiel gold medal at the International Sports Exhibition in Paris.

The directors of the Colt Gun and Carriage Co., Ld., have announced that owing to pressure from creditors it has become necessary to suggest the liquidation of the Company. Mention is made of a scheme of reconstruction, but it must be remembered that in June last year sanction was obtained for the raising of fresh capital under special conditions. The last accounts published showed that at the end of 1905 there was a debit balance on the profit and loss account of £32,000. The directors express their continued faith in the merits of the gun.

A circular has been issued by the Nobel-Dynamite Trust Co., Ld., announcing that the great expansion of the Company's business has necessitated the provision of additional working capital for the subsidiary companies, and further that the directors propose to obtain these funds by the issue of an additional £500,000 of five per cent cumulative preference shares of £10 each. These shares will be issued at a small premium to the ordinary and preference shareholders of the Company. Such a step requires certain alterations in the articles of association, and an extraordinary general meeting was held on the 21st inst. at which the necessary amendment was sanctioned. A further meeting has been called for the 6th inst. to give final confirmation to the proposals.

It was generally supposed at the time of last year's Bisley meeting that the maximum calibre for match rifles would be reduced so as to disallow rifles of ·320 bore, a size which had been adopted by a small proportion of the competitors because the extra diameter and weight of bullet was supposed to give greater accuracy. A recent announcement dismisses the supposition that a change would be made. Shooters themselves are not convinced that any real difference exists. The service ·303 calibre is the general favourite, but the enlarged powder space provided by the ·375-·303 appears to provide a valuable margin for adjusting the load, such as is not possible within the restricted dimensions of the service cartridge. The practice of fitting suitably bored barrels to Mauser bodies and stocks is likely to increase, partly because the Lee-Enfield action is insufficiently stable under high pressures, and partly because the strength of barrels fitted to service rifles is kept very low by the small diameter of the screwed end which fits into the body.

The annual dinner of the Livery of the Gunmakers' Company took place on the 14th ult., and it is interesting to note that amongst those present was Capt. M. B. Lloyd, H.M. Inspector of Explosives, not as a guest but as a member of the Livery. There have been one or two vacancies in the Court of the Company recently, but no public announcement has been made as to how they have been filled or are intended to be filled. Interest in the matter has abated since the technical duties of the London proof house authority have been properly fulfilled, but it is nevertheless to be hoped that technical ability will rank in the selection of candidates as a primary consideration. Such a man as Capt. Lloyd would greatly strengthen the influence of the Court, but even if his Home Office duties would stand in the way of acceptance there must be others who would be useful as well as socially eminent. The blank caused by Mr. Griffith's death has not been filled by anyone with the same kind of experience, and Col. Holden, also a liveryman, might be induced to act.

A TREATISE ON FIELD GUNS.

The new edition of Col. Bethell's *Modern Guns and Gunnery* displays in adequate fashion the remarkable changes which have been introduced by the new equipment. The addition of a buffer to absorb recoil has altered the entire aspect of field artillery, and as the author himself points out the design and construction of the carriage now approaches in importance the other matters which concern the gun itself. The mode of treatment adopted is greatly to be commended. Mathematical formulæ have entirely given place to verbal description and demonstration, so that the study of practical gunnery is no longer encumbered with schoolday difficulties. Just as the medical profession resists the attentions of enquiring outsiders by using long words of Latin derivation where Anglo-Saxon would be equally appropriate, so the study of artillery questions is hedged around by the barbed wire entanglements of mathematical demonstration. The reader who wishes for sound practical instruction resents this assumption of masonic symbolism, especially when he finds after much delving and striving that plain truths really exist if only authors would learn to express them. Just as the mystery of a medical prescription loses some of its potency when one sees the obsolete and inaccurate scales—balance is hardly an appropriate term—with which the ingredients are measured, so artillery loses some of its terrors when Col. Bethell's book has been read. He has the gift of clear exposition and brief summary, and even if his generalizations are somewhat broad it takes a cleverer man than the book is intended to reach to find fault with them. Vaseline may not really be present in Cordite to render it waterproof and to improve its keeping qualities. Even if it is there to prevent the bogie of fungoid decomposition, the reason is immaterial so long as this book is not judged as a treatise on service explosives. It is purely and solely for the guidance of officers and others who are called upon to qualify in practical gunnery, and who, having other work to perform cannot study the subject as an abstract science. From the point of view of such men, gunnery in certain of its aspects is a branch of mechanics, involving design, construction and practical use. The author is himself an advocate of the study of gunnery as a science, but he very wisely relegates that part of the programme he lays down for students, to a secondary position. Anyone who will read the present volume from cover to cover, as has practically been done for the purposes of the present notice, must admit that enough information is available to last the artillery officer throughout his career, excluding of course any new developments that may arise.

The 300 odd pages are not by any means confined to elementary teachings. Part I. deals with the principles of construction of guns, carriages and ammunition. Part II. treats of theoretical gunnery, Part III. with practical gunnery, viz., choice of position and the direction of firing operations under service conditions. Part IV., which is of greatest current interest to experts, contains a review, with copious statistics, of the leading types of quick-firing

equipments throughout the world. The first classification is under nations, and the second under the names of the great o dnance firms amongst whom competition is always so keen for the military contracts that are given out. The illustrations are exceedingly clear and well reproduced, though of detail there is necessarily very little because of the large number of designs passed under review. This work is bound to rank very high as the medium for obtaining general information on the subjects treated, and whilst Col. Bethell deserves every praise as author, Messrs Cattermole of Woolwich, the publishers, have ably performed their share of the work.

REVIEWS.

Interior Ballistics by Major Beverly W. Dunn, U.S.A., Notes on The Construction of Ordnance, No. 89. Washington, December, 1906.

THE subject of interior ballistics was for the first time treated in a serious and complete analytical manner by *M.* Sarrau in 1874, under the title of "Researches on the Effects of Powder." Later in 1882 Col. Sebert and Capt. Hugoniot published their study of the "Effects of Powder in the 10 centimetres cannon," and introduced a method of analysis which differed in many respects from Sarrau's. This new method of treating the subject was made use of in a text-book on interior ballistics published in 1890 and written by, now, Colonel Mata, who was at that time attached to the central schools of artillery Madrid. Mata and those before him, wrote of black powder only. It is therefore all the more interesting to read in Major Dunn's work the following:—"The writer's attention was attracted some years since to a treatise on this subject, by a talented officer of the Spanish Artillery, Colonel Mata. A prolonged and unsuccessful effort was made to secure a satisfactory agreement between measured ballistic data from our powders and data calculated by Colonel Mata's formulæ. The writer then undertook the task of deducing, along the general lines adopted by Colonel Mata, a set of formulæ."

Mata, writing for black powder, made several assumptions which might have been questioned, viz., (1) That the liquid products of combustion, at the temperature of combustion, occupied the same volume as the powder from which it was formed. (2) That the heat extracted from the powder gases during the projectile's movement up the barrel, was supplied by the hot liquid products. (3) That the rate of burning through the grain was directly proportional to the pressure. These assumptions enabled Mata to develop comparatively simple expressions for pressure and velocity in ordnance. Major Dunn is able to accept the conditions (1) and (3) for smokeless powders, because the *co-volume* of the products of an explosive is nearly equal to the volume of the powder and the velocty of grain combustion has been shown to be approximately directly proportional to the pressure. To take account of condition (2), Major Dunn makes the very doubtful assumption that with burning explosives the ratio of the specific heats of gases at constant pressure and constant volume is equal to unity.

The part under review is No. 1, of the work and entitled "Theory and Deduction of Formulas." Part II., will be entitled a "Handbook of Practical Applications and Problems," and therefore contain the proof or otherwise of the usefulness of Major Dunn's formulæ.

Mécanique des Affûts, by Capitaine J. Challéat, a volume of Encyclopédie Scientifique. Published by Octave Doin, Paris. Price 5fr.

THIS work, on the mechanism of gun carriages, is one of the series on applied mechanics, forming part of the encyclopedie, published under the direction of Dr. Toulouse. Several of the books in this series are devoted to the subjects of Gunnery and Ballistics and two of these have been already reviewed in these columns. Capt. Challéat has written a book complete in the theory of his subject and at the same time interesting to read. The pure description of gun carriages does not form a material part of this book, the subject is handled more with the view of demonstrating the laws underlying the mechanics of gun-construction. Nearly one-fourth of the book is devoted to the development of the formulæ of mechanics and recoil to be used in the later discussions of the recoil-controlling parts of gun-carriages. Throughout, the subject is dealt with in a way that will recommend itself to students of gun-construction.

WORK TABLES FOR M.D. CORDITE.

A correspondent writes:—"In your review of the *Text Book of Gunnery*, 1907 you do not appear to have noticed that the work table for cordite M. D. is as near as possible the same as the one published in your issue for November 1899. The authors of the text book are apparently using the same curve but they have added a uniform 13½ per cent. to your values. The article in your journal expressly stated that the pressures given were not "explosive vessel" pressures, a reduction having been made all along the curve so as to show the actual work performed. The following comparative table will show how the two tables compare":—

	Text Book of Gunnery, 1907.	Arms and Explosives, 1899. With added 13.5%
From 4 to 4·5 expansions ..	23·6	23·46
,, 4 5 ,, ..	44·5	43·98
,, 4 5·5 ,, ..	63	62·19
,, 4 10 ,, ..	169·2	168·8
,, 4 11 ,, ..	184·7	184·6
,, 4 12 ,, ..	200·7	198·9
,, 4 16 ,, ..	243·7	244·1
,, 4 17 ,, ..	253·2	253·3
,, 4 18 ,, ..	261·7	261·9
,, 4 19 ,, ..	269·7	269·9
,, 4 20 ,, ..	277·2	277·4

We might add on our own account that if the similarity is a coincidence following from two independent enquiries

from original *data* both parties may congratulate themselves on the conformity of the results produced; but if an equally obvious explanation holds good it seems a pity that the principle of giving credit where credit was due has in this instance been ignored.

APPLICATIONS FOR PATENTS.

OCTOBER 21-NOVEMBER 16, 1907.

23,188.* Rear Sights. J. Y. Bassell and T. C. Blenkner.
23,226.* Cartridge Loading Machine. W. E. Lake.
23,305. Shooting Controlling Device. M. A. van der Lijke.
23,335.* Cartridge Pockets. W. C. Fisher.
23,336.* Cartridge Belts. W. C. Fisher.
23,443.* Breech Mechanism for Rifles. C. F. P. Stendebach.
23,628.* Projectiles. E. C. R. Marks.
23,653. Ordnance Sighting Gear. A. F. Petch and F. Duncan.
23,654. Depression Control Gear for Ordnance. A. F. Petch and F. Duncan.
23,655. Ordnance Ammunition Supply. A. F. Petch and F. Duncan.
23,656. Ordnance Ammunition Supply. A. F. Petch and F. Duncan.
23,657. Direct Ammunition Supply for Ordnance. A. F. Petch and F. Duncan.
23,713.* Telescopic Sights. W. E. Lake.
23,722.* Telescopic Sights. W. E. Lake.
23,727. Ordnance Sighting Apparatus. A. T. Dawson and G. T. Buckham.
23,728.* Telescopic Sights. W. E. Lake.
23,765.* Barrel Carriages for Barrel Recoil Ordnance. Fried Krupp, A.G. (German application Feb. 11, 1907).
23,819. Percussion Caps, Detonators. King's Norton Metal Co., Ld., H. M. Smith and H. W. Brownsdon.
23,834. Explosive Fuses. J. Bramwell-Smith.
23,844.* Cartridge Extractor. R. Bird.
24,025. Explosives. Anglo-French F. & S., Ld., and Sir J. B. Edwards.
24,093.* Powder Receptacles. Fried Krupp, A.-G. (German application February 4, 1907).
24,094.* Self-Loading Barrel Recoil Ordnance. Fried Krupp, A.-G. (German application December 31, 1906).
24,123.* Breech Mechanism. S. A. S. Hammar.
24,212.* Electrical Indicating Targets. J. Y. Johnson.
24,218. Ordnance. Sir W. G. Armstrong, Whitworth & Co., Ld., and C. H. Murray.
24,272. Small Arms Sights. H. T. Ashton and J. J. Speed.
24,402.* Projectiles for Small Arms. A. V. P. M. Berthier. (French application Nov. 12, 1906.)
24,413. Gun and Howitzer Sights. A. F. Petch and R. Redpath.
24,663. Apparatus for Sighting Ordnance. W. H. Hyatt.
24,681. Recording the Sighting of Guns. W. K. Gregory.
24,734. Single-trigger Double-barrel Guns. W. Baker.
24,754.* Automatic Rifles. J. W. Creon.
24,837. Air Pistols or Guns. E. Anson.
24,867. Rifles. T. R. R. Ashton.
24,887.* Breech Action Guns. F. Jaeger. (German application, November 22, 1906).
24,915. Telemeters. C. Pulfrich.
25,122.* Automatic Firearms. T. C. Fidjeland.
25,137. Removing Metallic Fouling from Ordance. King's Norton Metal Co., Ld., T. R. Bayliss and R. A. E. Payne.
25,175. Bolt Action Rifles. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
25,191.* Gun Firing Apparatus. O. Runge. (German application November 15, 1906).
25,209.* Bullet for Saloon Rifles. P. Jensen.
25,220. Ammunition Hoists for Ordnance. A. T. Dawson and J. Horne.
25,250. Ordnance Breech Mechanism. W. Beardmore & Co., Ld., and A. Bremberg.
25,363. Ejectors. A. Greenwood and K. Andersson.
25,395. Automatic Firearms. C. H. A. F. L. Ross.

*These applications were accompanied by complete specifications.

SPECIFICATIONS PUBLISHED.

OCTOBER 31—NOVEMBER 21, 1907.

COMPILED BY HENRY TARRANT.

21,551 (1906). **Aiming Instructor Apparatus.** W. R. Clark, Upper Norwood, and F. W. W. Baker London. *(See Selected Patents).*

23,979 (1906). **Mountings for Quick-Firing Guns.** Lieut. A. T. Dawson and G. T. Buckham, London. A pair of quick-firing guns are arranged side by side on a centre pivot mounting. They are provided with cross connected sights and the elevating and other gear is so arranged that four men only are required for elevating, training and sighting the guns. Accepted October 26, 1907.

23,995 (1906). **Firing Mechanism of Ordnance.** Lieut. A. T. Dawson and G. T. Buckham, London. To prevent accidents arising from premature opening of the breech block when a "hang-fire" and not a "miss-fire," as is assumed, has happened, the patentees provide a locking bolt which prevents the breech being opened only when the actual discharge has occurred, or when the bolt has been deliberately withdrawn by hand. Accepted Oct. 26, 1907.

24,560 (1906). **Automatic Mechanism for Ordnance** C. R. S. J. Hallé, London. In patent No. 6,745, 1902, the patentee set out a method of automatically unloading the spent shell, and reloading a new one in small arms through and by means of "lazy tongs" or compound the recoil levers. This method he now applies to ordnance of any calibre. The energy of recoil buffered in the usual way is stored in springs to operate the "lazy tongs." Accepted Oct. 10, 1907.

26,251 (1906). **Bell for Air-Gun Targets.** A. Chapman, Dudley, Birmingham. The dome-shaped bell which is used in the ordinary way in air gun targets and which is so soon broken by the continual contact of pellet is replaced by the patentee by a plate of bell metal suspended behind the target. This plate is made of such thickness that it cannot be broken by the energy of the pellets. Accepted Oct. 17, 1907.

26,373 (1906). **Sling for Carrying Rifles.** R. N. Kelsey, Edington, Bridgwater. In order to facilitate the tightening of a sling for carrying a rifle on the back, the sling is provided with a running attachment which has simply to be pulled. Means are provided to hold it frictionally from unintentional movement. Accepted Oct. 10, 1907.

26,939 (1906). **Elevating and Loading Gear for Ordnance.** Lieut. A. T. Dawson and G. T. Buckham, London. Alterations are made in the elevating and loading gear of howitzers which may be accurately set to the necessary elevation by a slow movement or quickly brought back to the loading position. The elevating arm is pivoted to the trunnion arm at its centre and the elevating and loading screws are connected with the elevating arm at its opposite ends. Accepted Oct. 10, 1907.

27,890 (1906). **Recoil Apparatus for Ordnance.** E. J. Mead, Bournemouth. To lessen the total force of shock rearwards due to recoil, a certain amount of the energy is taken up through "lazy-tongs" mechanism by springs arranged on rods at right angles to the bore of the gun. Accepted October 24, 1907.

29,130 (1906). **Shot-Gun Cartridge Wads.** A. Brown, Edinburgh. To improve penetration and pattern, a wad is used composed of linoleum, or cork carpet. The upper or under side may be cupped and lubrication may be introduced. This wad is used in place of the ordinary felt wad. Reference, in accordance with Patents Act, 1902, is drawn in the specification to seven patents dating from 1882 to 1904. Accepted October 31, 1907.

142 (1907). **Recording Gun Practice at Moving Targets.** A. J. B. Légé, London. Without actually firing the gun a record may be obtained of the accuracy of aim at a moving target. Such apparatus has been described in Patent No. 26,215, 1903, and the method of moving a card to resemble the movement of a waterborne target is improved. Accepted Oct. 10, 1907.

795 (1907). **Setting of Time Fuses for Projectiles.** C. R. B. Owen and W. J. Griffiths, London. (*This specification is a Secret Document*).

1,114 (1907). **Pellet Charger for Air Rifles.** W. Bowdler, Bloxwich. A tubular pellet magazine is provided with a finger pressed lever at the end of which are two stops. One holds the lower or first pellet, whilst the second holds the next pellet against movement when the lever is pressed to release the first. Accepted Oct. 17, 1907.

1,925 (1907). **Breech Screws of Ordnance.** Lieut. A. T. Dawson and G. T. Buckham, London. Sometimes it is necessary to increase the length of the breech screw and instead of inserting loose discs, a plate is used which is made in the form of a spring washer to be sprung into an annular groove in the front face of the breech screw. Accepted Oct, 10, 1907.

3,441 (1907). **Cleaning Rifle Barrels.** E. Goodwin and Kynoch, Ld., Birmingham. Instead of using a cork either in the muzzle or the chamber of a rifle barrel to hold the solvent for dissolving fouling the patentees use a cartridge case for which the rifle is chambered in the neck of which an india-rubber stopper is secured by means of a bit of wire. This stopper prevents the solvent from escaping into the action. Accepted Oct. 24, 1907.

4,823D (1907). **Ejector for Automatic Small-Arms.** P. Mauser, Germany. In order to counteract the great strain which is imposed upon the ejector of an automatic arm due to the rapid action, the front is made elastic so that it may give slightly when the base of an empty cartridge case is brought into contact with it. Accepted October 31, 1907.

4,824 (1907). **Magazine for Air Rifles.** J. H. Cox, Birmingham. (*This Patent will be fully dealt with in the next issue of Arms and Explosives*).

5,666 (1907). **Automatic Mechanism for Firearms.** K. A. Brauning, Holland. By means of a "pivoted cocking fork" the fiirng pin of the automatically operated breech mechanism is cocked. The fork is brought into position by the recoil movement of the breech, and by a small alteration of parts may be made to operate efficiently when blank cartridges are used. Accepted Oct. 10, 1907.

8,038 (1907). **New Form of Projectile and Firearm.** S. Rogozea, France. This projectile is formed with a hollow cylindrical extension running back from its base. This extension fits over the outside of the barrel of the gun, and the barrel is completely fitted with the propelling compound. Accepted October 31, 1907.

9,676 (1907). **Automatic Targets.** Capt. E. Habersbunner and Sergt.-Major J. Stöcker, Bavaria. Two target members are arranged one behind the other, so that when struck by a projectile a locking device is released and one target falls rearwards and the other forwards. The locking device is constructed so that wind or other influences cannot disturb it. Accepted October 31, 1907.

9,778 (1907). **Target Practice Apparatus.** H. H. Cummings, U.S.A. The muzzle of a rifle is attached to a suspended device in such a way that the suspended or "following" device (quite close to the muzzle) has magnified movement as compared with the actual deflection of the aiming apparatus. The device is simple and is provided with a recording medium to show where a shot would have hit. Accepted Oct. 24, 1907.

10,043 (1907.) **Target Practice Apparatus.** P. M. Justice, London. (Agents for *The Sub-Target Gun Co., U.S.A.*). This invention aims at improving the apparatus for teaching "holding" known as the sub-target device. More particularly it is intended to provide a better method of attaching the rifle and to restrict the aiming movement so that the discharged projectile cannot strike outside a predetermined area. Accepted Oct. 10, 1907.

10,681 (1907). **Rifling Machines.** E. Jones, Perry Barr and Kynoch Ld., Brmingham. (*See Selected Patents*).

13,423 (1907). **Tangent Sight Slides for Small-Arms.** A. T. Ashton and J. J. Speed, Enfield. (*See Selected Patents*).

13,498 (1907). **Breech Loading Small-Arms.** H. T. Ashton, J. J. Speed and E. A. Reavill, London. (*This specification is a Secret Document*).

14,427 (1907). **Ammunition Wagons.** Fried. Krupp, A.-G., Germany. Ammunition limbers are provided with a protective shield for the gunners which may be used in several independent operative positions, one of which is as a back rest for the crew. Accepted Oct. 10, 1907.

17,521 (1907). **Manufacture of Nitro-Compounds.** Dr. R. Wolffenstem, and Dr. O. Boeters, Prussia. In the manufacture of nitro compounds phenol groups are introduced into the molecule in addition to nitro groups, by nitrating in the presence of mercury or mercuric compounds. For preparing picric acid 400 grammes of benzene are heated on a water bath with 660 grammes of nitric acid (1·48) and 50 grammes of mercury nitrate. The reaction product is first treated by separating it from the aqueous solution and the picric acid is afterwards separated from the nitro benzene by shaking with a dilute alkali and recovering in the usual way. The yield is 180 grammes picric acid and the rest nitro benzene. Accepted Oct. 10, 1907.

17,944 (1907). **Percussion Fuses.** Fried. Krupp, A. G., Germany. In percussion fuses in which a retarding device may be thrown into or out of action retarding compositions, because of their declared disadvantages, are replaced by empty passages of different lengths either of which may be thrown open to transmit the igniting jet. Accepted Oct. 17, 1907.

18,657 (1907). **Gun Covers.** W. Richards, Liverpool. A gun cover as constructed to hold two guns, sothat either may be inserted or withdrawn without interfering with the other. The partition runs down between the two portions of the cover. Accepted October 31, 1907.

18,861 (1907). **Differential Recoil Apparatus for Ordnance.** Lieut.-Col. J. A. Deport, France. To counteract the movement of recoil some ordnance is run forward when the shot is fired. The above patentee arranges that both the brake action after firing and the forward impulse given to the gun before firing are effected by a spring coiled round the gun. Accepted Oct. 24, 1907.

20,270 (1907). **Fuse Setting Device for Projectiles.** Fried. Krupp, A. G., Germany. The fuse setting appliance described in this patent is so built that when setting the fuse it can be applied in any desired angular position whilst at the same time it makes at the outside two revolutions of the setting device only necessary. Accepted Oct. 24, 1907.

SELECTED PATENTS.

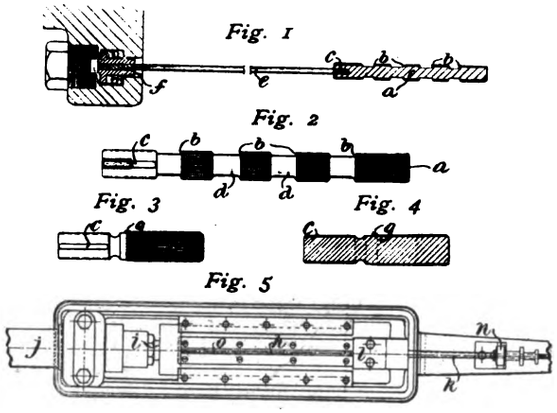
MACHINE FOR GROOVING RIFLE BARRELS.

10,681 (1907). E. Jones, and Kynoch, Ld., Birmingham. This apparatus for grooving rifle barrels is adapted for use with either of two tools. One *cuts* the grooves and is *pulled through* the barrel, whilst the other *presses* the rifling grooves and is *pushed through* the barrel.

The cutting tool *a* is shown in Figs. 1 and 2, and consists of the series of ribbed or grooved sections, the front edges *b* of the spiral bands of which are formed with sharp cutting edges. The first section is not formed with cutting edges but is provided with flutes *c* through which lubricant may flow to the cutting portions. Swarf and lubricant spaces *d* are provided between the ribbed sections. One end of the rod *e* is screwed into the plain end of the cutting tool, and the other into the fitting *f*, which is provided with a ball bearing to allow the rod *e* to revolve whilst the spiral tool is being pulled through the barrel.

The tool for *pressing* the rifling grooves into the barrel is illustrated in Figs. 4 and 5. The front part *g* of the ribbed section is of conical shape to allow of the ribs being gradually forced without cutting into the metal inside the barrel. The front guide section is the same as that of the cutting tool. This groove pressing tool is pushed through the barrel by means of hydraulic pressure or by a screw rotated by a worm wheel driven by a belt. The hydraulic machine is illustrated in plan view in Fig. 5. The rod *h* is pushed forward by the ram *i* working in the cylinder *j*. The barrel *k* is screwed into the block *l* at one end and is held at the other by the guide bracket *n*. The grooving

tool is placed in the guide tube *o* before the barrel is screwed into the block. The lubricant in the barrel is always under pressure as it has to lift a valve when pushed forward by the grooving tool,

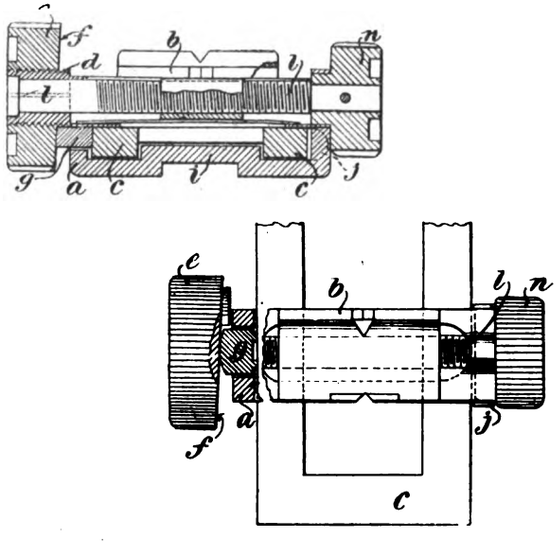


before it can escape. The strength of the valve may of course, be varied. The rod by which the tool is pushed through the barrel is prevented from bending by a series of discs working on the guide tube *o*. Accepted Oct. 17, 1907.

SLIDES FOR TANGENT BACK SIGHTS OF RIFLES.

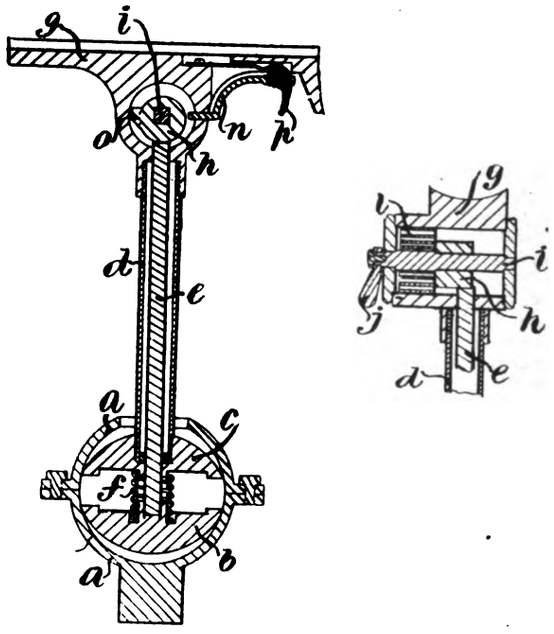
13,423 (1907). H. T. Ashton, and J. J. Speed, Enfield Lock. The device dealt with in this specification is designed to allow the slide for the ordinary tangent back sight of rifles to be clamped on the leaf to lock it at any particular elevation.

The device is clearly illustrated in the appended drawings and it will be seen that the slide *a* is provided with a wind gauge portion *b* and works on a leaf *c* of ordinary construction. On the left hand side the slide screw is extended as at *d* and this extension is provided with a right hand screw thread. The part *e* works on the extension and its inner cam face *f* is inclined in a direction opposite to the screw thread. A slot is formed in the wall of the slide itself adjacent to the cam face to accomodate the locking block *g* the back *h* of which is rounded and is in contact with the cam face *f*. The face of the block is ribbed and bears against the edge of the leaf *c*. The pitch of the screw thread on the extension *d* is more rapid than the inclination of the cam surface *f*, so that when the part *e* is rotated, the block *g* is forced against the edge of the leaf and the slide is locked against movement up or down the leaf. The stop *f* comes into contact with the side of the block *g* and prevents the clamping part *e* being unscrewed from the extension *d*. The slide itself is inset at *i* to prevent the sides of the leaf *c* being forced together should the clamping part be turned up too tightly when locking the slide. The gib spring *j* is inserted between the inner face of the right hand side of the slide and the side of the leaf. The wind gauge traversing screw *l* is operated in the usual fashion by the milled head *n*. Accepted Oct. 17, 1907.



APPARATUS FOR TEACHING AIMING.

21,551 (1906). W. R. Clark, Upper Norwood, and F. W. W. Baker, London. The apparatus described in this patent is simple in construction and is adapted to support a rifle to be aimed at the target for instructional purposes. The pulling of the trigger locks the apparatus so that the exact position of the rifle in discharge is indicated and the instructor can easily point out any error.



The device is illustrated in the drawings reproduced. The spherical socket *a* supports the whole apparatus and the two halves *b* and *c* of a divided ball are arranged inside it. The top half *c* is attached to the tube *d*, whilst the bottom half is screwed to the rod *e* running through the tube. The spiral spring *f* keeps the parts *b* and *c* apart.

The table *g* is adapted to carry the rifle and is fitted to receive the cam-shaped part *d* working on the spindle *i*. The part *h* is rotated by means of the handle *j* against the pressure of the spring *l* until the end of the part *n* engages the nose *o*. When the trigger *p* is pulled the part *h* is released and is forced round by its spring *l*. Through the cam-shape of the part *h* and the spring *l* the rod *e* is strongly depressed and the parts *b* and *c* are caused to bind frictionally in the spherical socket *a*. The apparatus is by this means locked. The part *h* is recocked and the rod *e* allowed to rise by turning the handle. Accepted Oct. 17, 1907.

Savage Repeating Rifle.

MARVELLOUS VALUE.
UNEQUALLED QUALITY.

·22 Calibre. Model 1903. Weight 5 lbs. 6 ozs.

The Model 1903 is a "Take Down" with 24 inch octagon barrel, pistol grip stock and rifle butt plate, chambered for the ***short, long and long rifle cartridges. The arm itself works rapidly and smoothly and is the most accurate repeater of its kind.*** The hammerless and shot gun safety features make the rifle safe and easy to handle, while the novel and desirable arrangement of the magazine will strongly appeal to those who constantly use an arm of this type. In a word, it is "Savage Quality" all through. ***This rifle was exclusively adopted for use in all the shooting galleries at the St. Louis World's Fair, 1904,*** 42,351 shots being fired out of one rifle. It defies competition. The only repeating rifle with automatic stop on magazine. • If you have not shot with Savage rifles you have something to look forward to. This is the best Rock and Rabbit Rifle ever produced.

Safety in Miniature Rifles. All makes of ·22 Long Rifle Ammunition, whether loaded with Smokeless, Semi-Smokeless or Black Powder, may safely be used in any of the ·22 Rifles of the Savage Arms Company's manufacture. • The 1905 Target Model is for accuracy superior to any Cadet Rifle on the market.

SAVAGE ARMS CO., 13/15 Wilson Street, Finsbury, LONDON, E.C.

ANOTHER

WINCHESTER SUCCESS.

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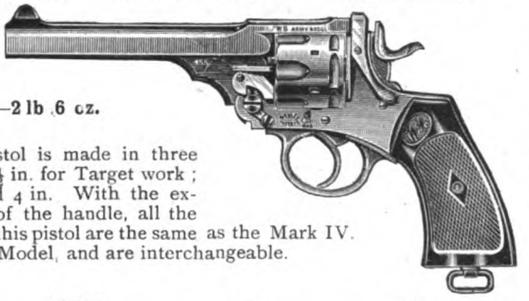

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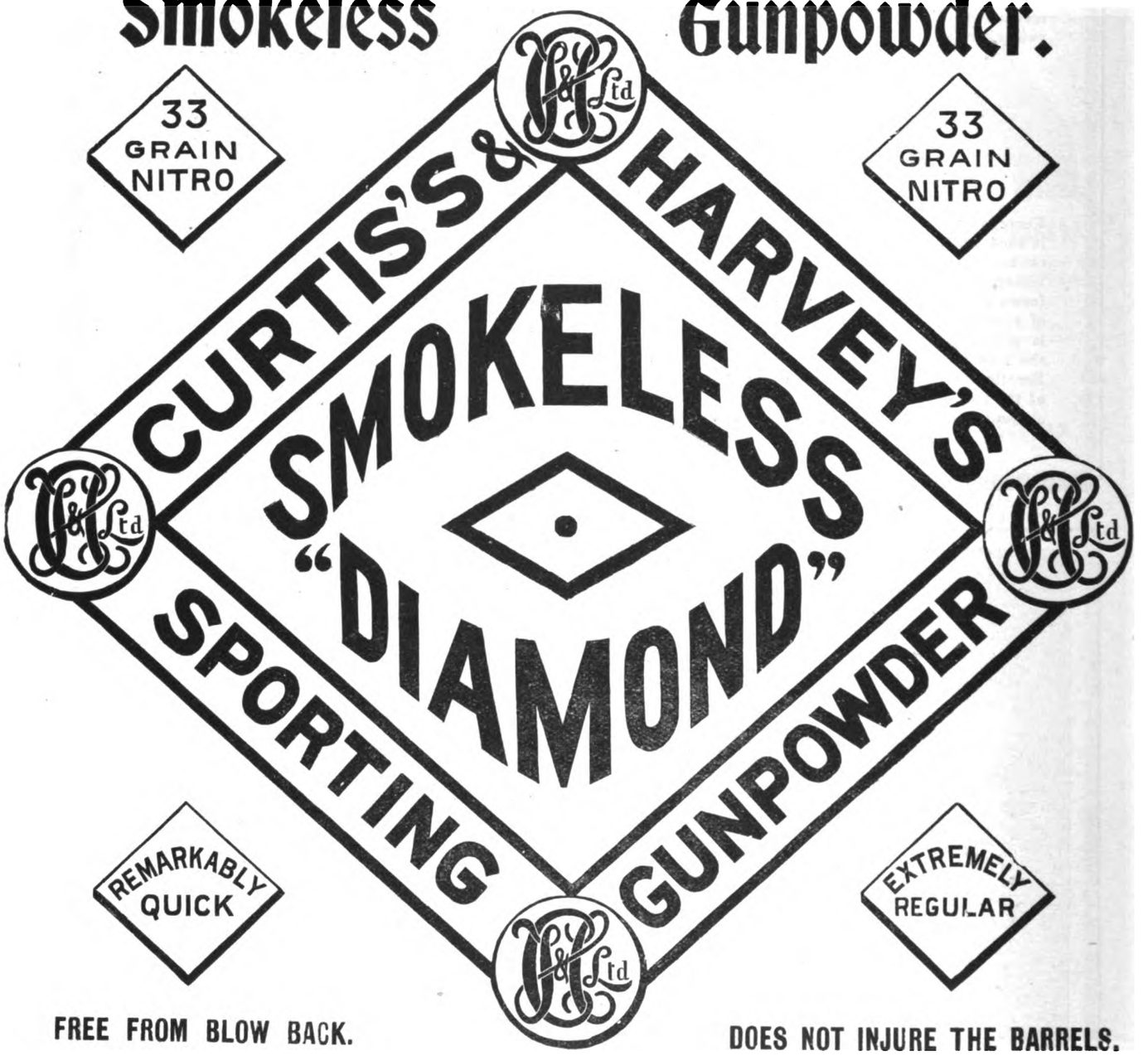

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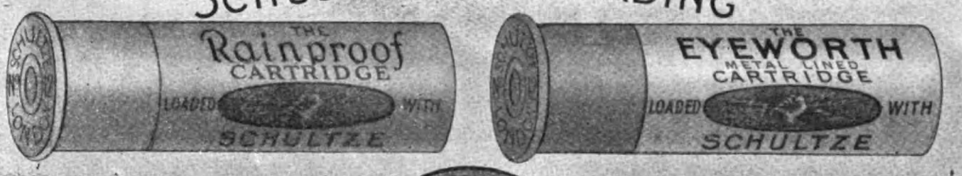

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