Arms & Explosives

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CURRENT TOPICS.

New Year Wishes.—With the opening of a new year one's thoughts naturally dwell kindly on the past and hopefully on the future. Gunmakers have in the past been far too inclined to concern themselves wholly with the routine of their daily trade and take too little note of the political and general problems which affect their business as a unit in the industry of manufacture. All this has now been altered, and few trades are more closely allied for the purpose of studying general problems than that of gunmaking. With Mr. Thorn must always rest the credit for having been the first to perceive the importance of trade organisation for the general interest. There are others, notably Mr. Edgar Harrison, who foresaw and laboured towards the goal of an allied gun trade. The accomplishment of their desires has fully justified the steps taken by those who definitely asserted the importance of combination even in a trade which was then supposed to be too jealous to combine. We now have a very active organisation in Birmingham, which is primarily concerned with the manufacturing interest. In London we have the centre of the retailing interest, retailing in gunmaking covering far more than the term usually conveys in other businesses. There is moreover a gun section of the Chamber of Commerce. It is to be hoped that the ambition of this last-named body will not clash with the settled convictions of the trade it seeks to help. No industry cares to be reformed from without, and yet outside help is of great value especially where political influence is required. If the gun section of the Chamber of Commerce will collaborate in forwarding the just aspirations of the gunmaker, good will result, but nothing but harm can follow if it adopts any course, seemingly right but yet inconsistent with practical conditions. The finest guarantee of harmonious working is that a strong contingent of the best elements of the gun trade may associate itself with that body.

The Gun Licence Act.—It is very much a question whether the proposal of the Chamber of Commerce to secure a regularisation of the Gun Licence Act is not covered by the warning to avoid playing with edged tools. The metaphor of the sleeping dog applies perhaps still better to the position as it exists to-day. We are forbidden under the Act to do all kinds of things which are regularly carried on with impunity. An immense trade in rifles and ammunition has been allowed to develop concurrently with the existence of an Act which claims what amounts to a prohibitive tax on 90 per cent. of the uses to which such arms are put. A strict definition of a dwelling house or the curtilage thereof would exclude the carrying of a gun round farms and fields, and also from carrying it from one place to another. Clause 10 entitles any officer of constabulary or constable to enter upon any lands or premises, other than a dwelling house or curtilage thereof, for the purpose of demanding a view of the licence of any person carrying a gun, or in default thereof his full name and address. This again is a clause which is so seldom put into effect as to have become a well-nigh negligible factor. The Government have admittedly undertaken not to enforce the Act against any person carrying or using a rifle in connection with rifle club practice, so long as he is a member of a club affiliated to the National Rifle Association. Whether this relaxation has been extended to members of other rifle club organisations we cannot say; but in practice one hardly ever hears of any person whatsoever being challenged in connection with the use of rifles, whether for club practice at the

range or private practice or sport at other places. It is almost certain that if once the provisions of this somewhat impossible Act were subjected to scrutiny and general amendment the privileges which now go by default would be seriously curtailed, and we should be far worse off than before. Any inconvenience which may now arise is strictly local in character, being merely an exhibition of energy by some isolated unit of police requiring diversion during the off season of the motor car. If the Gun Licence Act and the Game Act could be rigorously enforced against the poaching farmer who exercises his rights under the Ground Game Act, and against the thousand and one persons who spoil the quality of a shoot by incessant hedge-popping, the trade would benefit; but it is too much to hope that the reward of a ten-shilling revenue will stimulate active endeavour in this direction. It is, however, an easy matter to pursue with relentless animosity the harmless devotee of the miniature rifle and the air-gun, and it is hardly to be expected that these persons would be allowed under a revised Act anything approaching the unrestricted enjoyment of their hobby which seems to be the rule under the present Act as now administered.

Electric Shot Firing in Mines.—There appears to be an impression that we shall shortly see a marked development in the use of electric shot firing for safety explosives. The idea has gained ground for some time past that to give full effect to the safety properties of the permitted explosives their ignition should be effected by the alternative process which involves no emission of incandescent particles of gunpowder, either at the moment of ignition, or latterly in the act of burning. The low tension system of electric fuse has many advocates, in that it is considered somewhat safer than the alternative high tension system, having at the same time the great advantage that the circuit may be tested before the full current is switched on. The attention which has been paid to electric shot firing since permitted explosives were introduced has stimulated the production of many systems of current producer specially adapted for colliery use. The lowest initial cost is associated with primary batteries; but these are regarded as less reliable than the magneto or dynamo generators, whose motive energy is derived from the turning of a wheel. The magneto is characterized by the use of an electro-magnet, whereas the poles of the dynamo are electrically excited: being thereby free from the defect of requiring magnetisation from time to time. Primary batteries likewise require re-charging with chemicals. In both these respects the dynamo appears to justify its higher first cost by possessing regular and sustained efficiency throughout its period of service. Extra units need not be provided to take the place of apparatus undergoing a process of revivification. In that there are at least three alternative methods of igniting explosives by electricity the user must exercise careful discrimination to ensure selecting the system which best suits his own special needs and circumstances.

Cartridge Dumping in Canada.—A recent number of the financial and commercial supplement to the *Times* brings against the English manufacturer of cartridges the somewhat unusual charge of dumping. In connection with the proceedings before the tariff commissioners in Montreal and Toronto it was asked that the present *ad valorem* rate of 30 per cent., reducible to 20 per cent. under the preferential rate, be changed to two dollars per thousand on empty paper shells, six dollars on black powder cartridges and seven dollars on smokeless. It was stated that English houses are supplying upwards of three-quarters of the total consumption, and are preventing the Canadian manufacturers from making any profit. In one particular brand, the difference between cost of production in Canada and the selling price was stated to be only three per cent. This inability to compete under the protection of a 20 per cent. margin is attributed to the custom on our part of reserving the best quality of output for the English home market and sending material to Canada which has been rejected here for surface imperfections. It is further asserted, but with what truth we do not know, that the same cartridges are sold in England at prices 50 per cent. higher than are obtained in Canada. The whole argument seems to involve fiscal debating points of the approved order. The assertions of the Canadian cartridge makers seem to require further elaboration of detail before an opinion can be passed. At the outset it appears difficult to understand how manufacturing methods can be so bad on this side as to provide a margin of rejects large enough to satisfy the demands of the Canadian market. Moreover, being entirely unprotected in our own market, there is hardly room for a 50 per cent. rebate on goods admittedly carrying only surface defects. The matter is probably one in which English opinion is unlikely to be consulted. If the commissioners are of opinion that Canada will obtain greater benefit from increased cartridge manufacture, than injury from the all-round rise of prices which would follow a higher duty, then rates will go up, and England will be squeezed in one more market.

Prices of High Explosives.—The severe competition between manufacturers of gelignite and other high explosives which followed the break-up some time since of the price arrangement has resulted in a scale of reductions which must have practically annihilated the profits in the home market, even of the best situated firms. The manufacture of explosives is a risky business, and the profits should be large to provide an adequate compensation. It is, therefore, all the more to be regretted that the few firms in the business cannot work amicably together on a suitable basis of price arrangement. So far as we are able to understand the matter, the principal difficulty against finding a remedy for the existing trouble arises from disputes as to the sharing out on a proportionate basis of the available trade. The sales of any given firm, however large its total output, must depend on many factors, not the least of which is the ability of its agents to sell accessories proportionate in efficiency to the quality of the explosives which they may have to offer. There are, moreover, agents and agents, and it is not all of them who have made themselves acquainted with the numerous technicalities with which they should be familiar when dealing with a highly specialised business. The number and situation of various distributing depôts must also largely affect the incidence of sales; in that the small dealer who actively caters for a limited area is likely to take a large share of the business, notwithstanding the competition of the big firms who are not, so to speak, quite so much on the spot. It is to be hoped that an amicable basis of arrangement will shortly be put into force, now that it is recognised that the existing condition of affairs benefits nobody, and is injurious to all.

PROOF HOUSE PROSECUTIONS.

IT has been decided that the recent prosecution under the Proof Act of a well-known firm of sporting outfitters will no longer form the subject of an appeal by the defendants. The decision to abide by the judgment of the Court has partly arisen from the fact that the forfeiture of the guns complained of has been cancelled by a generous act of grace on the part of the London Proof House. That is to say the Gunmakers' Company have returned the guns to the defendants in pursuance of the statement made in Court that they were valueless as a set-off against the costs incurred. If put up for auction the guns might have fetched a moderate sum of money; but there were even more objections to this course than the alternative one of destroying them. The Proof House having fully vindicated its position, and having been awarded a fair sum in settlement of costs has undoubtedly taken the right course in showing that no malice has influenced its actions. With such a concession in their favour the defendants were certainly well advised in deciding to withdraw the notice of appeal. The fine was certainly a very heavy one if regarded from the point of view of its aggregate amount; but when judged by the standard of so much per unproved arm it was not out of the way. In fact bearing in mind all the circumstances of the case it is quite reasonable to agree with the view of the magistrate that the offence was a very serious one, in that the weapons in question must be regarded as dangerous to the public until the weak ones had been weeded in proof.

There is, however, an aspect in the prosecution which cannot very well be ignored; and now that the appeal proceedings have been withdrawn the case has ceased to be *sub judice*, and comments of a reasonable nature are quite justifiable. We refer of course to the postponement of the magistrate's decision to ascertain the results of proving the guns complained of. The Proof Act very clearly lays it down as an offence to sell or offer for sale an unproved arm, but there is nothing in the Act which makes it an aggravation of the offence if arms so wrongly sold afterwards prove of dangerous construction. So long as a certain percentage of all grades of gun go wrong in proof it should not be allowed to prejudice the defendants' case if a certain proportion of unproved guns forming the subject of proceedings break down under test. The magistrate was accordingly wrong in postponing his decision to hear the result of the test. By so doing he tacitly admitted that the severity of the punishment would be influenced by the result.

If an offence is aggravated by the failure of the guns to stand the proof, then when an unproved arm satisfactorily withstands the test by inference the offence is mitigated. The introduction of any such principle into Proof House prosecutions would produce a bad result. If a gun is made as strong as a cannon and as heavy as a battering ram there is still no excuse for failing to get it proved. Consequently the obligation to prove is entirely apart from any question as to the strength or weakness of the weapon; and all proof prosecutions should clearly be restricted to this simple aspect. It may fairly be stated that all offences under the Act are due to negligence and not to deliberate evasion; and the punishment should accordingly take note rather of the degree of negligence displayed than of the strength or weakness of the particular weapon or weapons involved in the act of negligence.

THE CONDITION OF TRADE.

ONE of the items in the propaganda of the Chamber of Commerce, as printed on another page, is to ascertain the condition of the gun trade with a view to enquiring into the causes of decline, if evidence of such is found to exist. The manufacture of guns must of course be considered in such a connection with reference to several entirely distinct classes of arm. Shooting is more actively pursued at the present time than ever before, and the constantly increasing turnover of the various brands of nitro powders, notwithstanding their increase in number, seems to afford positive proof that the consumption on the part of the home consumer is in a very healthy condition. The sale for best guns must obviously be based on the condition of the money market, as it affects the expenditure of those who shoot over the many highly preserved estates. Gun sales of this character have been very much below par during the past five years; but guns have been in use all the time, and a revival of sales must wait until the spending power has returned. The development of motor cars has doubtless produced its effect in finding other uses for available funds, but shooting is a popular and long established sport, and purchases due thereto seem to fluctuate in sympathy with general financial conditions rather than as a result of the rivalry of other pastimes. If the motor car is to be introduced into the argument, then golf, yachting, continental tours and many other alternative attractions must be similarly considered. We therefore return to the original argument that the renewal of trade in best guns merely awaits a freer state of the money market.

It is, however, in second and third quality guns that distinct reasons for enquiry exist. Whether trade has been diminished by an actual diminution of demand due to the gradual accumulation of sound guns of 20 and 30 years' standing amongst private persons who see no good reason for bringing their armoury up to date, or whether it arises from a displacement of the English manufacturer by his foreign rival is a question not readily answered. Under this heading it is clear that reliable *data* can only be obtained by a comprehensive system of enquiry amongst all who handle guns and rifles. The third, and probably the most serious, source of diminished turnover arises from the alterations which have taken place of late years in various foreign markets formerly supplied in a great measure by the English manufacturer. It is only those who are entirely unfamiliar with the internal condition of an industry who lodge general accusations against manufacturers of lack of energy in prosecuting the hunt for trade in all available quarters of the globe. Several firms could be quoted who have spent many thousands of pounds during the past decade in sending representatives into every possible market which the world contains. The information so gained is generally of a kind which is not readily imparted to others. General conclusions might, however, be obtainable, and it is even possible that these might be extended somewhat for the purpose of showing the position of the individual markets. That trade is not what it has been is generally admitted, and it is quite possible that in consequence of careful enquiry certain underlying truths might be arrived at such as would exercise a useful influence on future policy, for instance the reserving for English goods the privilege of the English proof mark unadorned with the word "foreign."

THE NEW GERMAN BULLET.

WITH reference to our article last month on the new military cartridge for the German army, as described in the *Kriegstechnische Zeitschrift*, a very interesting light has been cast on the subject in a report prepared by Capt. J. H. Hardcastle for the *Field*. We take the liberty of transcribing the accompanying tables from the columns of our contemporary. The first table gives certain statistics of the English ·303 cartridge, which have been specially worked out in several of the particulars given for a muzzle velocity of 2,060 f.-s., with a value for *n* of ·78 and for C of ·417. This table agrees very closely with that published on page 251 of the *Text Book of Small Arms*. The table of angles has, however, been specially calculated.

Range.	Angle of elevation.	Time of flight.	Remaining velocity.	Striking energy.
Yards.		Sec.	F.-s.	Ft.-lbs.
0	0	0	2060	2024
200	0° 9·0′	0·322	1688	1359
500	28½′	0·945	1238	731
600	37½′	1·21	1127	605
800	58′	1·77	989	465
900	1° 10½′	2·09	937	418
1000	1° 24′	2·42	872	379
1100	1° 39′	2·76	851	345
1500	2° 55′	4·31	714	241
2000	5° 2′	6·64	576	148

The second table, next given, shows the corresponding particulars as claimed for the Spitzer cartridge when adapted to the English service cartridge:—

Range.	Angle of elevation.	Time of Flight.	Remaining velocity.	Striking energy.
Yards.		Sec.	F.-s.	Ft.-lbs.
200	4·8′	·22	2378	1947
500	14·0′	·57	1819	1130
600	18·0′	·84	1647	927
800	29·2′	1·27	1330	604
900	37·3′	1·51	1208	499
1000	46·2′	1·79	1108	419
1100	56·3′	2·09	1028	361
1500	1° 49·2′	3·51	818	229
2000	3° 38·8′	5·79	621	132

The above particulars are evidently mainly the result of calculation, but they are interesting in that they afford some idea of the improved results which are reckoned to follow from the employment of an enhanced velocity, viz., 2,788 f.-s. observed, when working in connection with a bullet weighing about 150 grains. Capt. Hardcastle finds from a comparison of the two last columns of the table that the bullet weight assumed is 154 grains. By a further process of analysis he has evolved that the value of *n* must be ·576 to make the above figures possible. He has expressed the opinion that any such reduction in the factor for air resistance is quite impossible with ordinary variations of form. He adopts ·75 as the lowest value of *n* which can be regarded as feasible, even with the most favourable possible modification of the shoulder and point of the bullet. The value of C then becomes ·312, and the table which is now given shows his recalculation of results on this basis, still retaining the assumption of a ·303 bullet weighing 154 grains, and having a muzzle velocity of 2,840 f.-s. The latter is assumed to be the muzzle equivalent for an observed velocity of 2,788 f.-s.:—

Range.	Angle of elevation.	Time of flight.	Remaining velocity.	Striking energy.
Yards.		Sec.	F.s.	Ft.-lbs.
0	0	0	2840	2760
200	5′	0 243	2158	1560
500	17′	·758	1433	701
600	23′	·995	1250	533
800	39′	1·52	1010	348
900	50′	1·83	942	303
1000	1° 2′	2 17	881	265
1100	1° 16′	2·51	829	235
1500	2° 31′	4·17	657	147
2000		6·83	490	82

It will be noticed that there is a very serious discrepancy between the two last tables above quoted. The striking energy claimed for the new bullet at 2,000 yards is distinctly higher than that of the service ·303; but when the table is recalculated on the basis of a less improbable factor for air resistance we find that the striking energy for the new cartridge at 1,500 yards is equal to that of the present service cartridge at 2,000 yards. Assuming for argument's sake that the latter distance represents the extreme range of the present cartridge, then we find that the new bullet becomes ineffective at three-quarters of the distance in question. This places a very different complexion on the whole aspect of the new bullet. Judging it by the claims put forward on its behalf, it possesses an advantage at every distance up to 2,000 yards, accompanied by a vastly increased flatness of trajectory over the shorter distances. These things are obviously attainable provided that a means could be found for improving velocity without taking away an equivalent by way of reduced weight of shot. But in the new bullet we are told that the disturbance of efficiency occasioned by reducing the weight of bullet is more than compensated by the discovery of a new shape of profile which greatly diminishes air resistance.

It must not, of course, be assumed as impossible in principle to devise a new shape of projectile with marked advantages in respect to air resistance; but specimens of the new bullet show nothing more extraordinary than a sharpened point, and the point of the bullet is not the place where changes of form could be expected to revolutionise our ideas on air resistance. The French are reported to have made a great advance in the direction of a high velocity lightened bullet by tapering the rear of the projectile: and it is not inconceivable that material advances could be effected by modifications in this quarter. What we cannot believe in the absence of definite proofs to the contrary is that mere changes on the front of the bullet can diminish the retardation due to air resistance by an amount which can be approximately stated as equivalent in effect to a 25 per cent. diminution of cross-sectional area.

Whatever may be the true position of the new system of cartridge in ballistic science the above tables are at least of very great value in that they define with exactitude the properties in which the new bullet must differ from the old if the claims made on its behalf are to be upheld.

THE COMING RIFLE SHOOTING SEASON.

As soon as interest in game shooting begins to slacken many gunmakers find their attention fully occupied in making preparations for the sale of target rifles of the service or match variety. Orders have already been placed for large stocks of barrels to take the place of the worn and injured ones which had become more or less unserviceable at the end of last season. Never have the conditions which tend to produce accurate results been better appreciated than at the present moment. The military life of a barrel may be represented by thousands of rounds, but it is only now and again that a barrel is found capable of the highest performances at the target for more than a few hundred rounds. The process of deterioration sets in with the firing of the first shot, and it continues progressively until accuracy is visibly diminished and a new barrel is required. The extending use of the new type of cleaning preparations which attack the metallic fouling which has accumulated in the bore has introduced an entirely new aspect to a problem already of considerable technical interest. The ordinary scrubbing, rubbing and washing which was calculated to remove the deposits of destructive chemical agents is now recognised as insufficient treatment for a barrel if the highest achievements are to be attained with its aid. From time to time the bore must be thoroughly cleansed of the coating of cupro-nickel which is deposited during the rapid passage of the bullet along the bore. This kind of fouling may exist in quantities unperceivable by the acutest vision. Yet its presence can be determined by the use of a series of highly finished gauges advancing by ten-thousandths of an inch.

It seems to be generally recognised that a first-class target rifle capable of maintaining a regular elevation at 1000 yards must not exceed a diameter of ·3030 of an inch. It should in any case refuse a ·3032 gauge, and if it shows a slight tightness on a plug lapped down to ·3029 of an inch so much the better. Outside the rifle manufacturer's factory such gauges were seldom heard of in times gone by, but several of the more experienced trade experts have lately recognised the importance of applying this refined test to the diameter of the barrel. Quite apart from the question of diameter there is in addition the practical shooting test which determines many things that cannot be ascertained by the use of gauges. No matter how perfect may be the machinery which is used in barrel manufacture there must always be a certain proportion of the output which gives from the start a higher promise of first-class results than other barrels apparently subjected to similar treatment. The process of boring is for instance a variable factor, in that some barrels need very much less straightening than others to correct the straying of the drill point from the spinning axis of the blank. One or two barrels out of a large number may prove to have holes so straight that no subsequent setting is required. Such barrels can be finished off without placing the metal under the stresses which are induced by cold bending. Then again however truly the finish boring tools may be adjusted there are always some barrels which have a truer surface than others. In the cutting of the rifling much the same conditions exist, in that one barrel may respond to the tool so cleanly that no lapping of its surface is required, whereas another may show jagged edges which can only be removed in the usual way.

Assuming that the greatest care has been taken, and that every possible supervision has been exercised in carrying out each process on the most approved lines, there is still an extraordinary opening for variations when the rifles come to be fired on the testing ground. Some rifles show a distinct objection to planting their shots in the circumscribed space. After a time they may settle down to their work; but such barrels are not regarded as so satisfactory as others which behave properly the first time they are shot. Fortunate indeed is the shooter who can get such a rifle. Money cannot always buy them, and there is always a feeling that they must be reserved for those whose shooting reputation implies that full justice will be accorded to their good qualities. The cessation of manufacture in large quantities of the full-length ·303 rifle makes it in a measure more difficult than in the past to obtain selected barrels for target shooting purposes. With a large rate of production there is always a large quantity of material to choose from; but when the main resources of a factory are devoted to the output of another class of arm the manufacture of special barrels of highly accurate dimensions must mainly depend upon the exercise of special care and skill in the adjustment and operation of the machine tools.

Far more attention is paid now than was formerly the case to the careful selection and adjustment of the wood fore-ends to be fitted in match rifles. A dense and well-figured piece of wood symmetrically grained on both sides is much less liable to warp under changes of moisture and temperature than a piece which bears evidence of inequality of grain on the two sides. The actual freeing of the groove in the fore-end which receives the barrel is another of the items which exercises an important influence on the behaviour of the barrel. It has been well known of course for many years that the best of barrels could be spoilt by the twisting action of a badly fitted or improperly seasoned fore-end. It is, however, in the direction of attaining mechanical remedies for this source of trouble that recent years have shown a marked advance. Not only is the fitting of the wood carefully inspected in reference to every rifle passed for target use; but by a new system of packing the contact between metal and metal, that is to say between the loops and the barrel, has been obviated. The new arrangement provides the necessary support for the barrel, while reducing to the greatest possible extent the causes which promote irregularity of result.

In the matter of ammunition we have yet to learn what arrangements have been made to cater for the current year's requirements. M.D. cordite, or its equivalent, will certainly be used to a very great extent. Higher velocities and a moderated degree of pressure increase in the presence of high temperature are certainly advantages which all will adopt who are allowed to do so by the regulations. Quality in target ammunition seems for the time being to remain mostly a question of careful selection and gauging of all the components of the cartridge. The available variations of ballistics are now so well understood that rival manufacturers occupy a uniform position in this respect. There is, however, an unlimited opening for taking every care and precaution that manufacturing skill can suggest to reduce as far as possible the sources of variation which neutralise the marksman's skill.

ROUND THE TRADE.

We have received from the firm of Souzy & de Lacam, of 31 Boulevard Voltaire, Paris, a very complete catalogue of swords, rapiers and general fencing accessories, fully illustrated and showing immense varieties of patterns.

We have received an excellently turned out booklet descriptive of various methods and apparatus for electric shot firing in mines. The authors are Hunter & Warren, Ld., of Glasgow, and the whole production bears evidence of literary skill and praiseworthy enterprise.

The first number of *Zeitschrift für das Gesamte Schiess und Sprengstoffwesen* has just made its appearance. The issue contains several articles of note, most of them concerned with the chemistry and action of explosives. The printing and general get-up are distinctly above the average of German periodicals of a similar class.

The Marlin Firearms Company have forwarded a leaflet to this office describing their new Marlin "Baby" repeating rifle of ·22 calibre. The weight of the rifle with a 20-inch round barrel is about 3 lbs. 11 oz., while the octagon barrel pattern, with the same length of barrel weighs about an ounce less. The rifle is primarily intended for the ·22 short cartridge, but long-rifle ammunition may be used by means of a special carrier interchangeable with the ordinary type.

The Webley and Scott Revolver and Arms Co., Ld., write to us with reference to our announcement respecting their late Belgian agent, and they enclose a copy of a circular issued by them appointing Mr. Jansen, 27, Rue de la Madeleine, Brussels, who many years ago was agent for the old firm of P. Webley & Son. The circular goes on to call attention to the firm's trade mark (a castle or turret carrying a flag) as well as to the firm's property in the mark "W. & C. Scott & Son."

The Japanese Explosives Co., Ld., has been registered with a capital of £100,000 to carry on in Japan and elsewhere the manufacture of cordite, lyddite, melinite, guncotton, gunpowder, ammunition, and other explosives and materials used therein. The signatories, whose names give an idea of the personnel of the Company are as follow:—Sir Andrew Noble, Bart. (Armstrong, Whitworth), Sir Ralph W. Anstruther, Bart. and Mr. T. Johnston (Nobel's Explosives Co., Ld.), Mr. J. H. B. Noble, Mr. S. W. A. Noble and Mr. E. Kraftmeier and Capt. T. G. Tulloch (Chilworth Gunpowder Co., Ld.). The first directors are Sir Ralph W. Anstruther, Bart., Mr. T. Johnston, Mr. J. H. B. Noble, Mr. S. W. A. Noble, Mr. E. Kraftmeier and Capt. Tulloch.

The London Armoury Co., Ld., have sent us a leaflet describing new models of the automatic rifle, from which we take the following extract:—The Winchester model 1905 self-loading rifle is a hammerless take-down, made in ·32 and ·35 calibres. It is the first rifle of the self-loading type made for centre fire ammunition, the cartridges it handles being of the modern smokeless powder type, using metal patched bullets. The ·32 calibre shoots a 165-grain bullet, and gives a velocity of 1,400 f.-s. and a penetration of 21 $\frac{7}{8}$ in. dry pine boards with a full metal patched bullet, and 11 boards with a metal patched soft point bullet. The ·35 calibre shoots a 180-grain bullet, and gives a velocity of 1,140 f.-s. and a penetration of 18 $\frac{7}{8}$ in. dry pine boards with a full metal patched bullet, and a penetration of 10 boards with a metal patched soft point bullet, at the standard testing distance of 15 ft. from the muzzle. As these figures show, both cartridges give excellent penetration, and with metal patched soft point bullets they have great effect on animal tissue.

The Annual General Meeting of the Birmingham and Provincial Gunmakers' Association was held in Birmingham on the 13th ult., under the Chairmanship of Mr. W. H. Hughes. Among the questions touched upon in the course of the proceedings was that of finance. This was, however, soon settled, as the Association's balance to the good is ever growing and £350 of surplus funds have been invested. In regard to the Pistols' Act it was explained that while delays of a regrettable kind have occurred, a memorial covering the grounds for demanding relief from the more vexatious clauses has been drafted, and it is hoped that at an early opportunity it will be lodged with the Home Office. Mr. Hughes very properly took the opportunity of reminding his audience that the clause which has been wrongly interpreted to mean that householders must obtain a police certificate before effecting a purchase does not legally require that more should be done than obtain reasonable proof that the intending purchaser is a householder and purposes to use the pistol only in his own house or the curtilage thereof. A somewhat sarcastic reference appears to have been made to Mr. Thomas Challoner's Association. This arose in connection with an offer on that gentleman's part to amalgamate with the Birmingham body. The Chairman very naturally expressed a desire to know what were the component elements of the body which offered amalgamation. He, however, expressed his willingness to propose Mr. Challoner as a member of the Birmingham Association. The special interest of this announcement lies in the fact that it implies willingness to admit the allied trades to membership, that is of course treating Mr. Challoner as primarily a shot maker. Some reference was made to the question of the Gun Licence Act as it influences members of air gun clubs, and also to sundry other questions of trade interest.

The following is the text of a circular relating to the steps taken by the London Chamber of Commerce to ally itself with the interests of the gun trade. The Secretary, Mr. Kearie B. Murray, writes:—"You are probably aware, from reports which have appeared in the recent editions of the gun trade papers, that a meeting of those interested in the trade was recently held at these offices, at which a large attendance took place, when it was unanimously decided to form a Gun Trade Section of the Chamber. It is reported that at the present time the gun trade is in a far from satisfactory condition, and it is thought that a central organisation such as it is proposed to form could, in conjunction with existing local associations, do much to advance the trade generally. At the meeting above mentioned, which was attended by some fifty of the most important firms in the trade, a committee representing various interests was formed to consider what matters should be first taken up by the section and the best method of procedure. This committee, consisting of Messrs. Edgar Harrison (Messrs. Cogswell & Harrison, Ld.), Matthew Hirst (C. G. Bonehill), Martin Pulvermann (Martin Pulvermann & Co.), W. Darlow (Darlow, Ld.), S. R. Hollick (Charles Osborne & Co., Ld.), has recently met, and suggests that in the first instance the new section should confine its action to the following matters:—(1) To ascertain if the trade is an advancing, stationary, or declining position. If stationary or declining, to inquire into the reasons therefor, and to consider what steps can be taken to generally improve these conditions. (2) The amendment of the law in regard to the carrying of rifles for target practice. (3) The Pistols Act.—To obtain amendment of this Act, and if possible to delete the vexatious clauses thereof, seeking the co-operation of other bodies for that purpose. After these matters have been dealt with, it is proposed to turn the attention of the section to those ordinary matters and troubles which surround each of the forty-four sections represented by the London Chamber of Commerce. Experience has taught the Chamber that there are many matters which can successfully be dealt with by a representative trade section as a whole, and which individuals cannot possibly hope to cope with. Oftentimes these matters seem of little consequence to a trade, but they frequently assume great importance, and detrimentally affect the trade to a great extent. There are instances when a trade has seemed inclined to indolently accept the troubles which surround it without making an effort to obtain relief, but in those instances where a trade has combined it has certainly been to their mutual advantage. The committee therefore desire me to invite you to join the Chamber and the Gun Trade Section, as it is only by making the section thoroughly representative of all branches of the trade that the best results will accrue."

THE TEMPERATURE OF COMBUSTION OF M.D. CORDITE.

BY F. W. JONES.

THE methods in use for calculating the temperatures of combustion of explosives were explained in *Arms and Explosives* of September and October, 1904. The application of these methods for any particular explosive becomes interesting as soon as there are any actual measurements to compare with the calculations. Sir Andrew Noble read before the Royal Society, in June last, a paper entitled *Researches on Explosives, Part III.*, which for the first time makes known the closed chamber pressures of M.D. cordite. These results are in such complete accord with those calculated that their comparison should be of more than ordinary interest to all readers of the literature of explosives.

M.D. cordite is made by gelatinizing a mixture of 65 parts of guncotton, 30 parts of nitroglycerine, and 5 parts of vaseline. Before setting down a chemical equation in these proportions it is necessary to point out that commercial guncotton has on the average a nitrogen contents of 13·0 per cent. which does not correspond to any definite compound. For further illustration the following analysis of Stowmarket guncotton of 1897 nitrogen 13·11 per cent. may be quoted.

	Per cent.		Per cent.
Nitrocellulose insoluble	89·55	Nitrogen	13·44
„ soluble in Alcohol ...	0·52	„	4·68
„ „ ·750 Ether	3·72	„	11·93
„ „ Ether-Alcohol	5·75	„	12·71
Cellulose (unconverted)	0·26		
Ash	0·20		

This is a complex body when considered from a thermochemical standpoint. It can be shown, however, that if commercial insoluble guncotton of 13 per cent. nitrogen is considered as consisting of a mixture of cellulose and nitrocellulose of 13·47 per cent. nitrogen, only a small error can follow. It is this assumption which has been made below by taking one molecule of cellulose for five molecules of nitrocellulose. With M.D. cordite there is another point which must be taken into consideration, viz., the moisture and acetone left in the finished product. The two together equal on an average 0·8 per cent., the acetone varies, in a sample of 45 cordite 0·25 per cent. was found. In the equation below we have assumed 0·8 per cent. moisture and omitted the acetone. If these fine details were ignored the calculation would not be rendered absurd, as compared with actual measurements, but taking them into account the approach of the theoretical to the actual becomes very close indeed. In our equation we have taken the following proportions :—

	Equation.	Actual Composition.
Guncotton 13 per cent. nitrogen	64·84 per cent.	64·48 per cent.
Nitroglycerine	29·47 „	29·76 „
Vaseline	4·91 „	4·96 „
Moisture	0·79 „	0·80 „

$$12\ C_6H_5(NO_3)_3 + 32\ CH_2 + C_6H_{10}O_5 + 5\ C_{24}H_{29}O_{20}(NO_2)_{11} + 4\ H_2O$$
$$= 65\ CO_2 + 129\ CO + 68\ H_2O + 70\tfrac{1}{2}\ H_2 + 45\tfrac{1}{2}\ N_2$$

Weight in grammes involved 9123.

Estimation of Heat evolved.

Heat of formation of the ingredients.	Heat of formation of the products.
12 × 98·0 = 1176·0	65 × 94·0 = 6110·0
32 × 7·3 = 233·6	129 × 25·8 = 3328·2
5 × 624·0 = 3120·0	68 × 68·4 = 4651·0
4 × 68·4 = 273·6	14089·2
1 × 162·0 = 162·0	addition for Const. Vol. 204·6
4965·2	14293·8
	4965·2
Total units of Heat *water fluid*	9328·6 kilo cals.
Per grm. „ „ *water fluid*	1022·3 grm. cals.
„ „ „ *water gaseous*	946·3 „ „
„ vol. of total gas = 378 × 22400 ÷ 9123	928·1 C.C.

Temperature of Combustion.

In the issue of September last year this was proved to be given by:—

$$t = \frac{-a + \sqrt{a^2 + 4bQ}}{2b}$$

And we must refer our readers to this article, it will be seen that Q equals the total heat at the moment of the explosion, viz., 9123 × 946·3. To solve this we have:

a = 254 × 4·80 = 1176·00	b = 254 × ·0006 = ·1225
68 × 5·61 = 381·48	68 × ·0033 = ·2244
65 × 6·26 = 408·90	65 × ·0037 = ·2405
1966·38	·5874

Whence t = 2509 °C and absolute temperature T = 2782 °C.

Knowing the value of T and also the total gas per grm., it is easy to calculate the closed chamber pressures for different loading densities Δ, thus pressure

$$P = f\frac{\Delta}{1 - \Delta\ 0{\cdot}9281}.$$

Where for M.D. cordite $f = \frac{1{\cdot}033 \times 928{\cdot}1 \times 2782}{273}$ = 97650 kilos per sq. centimetre = 62·03 tons per sq. inch.

Thus:

$$P = \frac{62{\cdot}03\ \Delta}{1 - \Delta\ 0{\cdot}9281}\ \text{Tons.}$$

The relation between such calculated pressures for various densities, and those observed by Sir Andrew Noble, are as follow:—

Density of loading.	Pressure in Tons per sq. inch.		
	Observed.	Calculated.	Difference.
·05	2·7	3·25	+ 0·55
·10	6·9	6·82	− ·08
·15	10·2	10·67	+ ·47
·20	15·2	15·20	Nil
·25	20·7	20·09	− ·61
·30	27·6	25·73	+ ·13
·40	38·1	39·35	+ 1·25
·45	43·2	47·80	+ 4·60

A truly remarkable agreement up to 30 tons and therefore above the limit of gun pressures.

The only weakness in these calculations is the absence of exact data for determining *a priori* the products of combustion. The transformation adopted above agrees closely with published results but the basis would not be applicable in a general way. Since *MM.* Sarrau and Vieille published their researches on the mode of decomposition of explosives in

1885, many similar investigations have been made but none with the object of laying bare the factors which govern the resulting products of combustion or explosion at the different pressures or loading densities. Sir Andrew Noble in his paper takes up the position that "to attempt to express by chemical equations the transformation on combustion of an explosive would give an erroneous idea as to its simplicity." This resurrection of an old statement, applied to gunpowder by Noble and Abel in 1875, is unfortunate. Under different conditions of firing density, everybody acquainted with explosives would expect a variation in the products, except with special substances, but Nobel and Abel have always been read to mean that under similar firing conditions, gunpowder never gives the same products, and if they did not mean this then Sir Andrew Noble's reiteration is colourless. The results contained in the paper we are discussing show that the transformation on combustion of cordite, M.D. cordite and a nitrocellulose powder, is most regular and affected in a gradual manner by variation in the firing conditions, thus indicating that there is a simple explanation awaiting discovery underlying these results.

This Part III. of the *Researches on Explosives* contains the same evidence of thoroughness which characterized the previous parts. Sir Andrew Noble is truly a great authority on explosives, and by his skill and energy he has erected monuments of this subject which time cannot destroy. It is therefore most regrettable that he should have given figures for the temperatures of combustion which are neither real nor comparative. To label them provisional, does not lessen the offence from the scientist's point of view, because the method used ignores the established data and work of others. Sir Andrew Noble obtained these erroneous figures by dividing the heat evolved, by the mean specific heat of the products at normal temperature and thus the assumption is made that the specific heats of the products are constant from 0 °C to 5000 °C. This assumption is absolutely inaccurate. No one doubts the view that the specific heats of the gases forming the products of combustion of cordite, do increase materially with a rise in temperature and the only difference in opinion existing on the subject is respecting the cause of this increase. Some with Berthelot think this increase is due to intermolecular arrangement, whilst other regard it as evidence of the breaking up of the molecules into simpler bodies. Sir Andrew Noble's experiments support the former, because if dissociation took place the evidence of re-combination would have been obvious in the cooling curves. Fortunately Sir Andrew Noble stands contradicted by his own results. He has given us analyses of the products formed as well as the gas pressure at various densities of loading, these and the other data he obtained, enable one to calculate the temperature of combustion from two entirely different standpoints. The heat evolved and the composition and volume of the products, enable one to estimate temperature in a similar manner to that used above for M.D. cordite, viz., the specific heat method. On the other hand the pressure and total volume of gas, enable one to calculate temperature by the Clausius and Van der Waal's relation of pressure volume and temperature of a gas. The latter has been used earlier for calculating closed chamber pressure and by transposing, it can be shown that

$$T = P\left(\frac{41640}{\Delta v} - 41{\cdot}64\right)$$

Where T = absolute temperature
P = pressure per sq. inch in tons and
v = total volume of gas per grm.

The following tables have been taken from the *Researches No. III.*, and the calculated values explained above included for comparison.

CORDITE.

Density of Loading.	Sir Andrew Noble's Results: Pressures 1897	Pressures 1905	Per Gramme: Heat Water Liquid	Heat Water Gaseous	Total Gas	Temperature of Combustion	Temperature calculated from: Products of Combustion	1905 Pressures
	Tons	Tons	Grm. Cals.	Grm. Cals.	C.C.	Centigrade	Centigrade	Centigrade
0·05	3·0	2·9	1272·3	1186·8	877·8	5151	—	2357
·10	7·1	7·8	1250·7	1169·9	870·7	5105	2770	3132
·15	11·3	11·5	1249·9	1170·6	877·9	5088	—	2881
·20	16·0	17·2	1244·2	1174·9	888·7	5139	2847	3133
·25	20·6	21·1	1242·3	1165·8	871·3	5086	—	2879
·30	26·0	30·5	1273·6	1199·2	833·6	5259	2851	3535
·40	36·5	41·4	1299·7	1223·4	820·0	5397	2823	3256
·50	48·6	52·9	1360·0	1287·0	798·8	5749	—	3043
Calculated from Composition			1278·7	1170·7	885	2824		

M.D. CORDITE.

Density of Loading	Sir Andrew Noble's Results: Pressures	Per Gramme: Heat Water Liquid	Heat Water Gaseous	Total Gas	Temperature of Combustion	Temperature calculated from: Products of Combustion	Pressures
	Tons	Grm. Cals.	Grm. Cals.	C.C.	Centigrade	Centigrade	Centigrade
0·05	2·7	1035·9	961·9	955·4	4056	—	1968
·10	6·9	1029·8	962·4	946·4	4087	2523	2481
·15	10·2	1014·7	952·6	933·8	3996	—	2327
·20	15·2	1034·7	974·7	915·5	4120	2534	2551
·25	20·7	1041·4	981·1	888·6	4221	2490	2745
·30	27·6	1067·2	1007·6	875·3	4365	2505	2952
·40	38·1	1150·5	1090·5	831·2	4768	2694	2772
·45	43·2	1190·0	1132·5	810·2	5027	2692	2859
Calculated from Composition		1022·3	946·3	928·1	2509		

NITRO-CELLULOSE POWDER.

Density of Loading	Sir Andrew Noble's Results: Pressures	Per Gramme: Heat Water Liquid	Heat Water Gaseous	Total Gas	Temperature of Combustion	Temperature calculated from: Products of Combustion	Pressures
	Tons	Grm. Cals.	Grm. Cals.	C.C.	Centigrade	Centigrade	Centigrade
0·05	3·3	896·1	829·2	993·1	3488	—	2396
·10	6·3	869·8	802·4	969·3	3362	2169	2168
·15	10·4	887·8	820·2	970·1	3436	—	2377
·20	14·4	929·3	862·4	929·9	3648	2278	2355
·222	16·5	931·0	863·9	922·3	3668	—	2390
·29	21·5	970·2	910·3	888·5	3936	—	2307
·30	20·5	972·5	910·9	882·2	3926	2234	2105
·40	34·9	1021·4	961·4	846·8	4204	2377	2430
·45	40·5	1036·9	977·7	816·3	4283	—	2620

An examination of these tables will show that on this question of temperature, Sir Andrew Noble is contradicted by his own analyses of the products of combustion and confounded absolutely by his pressure readings. The temperatures obtained from the specific heats of the products of combustion

and the heat evolved, are concordant and agree with those obtained from the pressures or near enough when the errors in pressure-taking are considered. For instance note the difference between the two series of cordite closed chamber pressures and also that the earlier pressures would give a much closer agreement of the temperatures. Again note that nitrocellulose density 0·29 gave one ton more pressure than density 0·30, the higher charge the lower pressure. With this irregularity existing in pressure-taking, due not to real difference as the other details show, but to unreliability of pressure taking, one cannot expect more than a general agreement between the two calculated temperatures and this without doubt exists abundantly, thus the one corroborates the other. The calculations of temperature from pressure rest on the kinetic theory of gases, therefore we may say that these latest results add further confirmation to the accuracy of *MM.* Mallard and Le Chatelier's equations expressing the variation of the specific heat of gases at different temperatures, relations we use in our calculations.

In conclusion we will add the following quotation from Sir Andrew Noble's paper, viz., "I am from other *considerations* inclined to believe that the temperatures I have obtained are not far removed from the truth." In fairness to the scientific world these other *considerations* ought to be made known soon, because the disestablishment of the kinetic theory of gases, which would follow the establishment of these high temperatures, would give theorists not a little trouble. If cordite has a temperature on burning midway between that of the sun and the electric arc, as Sir Andrew Noble states, it explains erosion at once, because very much below this temperature iron is a gas.

CORRESPONDENCE.

THE DEVELOPMENT OF RIFLE SHOOTING.

To the Editor of *Arms and Explosives.*

SIR,—I have read a great deal of the large volume of articles, speeches, and correspondence which have appeared in the daily and other press for some years past in respect to the development of rifle shooting as a pastime, on a footing with football and cricket and the various other sports which the youth of this country indulge in. I have also made a careful study of the kind of attendance which one meets with at rifle clubs, miniature and full-range. I have throughout been struck by the circumstance that these clubs are more popular amongst the men who have left the day of active sports, and who are, therefore, not quite the kind of material suitable for the making of soldiers.

From enquiries I have made it looks as though there is something special about rifle shooting which makes it a class of pursuit which is not likely to be extensively indulged in between the ages of 15 and 25. When life is at its keenest and the energies most active the young man requires a sport which taxes to the full the qualities of pugnaciousness and antagonism. Rifle shooting, like golf and many other sports, is a task where the element to be overcome is inanimate. Although the stress of competition against the other members in a competition is doubtless keen in a well-contested match, the natural impulse to do or die must be held in check, and the task must be tackled on the principle of calm and deliberate calculation with still nerves and well-controlled muscles. Youngsters are not likely to shine in rifle shooting, and if one looks around singularly few examples of youthful marksmen of high merit are to be found. It is the older man, who has lost the more active temperament of youth, who excels in this pursuit. This view, which has struck me after surveying the question in the light of experience, leads me to the belief that the best way of directing public policy in regard to rifle shooting is to instil into youngsters on a compulsory basis the practice and principles of rifle shooting. Those youngsters, who, by social status, or special opportunity, are able to command outdoor shooting of whatsoever kind, will not find lacking the stimulus to further practice. But the point I wish to make is this: that if the rudiments of marksmanship are taught in the schools at the earliest possible age, a certain proportion of the boys will retain a desire to continue in form. Others who may drop the sport, with a view to engaging in cricket and football, will doubtless become members of a rifle club at the time of life when business and other reasons demand a cessation of the more strenuous sports. Rifle clubs in all quarters will serve the useful purpose of providing a means for practice by men in the volunteers, persons contemplating taking up positions abroad, and the proportion of those who, having learnt to shoot as boys, desire to stick to the work. The backbone of the club will be the man over 30 who takes up shooting for shooting's sake, and with a number of these in every centre of population rifle shooting will at least become a national sentiment.

The view I have here expressed confirms me in the belief that the present policy of extending rifle shooting as a compulsory element of school curriculum is the finest way of dealing with a problem of national importance. The clubs will occupy a somewhat secondary position, but as the one is the complement of the other so there should be no wish to say which is the more important in fulfilling the end we all have in view.

I have already spoken about the impulse to excel in shooting which must arise from the opportunity which many youngsters have of shooting in the open country at rabbits, birds and other similar small game. The air-rifle opens up the same kind of practice for boys who command a garden, even of moderate dimensions. Target shooting at the best is a pursuit which requires the stimulus of competition and keen concentration to make it enjoyable. It must be remembered that I am dealing with boys, rather than grown men, in endeavouring to define the kind of shooting they most appreciate. I, therefore, say quite seriously that a tobacco tin suspended by a string, and swinging with the wind, or in response to the shock of a bullet, represents more enjoyable practice than can be obtained with a target. The shooting so learnt is of a very interesting kind. It teaches quick alignment of the rifle and the pulling of the trigger at the critical moment. To pierce the prominent leaves of a tree, to knock the beech-mast off a bare tree in winter time, and to aim at the hundred-and-one marks which a garden affords, the back ground being always of a natural character, represents a class of shooting which comes very much nearer to practice than the most perfectly fitted miniature range. I, therefore, say that, in endeavouring to instil markmanship into the affections of the lads and young men of the country it is necessary to bear in mind the distinction which exists between them and fully-developed men, who have passed the period of participation in violent sports.

OBSERVER.

THE BALLISTICS OF M.D.S. CORDITE.

BY F. W. JONES.

IN our issue of February, 1904, the writer described and explained the use of some experimental formulæ for calculating the ballistics of rifle cordite. Both before and since this publication, these formulæ have been used with success in nearly all rifle bores. Anomalies do at times arise, but there are always reasons for the exceptional behaviour of cordite in these instances.

It is admitted on nearly all sides that in the near future rifle cordite will be replaced by what is known as M.D.S., *viz.* cordite of modified composition and made in the form of strips or long tapes. This modified cordite composition differs from rifle cordite composition in containing only 30 per cent. nitroglycerine instead of 57·5 per cent., the 27·5 per cent. difference being replaced by guncotton. At the present time manufacturers have not adopted a standard size for the strip, and are not likely to do so until the powder is adopted by our Government and manufactured to a specification.

to 2,400. Thus for the calculation of standard M.D.S. ballistics we have

$$\text{Pressure} = P = \frac{\Delta c^{0.35} w^{0.5}}{22 d^2} \quad \cdots \quad \cdots \qquad (1).$$

$$\text{Velocity} = v = 2400\, P^{0.37} \sqrt{\frac{c}{w + 400d}} \quad \cdots \qquad (2).$$

Where P = Pressure in tons per square inch.
Δ = Density of loading.
c = Charge of powder in grains.
w = Weight of bullet in grains.
d = Diameter in inches of a circle related to the section area of the bore, taking the rifling grooves into account.

With these expressions the table of results below has been obtained, and may be taken for the actual results in rifles and proof-guns with 28 in. barrels.

VALUES CALCULATED FROM FORMULÆ *(1)* AND *(2)* AND SHOW THE AVERAGE BEHAVIOUR OF CORDITE.

Cartridge.	Diameter related to Section of Bore.	Powder Charge.	Weight of Bullet.	Loading Density.	Calculated.	
					Pressure.	Velocity.
·600/3 in.	·617	115 grains	900 grains	0·678	12·78 tons	1,950 f.-s.
·577/3 in.	·581	105 ,,	750 ,,	0·714	13·43 ,,	2,052 ,,
·500/3¼ in.	·507	86 ,,	570 ,,	0·705	14·15 ,,	2,133 ,,
·500/3 in.	·507	82 ,,	570 ,,	0·752	14·85 ,,	2,126 ,,
·500/·450	·455	77 ,,	480 ,,	0·642	14·17 ,,	2,182 ,,
·450/ No. 2 nitro	·455	85 ,,	480 ,,	0·611	13·97 ,,	2,280 ,,
·450/3¼ in.	·455	73 ,,	480 ,,	0·744	16·06 ,,	2,225 ,,
·450/·400/3¼ in.	·407	64 ,,	400 ,,	0·672	15·81 ,,	2,248 ,,
·450/·400/3 in.	·407	64 ,,	400 ,,	0·659	15·50 ,,	2,231 ,,
·375	·372	43 ,,	270 ,,	0·795	16·01 ,,	2,144 ,,
·400/·360	·365	45 ,,	300 ,,	0·702	15·72 ,,	2,112 ,,
·360 No. 2 nitro	·365	58 ,,	300 ,,	0·558	14·11 ,,	2,304 ,,
·303	·307	32½ ,,	215 ,,	0·691	16·16 ,,	2,083 ,,
·375/·303	·307	42 ,,	215 ,,	0·750	19·62 ,,	2,545 ,,
7m/m Mauser	·280	33 ,,	175 ,,	0·634	16·53 ,,	2,298 ,,
6·5m/m Mannlicher	·260	32 ,,	157 ,,	0·681	19·30 ,,	2,512 ,,
7·9m/m Mauser	·316	36 ,,	225 ,,	0·625	14·96 ,,	2,091 ,,
7·65m/m Mauser	·306	35 ,,	215 ,,	0·640	15·81 ,,	2,149 ,,

The writer has shot M.D.S. in nearly all rifles where rifle cordite has been adopted. The powder used in these experiments was made by the New Explosives Company at Stowmarket, and was of such a granulation that 35 grains weight were required to give M.V. 2,300 f.-s. in the ·303 at a pressure of 19½ tons. This granulation was used because it appeared to be the most suitable, taking into consideration the pressure given for velocities near the limit fixed by recoil.

Having the results of all the experiments at hand it was thought that it would be useful if the rifle cordite formulæ could be modified or extended so as to be applicable for the calculation of standard M.D.S. ballistics. An examination showed that a slight change in the constants was alone required to effect this, thus the pressure constant for rifle cordite is $\frac{1}{20}$ and for M.D.S. thus must be $\frac{1}{22}$ also the velocity constant for rifle cordite is 2,380 and for M.D.S. this must be changed

If the M.D.S. which is adopted later, differs from that used in these experiments a readjustment of the constants will alone be required. The results and the calculations show that M.D.S. gives an advantage over rifle cordite of about 100 ft. additional velocity for the same breech pressure and when this is considered in connection with the less heating of the barrel and the absence of any material effect on ballistics by temperature one may describe the advantage as considerable.

It will have been noticed that the formulæ are described for the calculation of standard results, thus expression (*1*) cannot be employed for estimating either very low or high pressures. This is because Sarrau's pressure formulæ, from which it is derived contains a term, *viz.*, the length of a barrel passed over by the bullet when the maximum pressure arises, and this factor varies for large alterations of the charge of powder.

For calculating the variation in pressure consequent on an alteration in charge the following must be used thus, let

p = the percentage increase of pressure due to (3).
l = a percentage increase of load

Then $p = l^{1.85}$ ... ...

This relation holds in all experiments with cordite and M.D.S., and also in Mr. Housman's results (published in *Technics*) with Axite as the following shows.

Axite in ·303 long case.

Charge.	Velocity.	Pressure.	Calculated pressure.
33 grains	2,058 f.-s.	13·35 tons	13·0 tons
36 ,,	2,223 ,,	15·8 ,,	15·5 ,,
40 ,,	2,445 ,,	20·3 ,,	20·9 ,,
44 ,,	2,642 ,,	27·6 ,,	27·6 ,,

SAFETY EXPLOSIVES IN BELGIUM.

To the list of eleven safety explosives permitted in Belgian fiery mines, given in our last October issue, must now be added the six following :—*Colinite antigrisouteuse*, made by the Société Anonyme de Dynamite, Matagne, (nitroglycerine 25, potash 34, nitrate of baryta 1, wheat flour 38·5, bark dust 1 and soda 0·5) ; *Minite*, made by the Société Anonyme de Poudres et Dynamites, Arendonck, (nitroglycerine 2 5, nitrate of potash 35, rye flour 39·5 and soda 0·5) ; *Wallonite III*, made by V. Ansay et Cie, Forêt-Trooz, (nitrate of ammonia 70, nitrate of soda 25, and nitrated pitch 5) ; *Densite II*, made by Ghinijonet et Cie, Ougrée, (nitrate of ammonia 62·5, nitrate of potash 30 and trinitrotoluol 7·5) ; *Flammivore I*, made by the Arendonck Company, as above, (nitrate of ammonia 82, nitrate of potash 10, gelatinised nitroglycerine 4 and rye flour 4) ; *Fractorite B*, made by the Matagne Co., (nitrate of ammonia 75, oxalate of ammonia 2·2, dinitronaphthaline 2·8 and ammonium chloride 20).

In the following table, column A gives the maximum charge permitted ; B the equivalent of this charge expressed in dynamite No. 1, for comparison ; C the mass of rock brought down by this charge, also for comparison ; D the diameter of the cartridge, and E the no. of detonator used for firing :—

Permitted Explosive.	A grammes	B grammes	C cu. met.	D mm.	E No.
Colinite antigrisouteuse	900	497	2·087	43	6
Minite	750	405	1·7	43	6
Wallonite III	600	304	1·277	32	8
Densite II	550	297	1·247	30	8
Flammivore I	500	326	1·369	43	8
Fractorite B	500	286	1·201	43	8

453 grammes = 1 lb. ; 1 cubic metre = 1·3 cubic yard ; and 25·4 millimetres = 1 inch.

The exact equivalents in columns B and C cannot be determined because the dimensions of the mortar at the Frameries testing station did not permit of attaining the ignition charge.

The complete list of 17 safety explosives now permitted for use in Belgian fiery mines is given, together with their composition and maximum charge, in an appendix to the circular, dated October 25, 1905, of the minister for industry and work to the directors of the mining districts. This circular states that the maximum charges hitherto permitted were the limit charges, viz., those that, untamped, failed for a certain number of times to detonate an explosive mixture, increased by a certain quantity on account of the additional security afforded by tamping. Recent tests at the Frameries Station permitted the addition to the list of the new explosives mentioned above, the *limit charges* of which are sufficiently high to justify their adoption.

In the same connection M. Watteyne, Inspecteur Général des Mines, and M. S. Stassart, Ingénieur Principal des Mines, observe, in the *Annales des Mines de Belgique*, that the usual mine charge varies from 200 grammes (nearly 7 oz.) to double that amount, while rarely attaining 1,000 grammes (33 oz.), so that it is very easy in dangerous mines to adopt the *limit charge* which for safety explosives varies from 250 grammes (say 8 oz.) to 900 grammes (30 oz.). Before the tests at Frameries, the 13 permitted explosives had a mean *limit charge* of 69 grammes (30 gr. = 1 oz.), corresponding to 51 grammes of dynamite No. 1 ; but after the tests the 17 explosives now permitted have a mean *limit charge* of more than 588 grammes (say 20 oz.) corresponding to 337 grammes (say 11 oz.) of dynamite No. 1, and representing a disruptive effect more than six-and-a-half times greater.

TRADE MARKS.

ADVERTISED. DECEMBER 6—27, 1905.

277,293. } The word "VICMOS." To apply to arms and ammuni-
277,294. } tion and explosives. Cogswell & Harrison, Ld., London. November 14, 1905.

275,916. A device representing a roller lying behind a projectile. Fried Krupp, Ag., Grusonwerk, Germany. September 22, 1905.

276,591. The word "FAUNETA." To apply to small-arms. Westley Richards & Co., Ld., Birmingham. October 20, 1905.

277,295. } The word "VIX." To apply to arms, ammunition and
277,296. } explosives. Cogswell & Harrison, Ld. November 14, 1905.

274,799. The well-known E.C. Powder star device below which appears in bold letters "E.C. 3." To apply to cartridge cases and ammunition. The E.C. Powder Co., London. August 3, 1905.

277,437. } The word "ARDIT." To apply to arms, ammunition
277,438. } and explosives. Cogswell & Harrison, Ld. November 18, 1905.

277,427. The word "CURTISITE." To apply to explosive substances. Curtis's & Harvey, Ld., London. November 18, 1905.

277,439 } The word "EXCELTOR." To apply to arms, ammunition
277,440. } and explosives. Cogswell & Harrison, Ld., London. November 18, 1905.

277,411. The word "PEDMINSTER." To apply to small-arms. The Peddie Small-Arms Co., Ld., London. November 17, 1905.

There were no trade marks of any interest to our readers registered during the past month.

APPLICATIONS FOR PATENTS.

NOVEMBER 20—DECEMBER 16, 1905.

23,895.* Explosives. O. Silberrad.
23,930. Torpedo. F. Kopecky.
23,941. Targets. F. J. Falkner.
24,002.* Destruction of Fumes in Mines. H. Walker.
24,005. Air and Shot Gun Targets. C. B. Sturgess.
24,215. Rifle Carrier. J. Mossop and W. D. Milne.
24,220.* Measuring Velocity of Explosives. H. Mettegang.

24,501.* Projectiles. E. M. Johnson.
24,588.* Ordnance. J. H. Brown.
24,591. Rifle Ranges. J. Paterson.
24,694. Cartridge Cases. E. Jones and Kynoch Ld.
24,709 Ordnance Telescopic Sights. Fried. Krupp. (Date of application in Germany, February 15, 1905).
24,710. Automatic Small-Arms. T. R. R. Ashton.
24,778. Cartridge Turnover. A. J. Rudd.
24,795. Paper Targets and Holders. A. E. Downing.
24,869.* Fire-Arm Discharge. T. Mancin
24,884. Explosive. W. Upton.
24,900. Detection of Fire Damp. J. McCutcheon.
24,909. Rifle Sights. F. Greener.
24,915. Gun Cleaning Tools. F. Hirst.
25,014. Rifle Attachment. C. Leven.
25,081. Nitrocellulose Solvent. A. T. Cocking and Kynoch Ld.
25,208. Motor Gun Carriage. E. B. Ludlow.
25,222. Air Guns. A. H. Hill and W. F. Williams.
25,239. Explosive. H. Boyd.
25,307. Rifle Sights. E. Harrison.
25,383. Mines. F. Schneider. (Date of application in Germany, January 23, 1905).
25,403. Small-Arms. H. T. Ashton and J. J. Speed.
25,413. Gas Check T. G. Russell.
25,427. Target. J. F. Luckman and W. G. Griffiths.
25,448. Rifle Breech Actions. F. Greener.
25,507.* Torpedoes. A. Racic.
25,523. Small-Arm Sights. W. M. Scott.
25,551.* Hand Guard for Small-Arms. F. Greener.
25,568. Small-Arms. J. T. Peddie and The Peddie Small-Arms Co.
25,579.* Air Guns. A. L. Blumén and P. S. Emerlöf. (Date of application in Sweden, December 31, 1904).
25,656. Automatic Arms. The Mars Automatic Pistol Syn., Ld., and C. Brown.
25,020A. Cartridge Pouch. Samuel Bros., Ld., and A. J. R. Purcell. (Date of application under Rule 5, December 2, 1905).
25,741. Aiming Fire-Arms. R. T. Roth.
25,780.* Explosives. G. Reschke.
25,781. Explosives. G. Reschke.
25,852.* Small-Arm Trigger Mechanism. A. Tomischka.
25,860.* Torpedoes. G. Taddei.
25,879 Range Finder. E. L. Perry.
25,885.* Drop-Down Fire-Arms. C. F. P. Stendebach.
25,890. Rifle Range. H. Phillips.
25,939. Explosives. C. C. Dawson-Smith. (Agent for *A. C. Luck*).
25,976. Cleaning Gun Barrels J. Y. Johnson. (Agent for *The Saponia-Werke Ferdinand Boehm*).
26,016. Air Guns. E. C. and F. H. Green.
26,033.* Sights. M. Klingler.
26,059. Gun Case Sling. G. M. Thompson.
26,252.* Ordnance. Fried. Krupp, Ag. (Date of application in Germany, March 2, 1905).
26,266.* Gun Carriages. C. P. E. Schneider.

* These Applications were accompanied by complete Specifications

SPECIFICATIONS PUBLISHED.

NOVEMBER 23—DECEMBER 21, 1905.

COMPILED BY HENRY TARRANT.

23,387 (1904). **Automatic Small Arms.** T. R. R. Ashton, London. Automatic or semi-automatic mechanism for magazine rifles is dealt with in this bulky specification. The parts are operated by a small portion of the powder gases which act upon a piston. The sliding breech bolt is provided with a vertical locking action, and the breech is protected from dust or sand. Other improvements are dealt with. Accepted October 28, 1905.

24,790 (1904). **Range Finder.** Capt. A. H. D. Raich, Rochester. By means of two telescopes arranged so that their object glasses are some distance apart the two images of the object are made to coincide upon a mirror. The adjustment of the movable telescope causes the range to be indicated upon a scale. Solidity and simplicity of construction are especially aimed at. Accepted November 15, 1905.

25,584 (1904). **Sight for Fire Arms.** W. Meeson, Ponder's End. The sighting notch is carried at the apex of a triangle formed by two arms pivoted together at one end and having their other ends pivoted to nuts free to move in a guide which forms the base of the triangle. The nuts work upon a left and right-hand screw, the rotation of which causes the nuts to move towards or away from each other. Accepted November 23, 1905.

26,865 (1904). **Rear Sight Adjustments.** J. Hassen, London. An attachable device for rear sights of small-arms is adapted to make minute and accurate adjustments of the sight. It consists of a graduated tubular headed part which engages the milled screw heads already existing upon the sight. Accepted November 2, 1905.

27,974 (1904). **Movable Targets.** J. Gorst, Chester. Running and disappearing targets are arranged upon two cables fixed at top and bottom of two uprights. The targets are manipulated in much the usual way from the mantlets. Accepted November 9, 1905.

28,650 (1904). **Cartridge Holder.** J. J. Burnett and C. Bubear, Wellington, Somerset. A cartridge holder adapted to be attached to the ordinary bandolier is constructed from metal, and is adapted to hold the cartridges securely until they are required for use by means of a spring beading and spring tongues. Accepted November 9, 1905.

29,076 (1904). **Extraction of Fired Primers.** Sir W. G. Armstrong, Whitworth & Co., Ld., and S. M. Murray, Newcastle-on-Tyne. A spring arm is so arranged in the lock of the ordnance firing mechanism described in patent No. 12,715 (1904) that it is pushed back when the lock is opened, and is suddenly released to give a sharp kick to the fired primer, and so eject it from the gun. Accepted November 2, 1905.

262 (1905). **Driving Band for Projectiles.** R. A. Hadfield, Sheffield. Instead of the copper or cupro-nickel driving bands generally used, a band composed of copper containing 0·75 per cent. to 3 per cent. of tin is adopted. The hardness of the band is by this means considerably increased, and the flight of the projectile is rendered more correct. Accepted November 30, 1905.

319 (1905). **Range-finding Telescopes.** F. W. Allen, Leicester. In order to adapt the telescope of a range finder of the type described in patent No. 17,209 (1902) for use as a sighting accessory for ordnance, it is so constructed that some lenses may be removed and the power of the telescope varied. Accepted November 16, 1905.

524 (1905). **Self-indicating Targets.** Sergt.-Maj W. C. Savage, Transvaal. The sections of an automatic target are connected through bars yieldingly supporting them with an indicator. The indicator is fitted with shutters, one of which is caused to fall when the corresponding target section is struck. Accepted November 9, 1905.

3,921 (1905) **Armour-piercing Projectiles.** W. H. Harvey, London. The resistance of air or water to the passage of a projectile is decreased by arranging an open tube through the centre of the projectile. This tube is closed up to the moment the projectile leaves the gun by a base plug which is opened by the pressure of air or water. Penetration is by this method enhanced. Accepted November 23, 1905.

4,072 (1905). **Ordnance Firing Mechanism** Sir W. G. Armstrong, Whitworth & Co., Ld., and S. M. Murray, Newcastle-on-Tyne. The firing mechanism of ordnance containing the De Bange system of obturation is improved upon by providing that when the primer is renewed or the frame removed without opening the gun the firing pin is moved back and cocked by the turning of the bolt. Accepted November 9, 1905.

4,179 (1905). **Long Range Time Fuse.** Capt. R. P. R. Embury and F. Wigley, Coventry. Within the movable composition ring of a time fuse are arranged two annuli of composition one inside the other. There are also two fixed annuli of composition, and these are provided to allow the fuse to be used for very long ranges. Only a portion of each of the four annuli is burned for short ranges. Accepted November 30, 1905.

5,687* (1905). **A New Explosive.** G. Schultz and F. Gehre, Germany.

6,746 (1905). **A System of Fuse for Projectiles.** H. B. Strange, H. T. Ashton and M. J. C. Dennis. This specification is a secret document.

7,218 (1905). **Air Gun Locking Device.** J. Mayer, Germany. An automatic locking device for the pivoted barrel of an air gun is so constructed that greater resistance is offered to the downward tilting of the barrel than to the closing of the barrel. Accepted November 30, 1905.

10,072* (1905). **Revolver Lock Mechanism.** W. J. Whiting, Birmingham.

10,317 (1905). **Torpedo Launching Tube.** Capt. C. C. A. Fallenius, Sweden. A submarine broadside torpedo tube provided at its mouth with an enlargement extending towards the stern of the vessel, whereby the launching is rendered possible without the aid of a support for the torpedo outside the ship. Accepted November 30, 1905.

10,426 (1905). **Air Gun Cocking Device.** L. Jeffries, Birmingham. An air gun is constructed with a rigid barrel and breech fastening. The plunger spring is cocked by means of a rod adapted to slide in a direction parallel to the axis of the barrel. One end of the sliding rod is connected with the plunger, whilst the other end is adapted to be pressed against the floor to cock the gun. Accepted November 30, 1905.

10,480 (1905). **Illuminating of Ordnance Sights.** G. A. Bertalot. Cardiff. (Agent for *Com. T. Bonino, Italy.*) A method of illuminating sights for night shooting, consisting in reflecting a bead of light to the sights from a case containing an incandescent lamp. The lamp case is enclosed in an outer case, through which air circulates for cooling purposes. Accepted November 10, 1905.

12,463 (1905). **Fuse Setting Apparatus.** Maj. Sir H. W. W. Barlow, R.A., and W. Charlesworth, Woolwich. Apparatus for setting the time rings of fuses. When connected with the setter the body of the fuse is stationary whilst the ring is revolved. When the ring has been set the locking engagement of the setter is automatically interrupted, and by this means jarring either to the fuse or the setter is avoided. Accepted November 23, 1905.

13,092 (1905). **Submarine Mine.** T. Novero, Italy. A submarine mine containing an explosive charge which is ignited by a device when struck by a ship or other floating body. The mine may be rendered inoperative from a distance. Accepted November 23, 1905.

13,106 (1905). **Machine Gun Ejecting Apparatus.** Fried. Krupp, Ag., Grusonwerk, Germany. In machine gun extracting and ejecting mechanism in which two extractors and one fixed ejector are used, the disadvantage of the premature turning aside of the spent cartridges is avoided by arranging that the fixed ejector operates to displace one of the extractors from engagement with the rim just before the latter strikes the fixed ejector. Accepted November 9, 1905.

13,117 (1905). **Cartridge Extracting Mechanism.** Fried. Krupp, Ag., Grusonwerk, Germany. An improvement upon the mechanism set out in patent No. 13,106 (1905), dealt with above, is described in this specification. Instead of the ejector moving the supplementary extractor directly, the rim of the cartridge case is caused to push the extractor aside when the cartridge base comes into contact with the fixed ejector stop. Accepted November 30, 1905.

14,335* (1905). **Rear Sight for Small-Arms.** C. S. Daniel, U S.A.

15,263 (1905). **Magazine Rifles.** G. Hagan, Germany. When in position the magazine for rifles described in this specification is U-shaped and surrounds the sides and bottom of the breech. When loading, one side of the magazine is turned down upon a hinge so that 20 cartridges may quickly be thrown into one long vertical receptacle. Accepted November 9, 1905.

17,805 (1905). **Discharge Deafener.** Aktienselskabet Lygaads Gevärkompagni, Norway. A device containing two chambers, one each side of the bore, is fixed to the muzzle and is adapted to deafen the sound of discharge. By means of two "clacks" the gas is held and released gradually. Accepted November 2, 1905.

18,275 (1905). **Safety Explosives.** The Castroper Sicherheitssprengstoff, Ag., Germany. A method of rendering explosive mixtures of ammonium salts (especially chloride of ammonia) safe against fire damp consisting in adding equivalent amounts of one or more metallic salts of organic acids, particularly the salts of the fixed alkalis and alkaline earths. Part of these may be replaced by an equivalent portion of some oxygen yielding salt. Accepted November 9, 1905.

18,810 (1905). **Drop-down Small Arm Breech.** F. Jaeger, Germany. In order to strengthen the breech connection between the barrels and body of a drop-down gun, the ordinary central lump between the barrels is replaced by lumps beneath each barrel. Accepted November 23, 1905.

19,112 (1905). **Potassium Chlorate Explosive.** J. C. Smith, U.S.A. A blasting powder consisting of potassium chlorate varying from 20 to 35 per cent., granulated sugar 10 to 20 per cent., potassium nitrate 10 to 20 per cent, and stone coal or charcoal 25 to 50 per cent. by weight. The method of manufacture is fully set out in the patent and it is claimed to be cheap and safe. Very little smoke is given off when exploded. Accepted November 23, 1905.

19,336 (1905). **Straight Pull Rifle.** J. W. Esser, Birmingham, G. W. Barratt, Hornsey, and F. Barrett, Wood Green. Rifle mechanism, constructed especially to allow of rapid manipulation without taking the rifle from the shoulder, in which the forward part of the breech bolt when pulled rotates and unlocks itself from the breech and telescopes into the rear portion of the bolt The bolt is operated by a part similar to the "pump" of a Winchester. Accepted November 16, 1905.

19,434 (1905). **Fluid Pressure Recoil Brakes for Ordnance.** Fried. Krupp, Ag, Germany. The construction of the brake of the fluid pressure type for barrel recoil ordnance is modified so that it shall be as compact as possible. Accepted November 30, 1905.

20,455 (1905). **Laying Levers for Ordnance.** Fried. Krupp, Ag., Germany. The laying lever of ordnance is so connected to its handle that the throwing over of the lever can take place independently of the movements of the handle relatively to the lever. The gun layer need not change his position to operate the lever. Accepted November 30, 1905.

20,487 (1905). **Submarine Mine Firing.** G. Sautter, E. Harlé, and J. Rey, France. Firing mechanism of automatic mines or torpedoes is governed by the hydrostatic pressure of the water so that the mine or torpedo shall not be exploded by "sympathy," *i.e.*, by the shock of a neighbouring explosion. Accepted November 2, 1905.

21,340 (1905). **Travelling Gun Carriages.** Fried. Krupp, Ag., Germany. A travelling gun carriage with a limber tree is so constructed that the tree can be secured in two positions. In the lower position it serves to connect carriage and limber and in the upper it may be used as a training lever. Accepted November 16, 1905.

22,795 (1905). **Steel Projectiles.** Fried. Krupp, Ag., Germany. In patent No. 5,327, 1905, a steel projectile having a space filled with specifically heavy metal was described. This projectile is improved by providing a guiding band near the point to prevent oscillations when in the gun barrel. Accepted November 23, 1905.

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

SELECTED PATENTS.

A NEW EXPLOSIVE.

5,687 (1905). G. Schultz and F. Gehre, Germany. A new composition for which is claimed great explosive power, safety and freedom from injury to health during manufacture, is set out in this specification. Nitrate of ammonia is proportionately the largest component, but in conjunction with this is employed solvent naptha which is so acted upon as to liberate the hydrogen carbides, mesitylen and pseudocumol present in the di- and tri-nitro forms. The production of the nitro substances from solvent naphtha is effected by any known method, and these nitro substances contain the di- and tri-nitro forms of mesitylen and pseudocumol. These solid di- and tri-nitro substances are mixed with the oxygen carrier—nitrate of ammonia—by grinding them both in

mills. The following is an example of the new compound :—76 parts nitrate of ammonia, 10 parts of nitrate of potassium, 10 parts of the nitro substance described above, 2 parts of resin, and 2 parts of perchlorate of potassium. Accepted November 2, 1905.

REVOLVER LOCK MECHANISM.

10,072 (1905). W. J. Whiting, Birmingham. In revolver mechanism of the single-and-double action rebounding-hammer type the ordinary two-arm V-shaped mainspring is replaced by a spiral spring which is adapted to serve both as a hammer and as a trigger spring. The mechanism is in this way simplified and is rendered cheaper to manufacture.

The parts in different positions are illustrated in the drawings herewith reproduced. The hammer *a* (Fig. 1) carries the sear *b*

Fig. 3

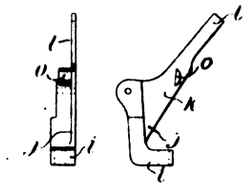


Fig. 1

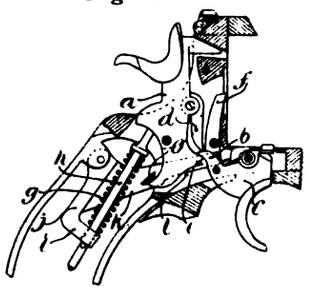
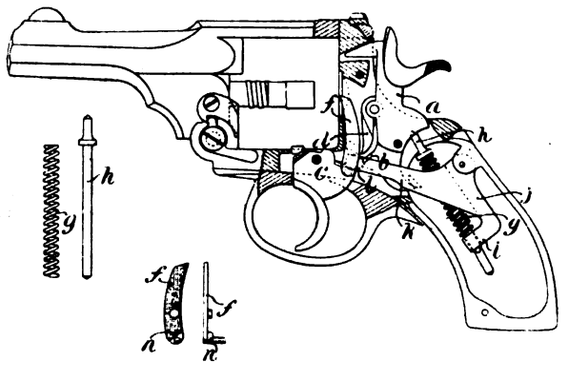


Fig. 2



and is operated by a trigger *c* of ordinary construction. The trigger blade *c* engages beneath the hanging lever *d* when the weapon is used as a double-action one, *i.e.*, when the trigger is pressed to carry the hammer rearwards from the normal positions ; and the blade engages with the bent *e* when the hammer is drawn back to full cock by hand for single action use. The pawl *f* gives the intermittent action to the cylinder in the ordinary way, and receives its movement through the medium of the trigger to which it is pivoted.

The spiral main spring *g* takes the place of the usual two-armed spring. The spring *g* works around the plunger *h*, the forward end of which presses against the rear of the hammer, and communicates the push of the spring thereto. The rear end of the spring rests upon the abutment block *i* which extends from the part *j* of the swinging limb *k* (Fig. 3) pivoted at the inside of the top of the grip. The rod *h* passes through and is capable of sliding within the block *i*. The forward part *l* of the limb *k* extends past the spring and plunger and has a bearing at its forward end upon the shoulder *n* of the cylinder pawl *f*. The push of the spring is, through this bearing, communicated to the trigger to which the pawl is pivoted. When the finger pressure is released, the trigger and pawl are returned to the normal positions.

The downward angular movement of the part *l* of the limb *k* is utilized also for imparting the rebound movement to the hammer in order to remove the nose of the striker from the path of the rotating cylinder. The side of the limb *l* is for this purpose provided with a lateral projection *o*. This projection is caused to bear upon the rearward extension of the hammer and so to force the hammer slightly backwards into the position illustrated in Fig. 2. Thus the pressure of the spring is split up and is adapted not only to force the hammer forward for discharge, but to return the trigger and cylinder pawl, and to bring about the rebound of the hammer. Accepted November 23, 1905.

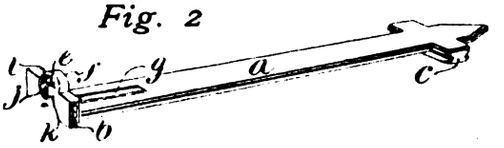
REAR SIGHT FOR RIFLES.

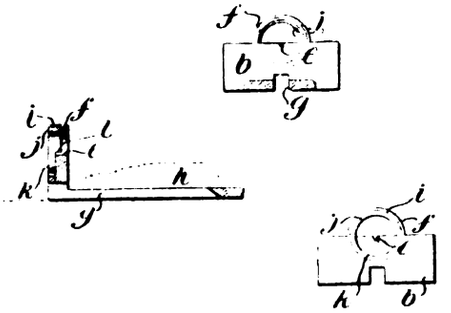
14,335 (1905). C. S. Daniel, U.S.A. The sight described in this specification is constructed to enable rapid sighting in practically any light—bright or dull. The vision is concentrated naturally and rapidly upon an ordinary sighting notch by a semi-circular hood arranged above it. Part of the hood consists of a ring of ivory or other material which will reflect as much light as possible under darkened conditions, but which will to some extent shade the sighting notch in a glare.

The sight is illustrated in the drawings printed below. The longitudinal sight-bar *a* extends forward from the body *b* of the sight proper (Figs. 1 and 2). The forward portion of the bar is provided with an anchoring wedge *c* which is seated in the groove *d* in the barrel of the rifle (Fig. 2). The body *b* is transversely disposed to the rear end of the bar *a*. Upon its upper edge is cut the sight notch *e*, and this notch is located at the centre of a circle of which the hoop *f* is a half. The body *b* extends each side beyond the hoop, and the notch is arranged at the centre of its

Fig. 1

Fig. 2





upper edge. The hoop is adapted to guide the vision quickly to the sighting notch. The longitudinal slot *g* in the rear of the bar *a* receives the stepped wedge-shaped part *h*. This part is moved backwards or forwards to elevate or depress the sighting part.

The hood *f* consists of the seating recessed at *i* which is adapted to carry the ivory hoop *j*. The lower portion *k* is formed with the shoulders *l* upon which rest the ends of the semicircular ivory hoop. The hood is made very narrow so that the game or target is not hidden. Accepted November 16, 1905.

Arms & Explosives

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CURRENT TOPICS.

The Short Service Rifle.—That the household troops are now doing sentry-go with the new short rifle suggests that the Government have determined to proceed with its issue to the infantry. Less than this could hardly be expected in view of the large number of arms which have been manufactured at Enfield and elsewhere. An important factor in the situation is likely to produce a correcting influence in respect to the above conclusion. With an overwhelming Liberal Government in office, pledged to diminish expenditure wherever possible, it is almost certain that policy will demand a set-off in other directions, such as will salve the public conscience. With Lord Tweedmouth in the Cabinet there can be little doubt that whatever may be the policy of the War Office in other directions, striking and meritorious changes may be anticipated in respect to the service arm. It is the one item of War Office output which the public thoroughly understands, and which newspapers can ventilate with an exceptional show of knowledge. Just as the Conservative party can be associated with propagating and supporting the policy of an inferior service arm, so the Liberal party is committed to the view that the English service rifle is bad, and that its faults should be remedied. Past policy can now be reversed without confession of previous failure by those making the change. The new cadet rifle will score a point in favour of the new Government; and it is probable that a new pattern of service rifle will rapidly be initiated to round off the success. This, and improved treatment of the volunteers, would diminish the criticism which might otherwise be earned by retrenchment in matters which, costing much, appeal less to the public. It may accordingly be inferred with virtual certainty that whatever may be the apparent degree of permanence which attaches to the new short rifle, the volunteers will never have it, and arrangements will soon be instituted for designing a new model. Mr. Haldane's name is kindly regarded by all who appreciate the immense personal interest which he has taken in the technical questions which have come before him in the past as a member of the Explosives Committee. To him was entrusted the task of announcing by speeches to his constituents the latest progress of the Committee he adorned; and we cannot help feeling that whatever schemes of expenditure are abandoned, the economy which would result from the adoption of a well-designed military arm will not be considered too dear, whatever may be the first cost involved.

The Shooting Season.—Now that the shooting season is well-nigh finished, it is safe to congratulate ourselves on thoroughly favourable conditions which have produced a large head of game with sufficient provision for an adequate breeding stock in the season to come. The enormous amount of shooting which has been carried on is sufficiently evidenced by the fact that, notwithstanding the many firms who are in a position to turn out large quantities of cartridges, the general experience is that all previous records have been beaten. Firms expecting good results have been able to apply the word "excellent" in reviewing the past season's records: those who expected moderate results feel that the outcome has been favourable; in fact, everyone who has a stake in the cartridge turnover has full reason for satisfaction. Judging by the general records and information which have come to hand there also appears to be reason for

supposing that the average quality of output has been good. Complaints as to unsatisfactory issues of powder have been non-existent so far as our own experience goes. Instances of questionable loading of cartridges have also been very rare. The only blot in the general record of success has arisen from a limited number of instances in which bursts have occurred under circumstances pointing to the lodging of a charge of shot in the barrel. Where the opportunity has arisen for making close investigation of the incidental circumstances the cause of such failures seems mainly to be attributable to a partial charging of the cartridge case with powder. So serious are the consequences of an obstruction of a weighty character in the rear end of the barrel that all cartridge loaders should seriously consider the question of so modifying their powder-filling apparatus as to provide a check which will not only notify a shortage of powder in the hopper, but provide some ready means of checking the delivery of each charge into the appropriate cartridge case. There is probably no firm in the trade which has more systematically studied the scientific loading of cartridges than Messrs. Cogswell & Harrison. In this firm's powdering machines the cut-off nozzles are combined with a series of short lengths of glass tube. The workman in charge of each machine is responsible for seeing that each tube contains its proper complement of powder before he makes the final movement which transfers the powder into the cartridge case. A little ingenuity similarly provides a suitable form of gauge glass or automatic indicator, capable of showing at once when the supply of powder in the hopper is approaching exhaustion. It is, in fact, not so much a matter of designing suitable expedients as of recognising the necessity for putting them into use.

The Cadet Rifle.—Gossip has not been long in making known to the gunmaking world that the War Office has expressed itself not wholly satisfied with any individual cadet rifle submitted in accordance with the recent circular. It has accordingly decided not to adopt any of the arms submitted, but to design one of its own, making use in the process of any meritorious features judged to exist amongst those submitted. The most remarkable feature about the whole proceeding is that the War Office should have received any rifles at all under an invitation which left a bare month, and in some cases less than a fortnight, for turning out a finished model of an entirely new type of arm. It had to be constructed from A to *Z* within the limits of a definite specification which left the question of mechanical design entirely open. It would be difficult to estimate how many thousands of pounds were spent by those who endeavoured to carry out a highly difficult task in what appears to be an impossibly short space of time. Whatever may be the character of the design ultimately adopted, it is to be hoped that the firms who have so ungrudgingly collaborated with the war department will be well paid for the museum of ideas from which the Enfield experts are admittedly deriving their inspirations. Our gunmakers are in logical sequence inventors first and manufacturers second, but on the question of profit orders for manufacture are of greater importance than gratuities from the Government for the use of inventions. There are many precedents for the course of action which has been pursued in the present instance. The new field artillery gun was jointly designed by the firms of Armstrong and Vickers-Maxim. The Government after examining and testing both models produced a joint pattern, embodying the best features of each; and as these two firms have never associated themselves with press onslaughts against the War Office it is to be presumed that their claims have been satisfied on an equitable basis. We are, in fact, inclined to avoid criticism of the means when the end is so eminently satisfactory to all concerned. About six months ago the universal need for a cadet arm was generally voiced. The new Small Arms Committee, together with the permanent officials of the War Office, set to work; and if reports are to be believed, something approaching a finished model of arm has been evolved in an inconceivably short period of time.

The N.R.A. Report.—This year's report of the National Rifle Association contains the usual records of competitions lost and won, and general progress of a satisfactory nature. The document, curiously enough, is silent concerning the most important item of recent progress, the omission of so important a particular being due to the fact that things have only within the past few days advanced to a stage ripe for public mention—that is to say, the whole of the conditions influencing miniature rifle shooting at the shorter distances have been subjected to careful analysis and enquiry, with the result that new regulations will shortly be announced. Chief amongst these is the abolition of the vexatious restrictions which have governed the miniature rifle. Hitherto there has been considerable lack of unanimity between the published rules and the conditions which practical riflemen endorse. For instance, the cost limit on a miniature rifle has not produced any good effect as a set-off against the constant bickerings, evasions, and protests which have arisen in connection with it. American rifles have been sold at the old prices, and English rifles have in several instances been supplied at rates giving rather less than a living profit. Rifles have not been improved in respect to cost, and it is accordingly an agreeable surprise to know that a vexatious clause is in process of removal. In respect, again, to the peculiar relations which exist between miniature rifles and service rifles firing miniature ammunition, it is satisfactory to feel assured that these anomalies will shortly be a thing of the past. The miniature rifle will in future be able to compete with the military pattern rifle under equal conditions of contest. Miniature rifles will not by any means enjoy a walk-over—this for the simple reason that when open sights are the rule the military length of weapon carries them more favourably disposed for aiming purposes than any miniature arm we have yet encountered. Hitherto it has been supposed that in the actual power to place its bullets on a small area the miniature rifle has an advantage over the reduced military, but the service rifle enthusiast will shortly be free to choose between the competing systems of tube, adapter, and specially bored small-calibre barrel. If amongst these he is unable to find a means of placing his bullets where the barrel is pointing we shall indeed feel surprised. The open-air miniature season thus commences with the most encouraging prospects that sport will be conducted under conditions which will give every possible opening for successful results. The best practice is obviously that which involves the most searching test of marksmanship, and it is interesting to know that the new rules shortly to be published embody conditions having that end in view.

A NEW ELEMENT.

HOWEVER one may regard the move to establish a powerful gun section of the Chamber of Commerce one thing is certain viz., that it has passed under the direction of a body of men whose ability, enterprise and business knowledge are without question. No one, for instance appreciates better than Mr. Edgar Harrison the true aspects of the problem which the manufacturing gunmaker must face if he desires to maintain his position. Mr. Hollick again is a man of singular insight and ability, and yet his services have never before been requisitioned on behalf of a trade he understands in a way that few grasp. When we turn to Mr. Martin Pulvermann we encounter another notable type, the man who thinks in hundreds and thousands of guns whilst others are laying their plans for selling in one's and two's and three's. He is typical of the factor or agent. Hartley in America ranks as a gun dealer, but is accounted many times a millionaire. He can do for a new type of arm what the library can do for the new play. He can buy up the market supply, and so share with the producer the profits and losses of a new piece of enterprise. Mr. Pulvermann properly used can benefit our manufacturers to a considerable extent. Up to date he has been largely associated with the vending of foreign proprietary articles. The question is why he should not similarly collaborate with such of our own factories as have standardized types to offer. With a strong representation of the retail element and the ammunition and allied trades conjoined there seems to be no shadow of doubt that the Chamber of Commerce gun section intends to be representative of the entire industry and not sundry portions of it.

On the subject of propaganda it is of course difficult to speak with as much certainty. We ourselves deprecated the suggestion to seek amendment of the Gun Licence Act. If the shooters as distinguished from the gunmakers are inconvenienced thereby they are much more likely to secure redress for their grievances than the trade who regards the matter purely from a profit-making basis. The appended report on the subject shows that the whole complaint could be met by a simple easing of the restrictions in respect to carrying rifles, air-rifles, etc., in connection with target practice. The objection has, however, already been met by the proposal to include air-rifle clubs in the easements which have been granted to members of clubs affiliated to the National Rifle Association. Suitable terms of entry will doubtless be arranged, and we shall find before us another example of the principle that the rifle-club movement needs but little help from the trade beyond a cheap and plentiful supply of suitable arms. That the Chamber of Commerce can give useful help in connection with the amendment of the Pistols Bill there can be little doubt. A good case has been made out, and nothing remains but to see that it is influentially urged in the proper quarters. Whether the trade is advancing, stationary or retarding, is a very right and proper enquiry to make. The manufacturing and distributing elements must be separately considered, and as the gun trade is one where the two are peculiarly intertwined, the gathering of reliable *data* will present considerable difficulty. The main fact in the new situation is undoubtedly the recognition of influential elements which have not previously been incorporated into any existing organisation.

PROTECTIONIST POLICY.

THE rival policies of free trade, protection and retaliation while at present the sport of the politician are nevertheless a real and pressing business problem to the man of every-day affairs who is called upon to keep his capital intact and profitably employed. From the point of view of serious business the results of the past general election must rouse a variety of feeling amongst those who looked to Mr. Chamberlain's policy to enable them to attack the problems of manufacture on a more favourable basis. The overwhelming victory of the Liberal party has been ascribed to so many different causes that the net result in any given connection is hard to establish. The manufacturer obviously favours protection as a means of securing a better hold on his market and less interference with prices by the unloading of surplus foreign products. Although we are a manufacturing nation there are many among us who are sufficiently remote from the actual making of life's necessities to regard protection as a new form of tax which they will pay without receiving compensation elsewhere. Amongst these is the farmer who dislikes the idea of being taxed so long as his own industry is at the mercy of unrestricted imports. To tax food in his interests raises a scare in other directions, so that for the moment the thing which has happened seems to be for the best interests of all parties.

The past two years have been fruitful in the fact that a new idea has been mooted and discussed. Its many-sided bearings have been canvassed, and conclusions have been formulated to suit the convictions and predilections of all sides. At the finish we appear merely to have postponed the subject *sine die* as one too difficult for immediate treatment. An idea has, however, been called forth which has taken firm root in many minds. The state of our commerce has been brought to the notice of persons who never before gave it a thought, and it is just possible that the final solution will come upon us unawares. There are many things short of positive protection which may do much for our solely pressed manufacturers. The patent law and a whole host of other subjects may come to be regarded in a new light now that we know so much about the conditions which influence the incidence of orders. Trade has at last made its voice heard in a country where it received far too little attention from the governing classes. Its interests are now regarded as all-important, and there can be little doubt that the new sentiment may have many results short of an upheaval of the free trade tradition. The mere fact that manufacturers are better organised than ever before, and that the technical aspects of the problems involved are keenly appreciated by the public may do much to secure by indirect channels some of the advantages which protection might give. That the Conservative party have done more for Ireland than a Liberal government dare attempt may suggest an interesting parallel in that the new Government may assist trade in many ways that will not violate the principles which have helped to bring it into power. We feel at least that the desire for an amended Pistols Act will find more favourable consideration from the Government now in power than from its predecessors in office. In other questions less exclusively affecting the gun industry we may likewise find a readier hearing of our grievances and that the processes of reform are less irksome to fulfil.

COMPARATIVE EFFECT OF VARIOUS DETONATORS.

THE French Commission on explosive substances checked the weight and composition of various types of detonators before subjecting them to two series of comparative tests called "theoretical" and "practical," the former consisting of two distinct classes, viz., *a*, free exposure to air, and *b*, partial confinement. The "practical" tests, based upon transmitting detonation of the fulminate to explosives having a high ammonium nitrate content or to this substance pure, gave comparative results, either by the number of complete detonations of the ammonium nitrate explosives or by the length to which the explosion was transmitted in pure ammonium nitrate. These results were compared with the theoretical effects of the first-named series of tests, and the following conclusions were arrived at :—

(1) To obtain serious guarantees as to the detonating of explosives, the regularity of detonators should be checked rather than a selection made of given fulminating compositions.

(2) Testing detonators in small lead blocks with gauges of the recesses formed and calculation of the mean difference of volume appears to afford a practical determination of regularity.

Before the Commission's report was published *M.* H. Schmerber, Ingénieur des Arts et Manufactures, Paris, had nearly completed some investigations in the same direction which he also divided into two classes, theoretical and practical, while his tests bore upon three types of detonator, viz.: (1) pure fulminate of mercury, (2) mixed picric acid and fulminate, and (3) mixed chlorate of potash and fulminate. His object was, he stated in a communication to the Société de l'Industrie Minérale, not only to study the comparative effect of various detonators, but also to find simple and rapid means for testing them.

Among the theoretical tests, that which consists in producing an indentation in a lead plate by a detonator placed vertically upon it gave comparable indications for detonators of identical charges, but not for those of different charges Satisfactory results were obtained by firing a detonator placed horizontally on the lead plate and gauging the cavity produced. When the effects of fulminate detonators were known it became easy to compare them with those obtained with detonators of different composition. As regards useful effect, detonators of picric acid base appeared decidedly better than those of the other types, the pure fulminate and fulminate-chlorate giving practically equal results, while as regards regularity pure fulminate detonators occupy the first place.

The fact must not be lost sight of that what is required in practice is not so much power in a detonator as instantaneity of detonation, a rapid transmission of the explosive wave. It also appears of interest to ascertain whether the results obtained with new and dry detonators could be depended upon in those kept for some time and that might have absorbed humidity. It was found that a short exposure to a damp atmosphere but slightly increased the weight of detonators of all three types, but that with long exposure, while the increase in weight of fulminate detonators was almost negligible, that of the picrated and chlorated types became considerable. The two latter, subjected to the tests in which they had shown good results when new and dry, now gave miss-fires or imperfect detonations, but the pure fulminate detonators appeared to be scarcely impaired.

A fact which appeared to recur in nearly all the tests is that the higher the detonator charge the less difference was appreciable in the various types. A curious circumstance is the facility with which detonation was transmitted to a second cartridge, while that of the first might have been very slight. Most of the practical tests were made in the open air, where detonation is transmitted less readily than in a closed chamber, so that comparison is easier, but they were completed by a series carried out under the latter conditions, more nearly resembling actual practice. An iron pipe 40 cm. (16 in.) long representing the shot hole was let (tight) into a cast-iron block representing the explosion chamber, and the cartridge with its detonator was well tamped with sand.

The same tests as before were repeated under these conditions, with the result that complete detonations with non-sensitive powders were more easily obtained than in the open air, while at the same time being perfectly concordant with the former tests so far as the less characteristic effects permitted of ascertaining. Picrated detonators, again, showed their superiority over those of pure fulminate, while the chlorated appeared to take an intermediate place, but when damp detonators were tested in a close chamber those of pure fulminate came once more to the fore by reason of their great regularity.

Summarising the results of his investigations, *M.* Schmerber arrives at the following conclusions, which fully corroborate those of the Explosives Commission :—

(1) Detonators of fulminate composition produce effects equal if not superior to those of pure fulminate, provided they be of careful and recent manufacture.

(2) Detonators of pure fulminate afford greater guarantee than do those of fulminate composition, because the regularity of their manufacture is more certain and their inalterability greater.

THE opponents of the magazine as a feature of miniature target rifles condemn it on varied grounds, first and foremost because a magazine arm is clearly more unsafe to use amongst a crowded concourse of competitors than a single shot rifle. The second objection to the magazine is that the mechanism involved generally obstructs the view down the barrel, whereby cleaning is more difficult to conduct, and periodic inspection is liable to be neglected. The third reason embraces the general experience that magazine arms are as a rule less accurate than those of single-shot construction. The assumption is of course that with lead bullets, which are only lightly crimped into the mouth of the case, the bumps and jars incidental to passing a cartridge from the magazine to the receiver and from the receiver to the chamber may loosen or deform the bullet and so spoil the shooting, The chief argument in favour of a magazine is that it facilitates the conducting of quick firing contests, and accustoms the shooter to the existence of a reserve supply of cartridges in the rifle itself. In other words there are desirable features about a magazine and technical difficulties in designing one free from overpowering disadvantages. The first essential of a successful mechanism of this character is that it shall be capable of optional use as a single firer.

RETAIL CARTRIDGE PRICES.

THE retail trade through its representative Association has boldly attacked the question of cartridge prices by soliciting aid from the large ammunition manufacturer. Put briefly, the proposal amounts to applying to all trade in cartridges the price restrictions which Messrs. Kynoch enforced with such signal success against a certain provincial firm. Messrs. Kynoch insisted against this firm's strongest objections that they should at least enjoy a living profit on the goods they sold. It is not, of course, the cutting dealer's policy to run his business on philanthropic lines, but merely to make two people's profits by doing four people's business. Given sufficient start and the genius for bold advertising, this policy frequently succeeds far beyond average expectations. While success may be attained by the individual, the trade in the aggregate suffers a noteworthy loss of revenue, in that an all-round lowering of prices occurs, and the total profits are diminished. The risks of gunmaking are considerable, and the skill and special knowledge necessary for such a business are greater than those in most other callings of life. There are special fire risks and dangers to be encountered, and the gunmaker himself frequently occupies semi-professional relations with his customers in respect to the selection and recommendation of loads. All these things should be taken into account in considering what is a fair basis of commission or profit to allow the gunmaker as a distributor of cartridges. The question is in no way complicated by the relation which may exist between the loader and the vendor of factory cartridges. Most gunmakers find it convenient to combine the two methods, and so long as the sportsman is properly served the precise method of supply involved is unimportant. However, speaking from a general knowledge of the business, we should be inclined to regard the gunmaker as fully earning a generous ratio of profit on a turnover which is necessarily concentrated over a few months in the year.

When nitro powders were first introduced, and the gunmaker was subjected to much greater restrictions than at present in respect to the storage of nitro compounds, it was found impossible to stock the many new explosives which were placed on the market. The gunmaker who made a point of loading as large a proportion of his turnover of cartridges as possible naturally objected to buying the newer nitros in ready-loaded condition. The manufacturers of new powder were then obliged in self-defence to seek other channels of distribution. The result was that many ironmongers, dry-salters and other general store dealers were invited to distribute a new class of goods bearing a substantial profit, and having the advantage of bringing a new kind of customer on the premises. Having once entered the business, and being free from many of the establishment expenses of the gunmaker, the new element in the trade introduced a policy of price cutting, in which the gunmaker was forced to follow suit. To-day we find that cartridge orders bear a gross profit which severely curtails the income of the gunmaker. The established position of the wholesale firms in the business, and the regularity of the turnover, make the case essentially one for friendly agreement between the more influential sections of the trade. During the past two years several notices of enhanced prices have been issued by the manufacturers, and a further crop of these missives has been issued very recently. The general lesson they convey is not only that prices of materials have risen, but that the wholesale firms are sufficiently sure of their position to know that their demands cannot be upset by the introduction of a flow of foreign materials. In England the specialisation of the sporting cartridges has been carried to such an extreme distance that competition from abroad is very little to be feared.

The sportsman is so critical of the behaviour of his cartridge that he can detect the smallest interference with its proper regulation and working. The maker of the powder adjusts moisture, pressure, and in fact the general activity of his powder within the nicest limits, and the gunmaker builds a weapon regulated in weight to the last ounce consistent with the comfort of the user. Any irregularity is bound to upset the nice adjustment so obtained; and it stands to reason that the English cap and the English powder produce a combination of result which can hardly be imitated with material made up by those having a less intimate knowledge of our conditions. This is how the position of affairs strikes us, and our view as to the cause, whether right or wrong, at least fits in with the observed conditions. The sporting cartridge trade may accordingly be regarded as an industry protected by natural conditions, in just the same way that the milk trade may disregard foreign competition. The value of the protection above outlined might only amount to a ten per cent. margin. Consequently any proposals for regulating prices must necessarily take account of the fact that every increase develops the temptation towards attacks on our preserves. There is, however, no suggestion that our gunmakers demand unduly high payment for their services to the shooting fraternity. They ask merely for a living wage, and if they agree in the aggregate with the principles of a price maintenance arrangement, that arrangement is likely to go through, and secure to them a margin of profit which, low as it may seem, has never previously been a certainty.

An additional benefit which might follow the introduction of minimum price limits would be the possibility of establishing a revival of cartridge loading by retail gunmakers. It is not of course to be inferred that the loading of cartridges by our London and provincial gunmakers has ceased. There are, however, many signs that the continually decreasing margin which has existed between the price of components and the wholesale price of cartridges has rendered it less and less tempting to engage in the anxious details of cartridge filling. Any considerable revival of this aspect of the gunmaker's business must undoubtedly be accompanied by a definite change of attitude in respect to the question of factory loading. There is no essential difference of principle between the methods adopted by the gunmaker and at the factory, and it is merely propagating a fallacy to suggest that such a distinction exists. In our opinion it is entirely unnecessary for the gunmaker to represent that his cartridges possess some peculiar virtue, to which the factory article cannot aspire. He would in fact occupy a more tenable position, and one more likely to promote his own interests if he contented himself with showing that every possible precaution has been taken to ensure the greatest exactitude of process and the highest quality of material. Those gunmakers whose cartridges enjoy a well-deserved reputation for success in the field are characterised by all the virtues of sound workmanship, and are markedly deficient in evidences of striving after individuality and pecularity of detail.

ROUND THE TRADE.

Our patent columns give evidence that Mr. John Robertson has been making experiments with an improved pattern of his single-trigger mechanism.

The firm of Curtis's & Harvey, Ld., have recently erected at their Cliffe factory the necessary magazines, buildings, and other facilities for loading Government ammunition under arrangement with the Coventry Ordnance Works, Ld.

Those gunmakers who contemplate joining the gun section of the Chamber of Commerce should lose no time in writing to the Secretary at Oxford Court, Cannon Street, for an application form to be used for expressing their wishes.

The Rexer automatic gun was fired in the presence of Col. Hadden at Runemede recently. It should be understood that as Director of Artillery, the gallant Colonel has more to say on small-arms questions than is supposed by those who assume that the Small-Arms Committee is the dominant authority.

According to reports the new "D" bullet of the French army is a cigar-shaped cylinder of bronze cased with nickel. The idea of course conveyed by this description is that the factor of air resistance is diminished by giving the bullet a taper at the rear following the general principle of the lines of a boat.

The Schultze Gunpowder Co., Ld., sent out a circular about the middle of last month notifying the trade of an increase in the prices of sporting cartridges. With the exception of the "Yeoman" cartridge the gross prices will remain as before, and the higher prices will take effect by a revision of discounts.

A paragraph in one of the newspapers informs us that the War Office will shortly have introduced to their notice a new rifle which is said to be superior to any other military weapon of its kind in existence. It can be fired five times in two-and-a-half seconds, which gives an infinitely faster rate than is possessed by the best known gun at the present time. The writer of the paragraph seems to possess as hazy an idea of the workings of the War Office as of the proper use of the word "infinite."

According to the *Times* Engineering supplement, the Coventry Ordance Works are contemplating the establishment of an artillery range on the foreshore of the Wash between Freiston and Gibraltar Point. A firing platform will be enclosed by a wire fence on the foreshore at Freiston, a road constructed between the platform and the shore, and an existing creek will be trained from low water mark to the firing platform. The range will be about 12 miles (20,000 yards), and the creek is to be straightened and deepened to allow of the passage of barges carrying the guns, which will be delivered and shipped at Boston Dock to be tested.

We omitted to make mention in our past issue of the receipt of several calendars for the present year, especially notable amongst these is the monthly desk calendar sent out by Messrs. William Bennett, Sons & Company, of Camborne, Cornwall. The Curtis's & Harvey pocket calender and diary is almost too well known to need special description, since it has already achieved the position of an intimate confidant to many of our readers. The Loewe week-at-a-glance diary is characterised by great ingenuity, in that the tearing off of the slip for each completed day exposes a corresponding slip for the same day in the following week. The sheets are alternately coloured so as to indicate at once where the break occurs.

According to a recent *Army List*, the membership of the Small Arms Committee now consists of—President: Col. C. C. Monro, *P.S.C.*, Commandant, School of Musketry, Hythe; Ex-Officio Members: Lieut.-Col. F. F. Minchin, *P.A.C.*, Chief Inspector, Woolwich, Col. J. D. Hopton, Inspector of Small Arms; Naval Member: Lieut.-Col. L. T. Pease, R.M.A.; Military Members: Major M. L. MacEwan, 16th Lancers *(for Cavalry)*, Brevet-Major E. F. O. Gascoigne, D.S.O., Grenadier Guards *(for Infantry)*, Major Hon. T. F. Fremantle, 1st Bucks V.R.C. *(for Auxiliary Forces)*; Secretary: Capt. S. W. Douglas, R.A., *P.A.C.* In other words, the new Committee is very much the same as the old one, barring one or two slight changes, and the omission of certain officials who were previously members.

Mr. C. B. Fry has expressed some very interesting opinions on rifle shooting which bear out several of the views put forward by a correspondent in our last issue. He complains of the tameness of the sport as at present practised, and he gives it as his opinion that the root of the present unpopularity of rifle shooting lies in its dullness. He asks whether footballers would desert their favourite pastime to spend the afternoon prone upon the ground blazing away at a lifeless target. There is much that is true in what our fashionable athlete has to say, but one would not doubt after reading his remarks that he speaks with more sympathy for footfall than for shooting. Even if the target is lifeless the wind and the nerves certainly fail to follow suit. Rifle shooting undoubtedly possesses a fascination which appeals to many kinds of mind, but as everyone is not constituted alike it must be recognised that there exists a vast amount of commonsense in his demand for a greater variety of moving targets and careful organisation of team and other contests where the element of personal antagonism is brought more prominently to the front.

Messrs. Kynoch have issued the following circular to the trade under date January 6, concerning the question of cartridge prices:—"We have been asked by the Gunmakers' Association whether we will adopt Price Maintenance in conjunction with the other ammunition and gunpowder manufacturers. It is proposed that minimum prices be fixed for the various qualities of cartridges, as—All Brass, Half Brass, Waterproof, Gastight, C.B., and Unlined Cases, and that the manufacturers only sell cartridges on condition that they are not retailed below these minimum prices; and cases on the condition that when loaded they shall not be retailed below the minimum prices. The powder manufacturers also will sell their powder on the condition that when loaded into cartridges the latter shall be retailed at not less than these minimum prices. For our part, we consider that Price Maintenance is the fairest and best method of trading in cartridges, and if the opinion of our customers is largely in favour of it we shall be very pleased to carry it out. We are, therefore, writing to all our customers for their opinion, and, if it is sufficiently unanimous in favour of it, a further meeting of manufacturers and retailers will be held, at which the various prices will be agreed upon. After this the manufacturers will see to the carrying out of the proposal. Will you, therefore, please reply to us on the enclosed post card, saying whether or no you are in favour of Price Maintenance?"

The following extract from a note in the *Daily Report* contains an interesting reference to the development of the Morris Tube Company:—"The original business was commenced in a small way in 1882, and in 1887 it was taken over by a company with a capital of £100,000. This was decreased in 1888 to £30,000 by a return of £40,000 in cash to the shareholders, and by the surrender to the company of £30,000 in ordinary shares in exchange for 250 founders' shares. This was a perfectly equitable arrangement, and from that time the enterprise prospered and grew steadily, the dividends for the next twelve years averaging £6 6s. 8d. per annum. The South African war gave a further fillip to the business, and it became necessary in 1900 to extend the works, and it was decided to purchase a site in a convenient place and build and equip an entirely new and up-to-date factory. A freehold site of about thirteen acres was bought at Dagenham, in Essex, buildings erected, and the best and most modern machinery and appliances, driven by electric power, fitted up. To enable the company to pay for the cost of the site, buildings and machinery, the capital was re-arranged, and now consists of £50,000 in £1 shares and £15,000 of 5 per cent. debenture stock, the founders' shares having been cancelled. On the completion of the plant and machinery, the company, after putting a large sum to reserve, paid a dividend of 12½ per cent in 1902. This was succeeded in the following years by regular distributions of 10 per cent., and the shares now carry a six months dividend at that rate, which is usually paid early in April."

SUBMARINE EXPLOSIONS.

By C. E. Bichel.
(Translated from "Marine Rundschau" Nov., 1905, by Axel Larsen).

When a solid explosive is converted into its products of decomposition—entirely or partially gaseous — the gases formed cool more or less quickly. according to the character of the material surrounding the charge.

It is known that an explosion comprises two distinct effects, viz., percussion and pressure, the former chiefly depending on the product of the rate of detonation and the amount of

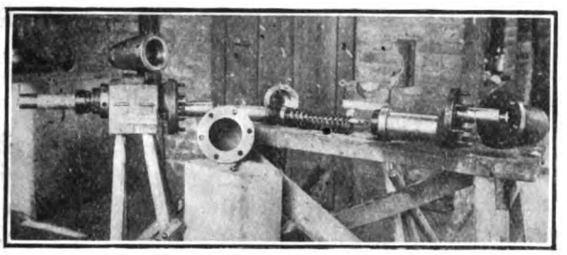


Fig. 1.—Dr. Blochmann's Dynamometer.

gases generated, whilst the latter varies with the volume of the gases, the temperature of explosion and the density of charging. The percussive force is not influenced by the material surrounding the charge, but the pressure is effected thereby through reduction of temperature and consequent checking of gaseous expansion. In conjunction with the resistivity, which is not considered here, however, this heat-absorbing influence of the surrounding material on the deve-

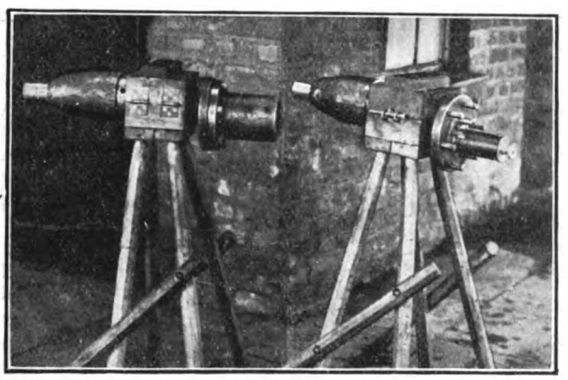


Fig. 2.—Dr. Blochmann's Dynamometer.

lopment of the gases has hitherto stood in the way of correctly gauging their effect, and it furnishes one of the reasons why universal power gauges have proved failures.

In Bichel's pressure gauge (described in "New Methods of Testing Explosives" by C. E. Bichel. Charles Griffin & Co., Ld., London, 1905), the test charge is exploded in vacuo and the surface-influence of the firing chamber is eliminated by so varying the area of the latter as to enable an "ideal" (or "theoretical zero") pressure being arrived at. This apparatus is quite suitable for measuring comparative pressures of differing explosives, but if similar comparisons are required in respect of explosives fired under water, a modified contrivance must be resorted to.

An apparatus for measuring explosions under water was constructed by Dr. Rudolph Blochmann, of Kiel, and described by him in the second number of the *Marine Rundschau*, 1898. With his assistance the writer has recently had a similar submarine power gauge constructed and a large number of experiments carried out therewith. Some details of construction may be gathered from the accompanying photographs (Figs. 1 and 2). For further particulars the reader is referred to Dr. Blochmann's treatise itself.

The diagram obtained with Dr. Blochmann's dynamometer presents two distinct maxima, one of which he ascribes to molecular undulation, the other to mass-movement of the water. (Fig. 3). During a series of experiments at Schlebusch the maxima were mechanically recorded as previously noted by Dr. Blochmann, and led to closer study of the whole matter.

It does not appear to have occurred to Dr. Blochmann to trace the phenomenon to the nature of the explosion itself; at least no such inference is drawn in his paper. But if the theory of distinguishing between percussion and pressure is applied to the diagrammatic records, it will at once be seen that what Dr. Blochmann calls "undulation" represents the percussive force or *vis viva* of the explosion, whilst the second maximum coincides with the pressure.

Fig. 3.—Diagram from Dynamometer.

The percussive force, being a function of the rate of detonation and the molecular projection, acts during such an infinitesimal space of time on the surrounding water that the latter, without being set in motion, communicates the shock directly to the piston of the dynamometer, and the first deflection is thus registered. Immediately afterwards—at a distance of one metre from the exploding charge in about 1-20th of a second—the second maximum is recorded by the gas pressure meanwhile developed. The gases form very rapidly at the outset, but soon cool and condense through contact with the water mass and ultimately escape in bubbles towards the surface, throwing up large aqueous volumes.

It is not surprising that the general mass of the water is incapable of yielding to an impulse which is transmitted at a rate of some four to five miles per second. The effect of the percussive force is therefore felt as a molecular vibration, as observed by Dr. Blochmann. The formation of the gases proceeds at the rate of detonation and, initially, within the volume occupied by the explosive charge, but this volume is increased at the same rate as the water is forced back by the gas pressure. The expansion of the gases takes a certain time, likewise their cooling and escape, and these stages of action are doubtless presented by the second maximum in the diagram.

If we compare the diagrams obtained under water with those obtained in the vacuum firing-chamber of Bichel's

pressure-gauge we find that the latter (Figs. 4 and 5) show undulations (due to the tension of the spring) which gradually grow shallower until they ultimately merge into the straight line which indicates the final pressure of the cooled gases. The initial ascending curve represents the percussive force, whilst the tapering sinusoid illustrates the gradually decreasing gas-pressure. In this case, the explosion occurring in vacuo, the percussion-line merges into the pressure-line

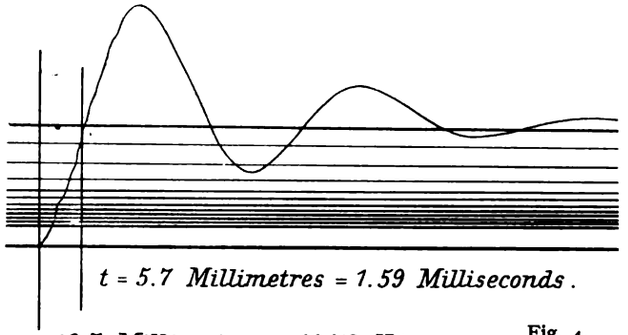


Fig. 4.

without interval. In water, on the contrary, the two effects are very distinctly defined, as the explosion takes place in a medium possessing comparatively high inertia. The water resists the instantaneous impulse of the percussive force, but yields to the less rapid action of pressures due to gas-expansion and contraction. Even on the shore, close to the place of firing, the two phases of explosions under water may be distinctly felt as separate concussions. If it is true that the

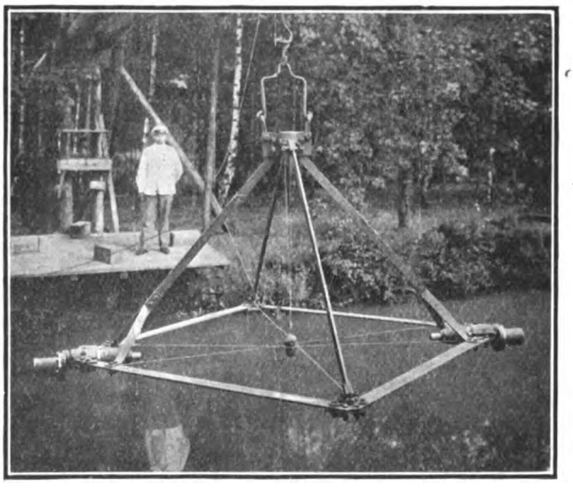


Fig. 6.—FRAMEWORK POISED OVER WATER.

heights of the diagram-curves correspond to the percussive force and pressure respectively, then the first maxima must of necessity vary with the different rates of detonation, and the second maxima with the different pressures. Two explosives with different rates of detonation were therefore used by way of comparison, equal weights and a No. 8 detonator being employed in each case. Two dynamometers, diagonally facing each other, and having springs of different tension, were used for each experiment. The distance from the centre of gravity of the charge to the piston of each dynamometer was one metre. Fig. 6 shows the position of the charge and the two dynamometers with frame ready for submerging, and in Table 1 the ordinates of the diagram-curves with corresponding rates of detonation will be found.

The ordinates of the first maxima are not, of course, directly proportional to the rates of detonation. Direct proportion exists only in their relation to the percussive force-values, which latter depend both upon the square of the rate of detonation and the mass of decomposition products.

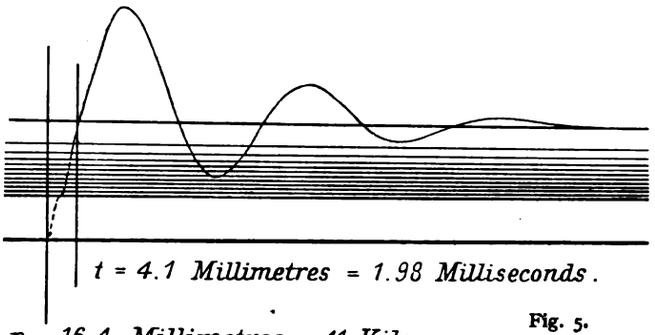


Fig. 5.

The second curve maxima, however, show direct proportion.

That the theory of two separate and different phases of explosion should have been confirmed by subaqueous shot-firing is of no little importance for determining the practical value of explosives in general and of such explosives in particular as are used for torpedoes, mines, and shells. In the following the question will only be dealt with as far as their latter application is concerned.

TABLE I.

Explosive.	Weight of Charge.	Gravimetric density.	Rate of Detonation.	Ordinates of the first Maximum.	Pressure by constant volume.	Ordinates of the second Maximum.
	Grammes.		Metres per sec.	mm.	Kilogr. per sq. cm.	mm.
Trinitrotoluol— $C_6H_2(NO_2)_3CH_3$ ..	500	1·55	7,618	28·0	12,385	29·5
Dry Guncotton— $C_{12}H_{15}(NO_2)_{15}O_{10}$	500	1·25	6,383	27·5	11,127	30·0
Ammon-Carbonite— 82% Ammonium nitrate 10% Potassium nitrate 4% Flour .. .. 4% Gelatinised Nitro-Glyc. ..	500	1·19	3,094	17·0	8,345	19·3

As already mentioned, the velocity with which an explosive flashes into gas, when detonated, is enormous and, in the case of some of the most brisant species, attains a rate of some 9,000 metres per second. In previous publications* it has been shown that the effect of this kinetic energy may be illustrated by firing the charges placed on lead-discs which show more or less deep cavities according to the different rates of detonation. A number of similar experiments were carried out under water. The charges used were guncotton

* "Glückauf," No. 15, 1905, "Sprengwirkungen."—"New Methods of Testing Explosives," page 61.

and trinitrotoluol, each occupying a volume of 450 cubic centimetres. The cartridges were placed in an upright position in the centre of 20 centimetre steel-plates (Figs. 7, 8 and 9). No attention was paid to weight, as, in the case of shells, mines, and torpedoes, the weight of the bursting charge

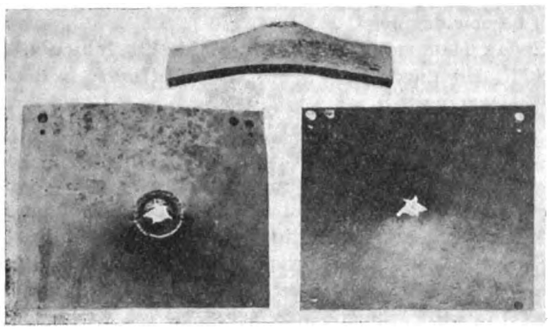


Fig. 7.—EFFECT OF COMPRESSED TRINITROTOLUOL.

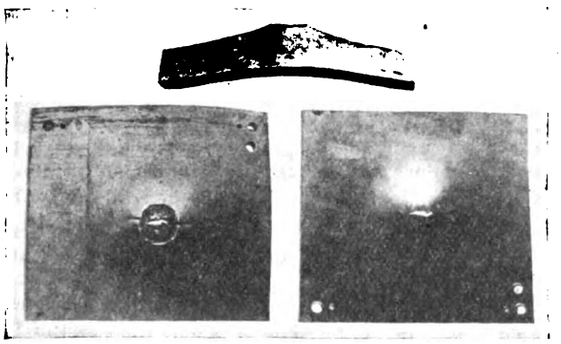


Fig. 8.—EFFECT OF WET GUNCOTTON.

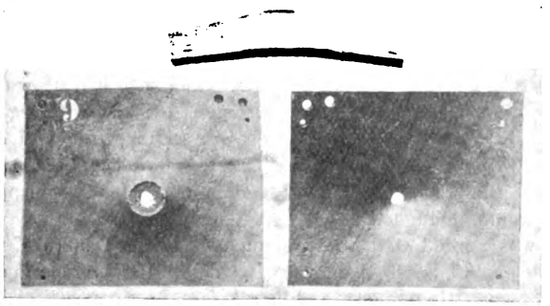


Fig. 9.—EFFECT OF DRY GUNCOTTON.

is of less consequence than the maximum quantity which may be packed into a given space. Higher density of charging means increase of molecular mass, and, the velocity of detonation remaining unimpaired, consequently stronger impact against the surrounding walls—in this case, water.

Trinitrotoluol can be compressed to a density of 1·7. A volume of 450 cubic centimetres will thus hold a charge weighing 765 grammes, as against 540 grammes of guncotton having a density of 1·2. To this the superior effect of the former is partly due. Owing to the involved proportion existing between given distances from the centre of gravity of the charge, and the corresponding explosive effect, it is of course essential that the shape of the receptacle holding the charge should remain the same.

Bearing in mind that a drop in the rate of detonation means a less destructive effect, and in view of the fact, confirmed by the dynamometer records, that the pressure is developed *after* the percussive force, it is obviously to the latter action, the *vis viva*, of an explosive rather than to the concomitant pressure that its destructive properties are mainly attributable. Correct estimates in this respect may therefore be formed by comparing the first maxima recorded in the dynamometer diagrams, that explosive which shows the largest ordinates of the first maximum being the most suitable for purposes of contact-demolition. In shells the higher density of any one of a given number of explosives, otherwise of equal strength, results in the production of a larger number of efficient fragments, those of lesser density giving larger and fewer pieces.

(To be concluded.)

CHAMBER OF COMMERCE.

GUN TRADE SECTION.

Meeting held on Wednesday, 24th January, 1906, at 2.30 p.m. Present: Messrs. Edgar Harrison, Martin Pulvermann, H. Blanch, Harry Lane, S. R. Hollick, G. H. Williams, E. H. Stone, J. S. Salter, R. Green and others.

Mr. Edgar Harrison was requested to take the chair during the reading of the minutes of the meeting of 29th November, 1905. Letters of regret at inability to attend were read from several houses in the trade, each of which expressed sympathy with the proposal to form a Gun Trade Section.

Election of Chairman.—Mr. Hollick proposed and Mr. Pulvermann seconded, that Mr. Edgar Harrison, of the firm of Messrs. Cogswell & Harrison, Ld., be the first chairman of the Section, and take office for the ensuing year.

Election of Deputy Chairman.—Mr. Blanch said that as it was the desire of the new Section to be representative of all branches of the trade, he thought the deputy chairman should be nominated by, and represent one of the large export or import houses in the trade. He therefore moved "That Mr. Martin Pulvermann be elected deputy chairman of the Section for the ensuing year." This was seconded by Mr. Hollick and carried.

Report of Committee.—The chairman, on behalf of the Special Committee appointed at the General Meeting, held on the 29th November, presented the following report, which he moved should be received and adopted. This was seconded by Mr. Martin Pulvermann and carried, after being read to the meeting by the secretary.

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 a meeting held on the 24th January, 1906, at 2.30 p.m.

The terms of the reference to your Committee were as follow:—

"To investigate present circumstances and to collect facts to enable an amendment of the Gun Licence Act to be

carried with a view to facilitate the employment of rifles for shooting practice and military purposes."

Your committee have held several meetings, and in regard to the Gun Licenses Act of 1870, recommend the addition of the words printed in italics to Clause 7, Gun Licenses Act, 1870.

7. Every person who shall use or carry a gun elsewhere than in a dwelling-house or the curtilage thereof without having in force a licence duly granted to him under this Act shall forfeit the sum of ten pounds.

Provided always, that the said penalty shall not be incurred by the following persons; namely,

(1.) By any person in the naval, military or volunteer service, etc.

"*By any person carrying a rifle or air gun to or from any place for the purpose of target practice or whilst engaged practising at a target.*"

(2.) By any person having in force a licence, etc.

(3.) By any person carrying a gun belonging to a person having in force a licence, etc.

(4.) By the occupier of any lands using or carrying a gun for the purpose only of scaring birds, etc.

(5.) By any gunsmith, or his servant, etc.

(6.) By any person carrying a gun in the ordinary course of his trade or businesses as a common carrier.

Your Committee, regarding this matter as one of national importance, recommend that an influential Deputation be formed to wait on the Chancellor of the Exchequer to place before him the recommendations of the Section.

Although not coming within the terms of the reference, your Committee considered it their duty to take steps to carry out the Resolution passed at the General Meeting in regard to the formation of the Section, and they therefore drafted a letter to the houses in the trade informing them of the formation of the Section and requesting their support thereto. Your Committee are pleased to report that in response to this letter twenty-eight firms have applied for membership and the number is still increasing.

With regard to the future action of the Section, your Committee strongly recommend that action in the first instance be confined to the matters hereinafter indicated, and that after these have been dealt with the Section deal with the less important matters which affect the Trade:—

(1.) The amendment of the law in regard to the carrying of rifles for target practice.

(2.) To ascertain if the trade is in an advancing, stationary, or declining position. If stationary or declining, to inquire into the reason therefore and to consider what steps can be taken to generally improve these conditions.

(3.) The Pistols Act.—To obtain an amendment of this Act, and if possible to delete the vexatious clauses thereof, seeking the co-operation of other bodies for that purpose.

In presenting this report your Committee would urge each member of the Section to use their influence in obtaining new members, as it is desired to form a strong central body, which can collect the views of the trade in the various parts of the country and with one voice take any necessary action, parliamentary or otherwise, which, backed up by the undoubted influence of the London Chamber of Commerce, is most likely to meet with success.

In conclusion your Committee recommend that the Ammunition Trade should be included in the Section, and for this purpose suggest that the title of the Section should be altered to that of "The Gun and Ammunition Trade Section of the London Chamber of Commerce."

Your Committee having completed its labours recommend that it be now dissolved.

EDGAR HARRISON, *Chairman*. M. PULVERMANN.
S. R. HOLLICK. M. HIRST.
W. DARLOW.

The Chairman then said that the wish of the Section was that the members would now consider the report *seriatim*. With regard to the Gun Licenses Act, 1870, it was, after some discussion, agreed that a deputation be formed to wait on the Chancellor of the Exchequer to place before him the views of the Section in regard to the additional clause which they proposed should be included in the Act. It was agreed that subject to their willingness to serve Messrs. Pulvermann, Blanch and Gamage should form the Committee to organise the deputation, with power to add to their number, and with instructions to seek the co-operation of the Gun Trade Section of the Birmingham Chamber of Commerce and other bodies interested. It was decided that the first meeting of this committtee should take place on the 31st instant, at 2.30 p.m.

General Committee of the Section.—The Chairman said that he had been advised that it was the usual mode of procedure for Sections to appoint a General Committee to deal with matters affecting the Section in a general way. This Committee would, if necessary, after consideration of such matters, report to the Section, who would then decide at a general meeting as to the action to be taken.

After some discussion it was agreed to invite the following to become members of the General Committee of the Section:—Messrs. Blanch, Hollick, Ramsbottom and a representative of Messrs. Eley Bros., and the Schultze Gunpowder Company.

The Acting Secretary reported that it was understood that the Chairman and Deputy Chairman of Trade Sections were *ex-officio* members of all Committees of such Sections.

Future Action of the Section.—The meeting, after discussion, agreed to refer the amendment of the law in regard to the Pistols Act and the enquiry into the position of the trade to the General Committee thus appointed, power being given to the Committee to add to its number for the purpose of obtaining evidence.

It was agreed that the first meeting of the General Committee should be held on the 31st inst, after the meeting of the Special Committee appointed for the purposes of the Deputation.

New Members.—Forms of application for membership were received and passed by the Section.

A vote of thanks to the Chairman terminated the meeting.

THE Colt Company have announced the issue at an early date of an automatic pistol on the Browning model, bored and fitted for a ·45 calibre cartridge. A very ingenious departure has been adopted in the design of the cartridge, the mouth of the case being swelled to provide a seat for the bullet, so obviating the disadvantages which arise from holding the bullet in place by an excess of friction.

THE BALLISTIC COEFFICIENT.

By CAPT. J. H. HARDCASTLE, R.A.

ABOUT fifteen years ago, when the introduction of the small bore rifle was under discussion by the military authorities of this country, a young officer was sent for instructional purposes to witness some experiments with a modified Martini-Henry rifle. During the experiments the inventor casually remarked on its excellencies as a sporting rifle, because the greatest height of its trajectory at a hundred yards was not more than an inch. "Really," replied the young officer, "that is very good, so you have been able to obtain a muzzle velocity of two thousand feet a second from this pattern weapon?" The inventor's reply was not recorded, but it is recorded that he stated subsequently that this young officer was one of the most brilliant mathematicians that he had ever come across. To complete the story it is only necessary to relate that this young officer's tutor had primed him with the answer, and told him to lure the inventor on to making the statement.

In so short a range as 100 yards it is safe within limits to neglect the ballistic coefficient and to work as though there was no air resistance. In that case the greatest height of the trajectory measured in feet is equal to four times the square of the time of flight measured in seconds. By a rapid mental calculation the time of flight over the named distance can be estimated and a second piece of mental arithmetic gives the velocity at once. In the general run of work, however, it is impossible to neglect the ballistic coefficient, and it is most necessary to have a clear conception of what it is and why it varies. The *Journal of the United States Artillery*, dated September-October, 1905, is only just published, owing to press of other work in the printing house. It contains a thoughtful article by Captain Alston Hamilton, of the Artillery Corps, on the subject of this article and of the same title. It also contains two controversial articles, one by Capt. Hamilton and one by Professor Alger, bearing on the same matter, all three of which can be commended to the studious for careful perusal.

To the general public constant use of mathematical symbols acts as an efficient danger board, and yet there are many of our readers who would like to be informed of the general drift of the discussion, and would like to be able to form a clear picture on their minds of the real meaning and use of that high-sounding thing, the ballistic coefficient. If it is desired to get at the very heart of the matter, it must be confessed that no mathematician, however eminent, can put forward a complete explanation of all its peculiarities. But if it is desired to use it intelligently and not to probe deeply into its profundities, its meaning and use can be explained without presupposing any knowledge, except that of arithmetic, by the employment of conversational terms to the exclusion of technical and mathematical methods of speech.

The tables we use to discover where and when, and at what slope and speed a certain projectile will come down to the earth again when fired at a certain velocity at a known angle of elevation, are just on a par with a draper's ready reckoner table, whence we can find how much so many things cost at the rate of so many pence and farthings apiece. One is instructed to go sideways, so far on one line and down so much on another, and where the two lines meet there is the answer, which is promptly filled into the account without any further questions being asked. The comparison is exact when we are working a ballistic sum for an unit projectile, the unit of the ready reckoner table, being one farthing. If we had to use the ready reckoner for foreign moneys a small sum would have to be done to find the proportion between a centime and a farthing, and then our ready reckoner could be used for French moneys by a simple multiplication or division sum. Unfortunately for those who have to earn their living by calculating range tables, we are not always using unit projectiles, and so we always have to employ a multiplier which we call the ballistic coefficient, and it is a number which varies from ten to a thousandth part of ten. Just like foreign money, its exchange value is never constant, and the causes of its variation are quite as obscure. We know certain reasons and methods of its fluctuation, and can safely prophesy from them the effects, just as a banker can tell the effects of a war scare on Consols. But there are many fluctuations of the money market which cannot be reduced to any law at present, and the ballistic coefficient is liable to as many changes, and for the same reason that our knowledge of the laws is not perfect and complete.

In consequence of our ignorance of the precise laws governing the resistance of the air, no mathematician can put forward a rigid demonstration that if such and such a projectile is projected into still or moving air of such and such temperature and pressure and humidity, at a given angle and velocity, it must fall on some defined square foot of the country side. The problem is soluble by pen and ink, not forgetting the addition of the brain of a first-class mathematician, under certain circumstances and a few of them are tabulated. (1) The angle of projection must be known precisely, that is the "jump" or "flip" must be ascertained as well as the quadrant elevation, which latter can be put on as exactly as may be desired. From the most careful experiments I have made and heard of, this error may amount to several minutes of angle. (2) The weight of every cubic foot of air through which the projectile is to pass must be known. Except in flat trajectories this is never known to 1 per cent. (3) The velocity of movement of air (called wind) encountered by the shot must be known. A Dines' anemometer will record this at the level of the instrument, but the velocity of the wind increases as the height above the earth increases. A rough correction can be made by multiplying the speed of the wind by the fourth root of the time flight, and this correction will be near enough to the results obtained by observations on the Eiffel Tower and at Blue Hill Observatory. (4) The weight and diameter of the projectile must be known This is always known. (5) The resistance of the air of a shot of known external dimensions, moving at a known velocity must be known. This is not known, and I will refer to this matter later on.

Capt. Hamilton refers in his valuable article to the headings (2), (3), (4) and (5), and his accompanying tables refer in great detail to (2), and his controversy with Prof. Alger refers entirely to (2). It appears to me that this is only a pen and ink battle. No one knows, according to Capt. Hamilton, what law connects the height above the earth with the weight of a cubic foot of the air there present. In the absence of precise and extended experiments, one rational law is as good as another. Newton thought that the resistance of the air varied as the square of the velocity. Experiment has shown

him to be in error. Consequently Capt. Hamilton's tables II. and III. have only an academic interest, although they represent many hours of hard work. Capt. Hamilton in Table I. gives a table to correct for what he considers to be the erroneous assumption that in high angle fire the barometric pressure is to be taken as that obtaining at two-thirds of the greatest height reached. This table also has a purely academic interest. His table V. affects to give a mathematically correct solution to the problem of the effect of a head or rear wind on a projectile, by means of a percentage correction of the ballistic coefficient. If the little sums are worked out for the ·303 rifle at 500 yards and 2,000 yards range the results are obviously incorrect. The effect of wind on heavy ordnance is so small that any small correction looks reasonably true. By Capt. Hamilton's method of correcting for a ten-mile wind the ·303 rifle at 300 yards requires about one per cent. change of the ballistic coefficient, and two per cent. at 2,000 yards. The effect of these corrections works out as one yard and 75 yards of range respectively. By Didion's theory the effect of such a wind is three yards and 24 yards respectively. The 500 yards correction in either case is incapable of experimental proof. At 2,000 yards the time of flight may be as much as eight seconds, during which time the wind will have travelled 120 feet or 40 yards. How such a wind is to effect the range by twice its own travel is a mystery which I will not attempt to elucidate, beyond suggesting that Capt. Hamilton is making an error. Some months ago I occupied several columns over this matter, so I will not further labour the question.

His tables VI. and VII. are of no particular interest, but his table IV. is little short of a godsend. It is Siacci's table of "β" worked out to every hundred yards and to three places of decimals. This table is founded on the results of complex mathematical work, being derived from laborious checking of the results of elaborate and quick methods of calculation of trajectories. The table was published in England by Major Hickman, R.A., in the Proc. of the Royal Artillery Institute, volume 27, and is not used as often as it should be. Siacci found that in calculating a very long trajectory he had to break it up into a number of arcs and calculate and sum the results of each arc. To save other people all this trouble he practically calculated a set of trajectories by his exact method covering every possible ballistic coefficient, angle and velocity, and then calculated them over again by the ordinary method and naturally got a different result. His table of "β" gives the result of his comparisons and allows us to perform the calculation of any trajectory by one process, provided we put in his value of "β" into the ballistic coefficient. In fact to quote the historic case of the Jubilee shot calculated in some twenty different arcs in the *Text Book of Gunnery*, Siacci hopes to enable us to calculate it now in one arc, and the table published by Capt. Hamilton helps us to apply Siacci's method with a minimum of labour.

I said I would return to the consideration of our knowledge of the resistance of the air, and show that we are still very ignorant of the matter. At the foot of page 103 Capt. Hamilton gives a formula which he states is based on recent experiments, but he does not name the experimenter, and in spite of diligent search I know of no published experiments, except the classical ones of Bashforth, and the Krupp experiments subsequently carried out to observe the effect of altering the curvature of the point of the projectile for an ogive of 1¼ diameter to an ogive of 2 diameter. On the latter experiments Ingall's tables are founded. I have made it my business to carry out a critical comparison of the two sets of tables, and I can find no constant value for the coefficient of shape, neither can I find the slightest evidence, theoretical or practical, why such a constant should exist. The law of the resistance of the air appears to be most complicated, and to vary with every conceivable variable of the projectile, its length, diameter, spin, radius of gyration, shape of base, nature of driving band, shape of head, steadiness and so on throughout the whole category. The whole experimental evidence that has yet been published consists of the records of some three hundred rounds of Bashforth's with a 1¼ diameter ogive and some hundred or so rounds by Krupp of 2 diameter ogive and perhaps another hundred by one of the two with odd shaped projectiles, such as flat and hemispherical and spherical projectiles. In our ignorance of the effect of variation from standard shape we have to use a coefficient of reduction, and this coeffiicent is sufficiently described by Major Hickman as "coefficient to correct for erroneous assumptions."

REVIEW.

Les Explosifs de Sureté au Siége d'expérience de Framoires, by V. Watteyne and S. Stassart. Published by L. Narcisse, Brussels, 1905.

IN our issue of last month we referred under the title of *Safety Explosives in Belgium* to an article in the *Annales des Mines de Belgique* on the testing of safety explosives at the Frameries Station. This article has been reprinted under the title at the head of this notice. To all those connected with the manufacture and use of safety explosives this book will prove of more than ordinary interest. The authors deal with risks and accidents which have occurred not only with explosives but also lamps, and they say that although the Belgium mines are the most dangerous in use, nevertheless during the period of 1901-1904 the percentage mortality due to accidents from explosions is less in Belgium than in any other country. This alone should be a sufficient recommendation for this book which is said to contain a description of Belgian methods.

The book contains tables of composition, "charge limite," and other details of various explosives, which will no doubt be useful, because the "charge limite" gives a practical value to the safety of an explosive, and it is not in direct relation with the theoretical temperature of combustion. The latter does not appear to be the only factor of safety. All safe explosives must give a low calculated value for temperature, but below an apparent limit indefinite factors, as indicated by composition, produce great effect on the "charge limite." Two other details tabulated are of more than ordinary interest, viz., the strength of explosives, as indicated by the weight of charge equivalent to 10 grms. of No. 1 dynamite, and the usefulness of the blasting agent, as shown by the amount of rock displaced by the explosion of the "charge limite."

To the manufacturer and expert the compositions of practical explosives, and the results given by them, should be a true guide for investigations. In conclusion, we may

say that the book is correctly described as containing the latest information on the developments of explosives for use in dangerous mines.

TRADE MARKS.

ADVERTISED. JANUARY 3—24, 1906.

277,030. The word "RADIO." To apply to blasting explosives. The Carbonite Syndicate, Ld., London. November 14, 1905.

277,291.) The word "MARKOR." To apply to explosive substances
277,292.) and sporting ammunition. Cogswell & Harrison, Ld., London. November 14, 1905.

274,113. A device representing a hand, over which is drawn partly the outer rings of a target, and in the centre a shot-pierced square bulls-eye. To apply to sporting guns and rifles. A. Hollis & Sons, London. July 5, 1905.

277,780. A device representing an owl sitting upon a branch. Round the owl's neck appears a bow upon the ends of which the words "W. S. Greaves, Limited," are written. To apply to explosive substances. W. S. Greaves, Ld., Ironville, near Alfreton. November 30, 1905.

277,990. The well-known "E.C." Powder Co.'s star design, with the addition of the letters beneath and above E. C. 3. To apply to gunpowder and ammunition. The "E.C." Powder Co., Ld., London. December 6, 1905.

REGISTERED. DECEMBER 21, 1905—JANUARY 17, 1906.

276,551. The Carbonite Syndicate, Ld.
276,163. L. Jeffries.

APPLICATIONS FOR PATENTS.

DECEMBER 18, 1905—JANUARY 27, 1906.

26,371.* Target. H. V. Kent.
26,611.* Ordnance and Small-Arms. J. Luciani.
26,673. Targets. H. Jenischewsky.
26,734. Breech-Loading Small Arms. C. Ryland.
26,871. Loading Apparatus for Guns. Sir W. G. Armstrong, Whitworth & Co., Ld., and Sir A. Noble, K.C.B.
27,065. Torpedoes. D. Cook.
27,123. Teaching Rifle and Gunnery Practice. C. Maxted.
27,257.* Recoil-operated Small-Arms.

1906.

6. Rifle Targets. C. Reid.
32. Ordnance. W. Feicks.
51. Ordnance. Fried. Krupp, Ag. (Date of application in Germany, March 17, 1905.)
177.* Small Arms. P. Philippides.
178.* Small Arms. P. Philippides.
241. Ordnance. A. T. Dawson and G. T. Buckham.
262. Air Guns. W. S. Armstrong.
437. Explosives. O. Silberrad, Jun.
20,782A/05*. Automatic Fire Arms. O. Imray (Colt's Patent Fire Arms Manufacturing Co.). (Date applied for under Rule 5, October 13, 1905.)
595. Range Finder. A. H. Pollen and H. Isherwood.
791. Gun Carriages and Mountings. F. T. Fisher and C. H. Dewett.
914.* Small Arms. F. W. Stillwell.
933. Ordnance. C. Holmstrom and E. Middleton.
965. Small Arms. H. V. Anderson.
1,071.* Ordnance. Rheinische Metallwaaren und Maschinenfabrik.
1,179.* Gun Mountings. H. Mötz. (Date of application in Germany, February 1, 1905.)
1,218. Targets. G. Hunter.
1,271. Small Arms. The Birmingham Small Arms Co., Ld., A. G. M. Driver, and G. Norman.
1,272. Rifle Sights. C. H. Watson and F. W. W. Baker.
1,470 Torpedoes. A. J. van Stockum.
1,571. Gun Mountings. H. C. Moultrie.
1,573.* Explosives. G. Grobet. (Date of application in Germany, January 28, 1905.)
8,286A/05. Small Arms. A. T. Dawson and G. T. Buckham. (Date applied for under Rule 5, April 18, 1905.)
1,718. Range Finder. A. H. Pollen.
1,727. Electric Fuse. A. F. Webb.
1,737. Small Arms. R. Wake.
1,796. Electrical Fuses. A. C. Livesey.
1,881. Electrical Fuses. Verity's, Ld., and A. E. Gott.
1,895. Torpedoes. A. Ashton.
1,943 Projectile Fuses. Sir W. G. Armstrong, Whitworth & Co., Ld., and J. S. Douglas.
2,035. Ordnance Mountings. C. Holmstrom and E. Middleton.
2,048. Explosives. A. T. Cocking and Kynoch, Ld.

SPECIFICATIONS PUBLISHED.

DECEMBER 28, 1905—JANUARY 25, 1906.

COMPILED BY HENRY TARRANT.

28,651 (1904). **Cartridge Carrying** J. J. Burnett and C. Bubear, Wellington, Somerset. In Patent No. 28,650 (1904) the above inventors dealt with a cartridge holder of metal, which would hold a cartridge securely, but not so securely that it could not be withdrawn by the fingers. Holders of this type are by the present invention secured at the bottom of tubes vertically arranged on the breast of a waistcoat or coat. Each tube is filled with cartridges which are withdrawn one by one from the holder at the bottom. Accepted December 29, 1905.

28,750 (1904). **Sighting and Firing of Naval Ordnance.** R. G. Tyler, London. The sights for ordnance accustomed to be constantly on the move, such as on board ship, are mounted independently of the gun, and are arranged under the control of a gyroscope, so that they are constantly maintained upon the target. The gun is automatically discharged by the closing of a circuit the moment it assumes its correct position in relation with the sights. Accepted December 29, 1905.

790 (1905). **Operating and Controlling Ordnance**. The British Thompson-Houston Co., Ld., London. (Agents for *the General Electric Co., U.S.A.*) A system is described of controlling one or more guns from a distant point, such as a range-finding or battery commander's station which may be situated out of the danger zone. The system permits any individual gun to be directed and discharged at will, and allows of proper co-operation between the several guns. Accepted December 30, 1905.

1,064 (1905). **Automatic Rifle Mechanism**. R. H. Kjellman, Sweden. An automatic rifle in which the breech mechanism and the barrel recoil together for a limited distance. The barrel then becomes unlocked and remains stationary whilst the breech bolt continues its rearward travel. The barrel is impelled by a spring back to its original position, and the bolt follows it, taking a new cartridge to fill the place of the spent one ejected. A spring-controlled catch holds the barrel whilst the bolt completes its rearward movement. The bolt releases the catch, and in turn is held by it until the barrel again releases it when returned to its proper position. The firing-pin is retained in its cocked position by a sear indirectly connected with the trigger by a lever having a double fulcrum. The "pull off" is by this method made "sweeter" than usual. The butt may be separated easily from the stock part which contains the movable parts for cleaning or repair purposes, and the mechanism may be used for single firing. Accepted December 21, 1905.

5,315 (1905). **Rifle Sight Attachment**. R. E. Campbell-Gompertz, India. A small flat disc is attached, preferably to the sliding bar of a rifle leaf back-sight, so that the fore-sight is obscured to the eye not actually engaged in aiming. Objects a short distance away are not hidden, and so shooting with both eyes open is rendered easy. Accepted December 14, 1905.

6,880 (1905). **Railway Fog Detonators**. W. Pugh, Cambridge. In order to save one of two detonators used for railway signalling in foggy weather, the first explosion is caused to release a spring which automatically pulls the second reserve detonator off the rail. If the first detonator does not explode, the reserve remains in its place. Accepted December 21, 1905.

8,079 (1905). **Operating Small-Arms as Machine Guns**. E. H. Clive, London, and Sir W. G. Armstrong, Whitworth & Co., Ld., Newcastle-on-Tyne. A machine for automatically operating ordinary rifles is set out in this patent, and is an improvement upon that described in Specification No. 17,759 (1903). The rifle or rifles are secured to a frame into which they fit, and so long as the cartridges in a hopper last the turning of the handle of the machine continuously loads them into the breech, discharges them, and expels the empty cases. Accepted December 14, 1905.

9,379 (1905). **Automatic Pistol Construction**. J. Warnant, Belgium. An automatic pistol, in which the barrel may be broken down after the style of a sporting gun, to render it accessible for cleaning, for loading the pistol shot by shot, or to allow of the introduction of a supplementary cartridge after the magazine is filled. The sliding breech mechanism is arranged in a detachable casing situated at the top of the body. Accepted December 14, 1905.

9,379A (1905). **Automatic Pistol Construction**. J. Warnant, Belgium. In the Specification No. 9,379 dealt with immediately above, a break-down automatic pistol is described. In this patent is set out a pistol working exactly on the same principle, but with a fixed barrel and breech. Accepted December 7, 1905.

9,787 (1905). **An Improved Telescopic Sight**. W. Youlton, London. The danger of the eye of the shooter being struck by the eyepiece of a telescopic sight when the weapon to which the sight is attached recoils is obviated by arranging the eyepiece in a sliding tube. A bar attaches the sliding tube to the bolt head, and the eyepiece is moved forward away from the eye when the gun is recoiling. A spirit lever is also attached to the eyepiece, so that the shooter may ascertain whether the rifle cants or not. Accepted December 21, 1905.

11,278* (1905). **The "Boss" Improved Single-Trigger Mechanism**. J. Robertson, London.

13,104 (1905). **Firing Mechanism of Automatic Guns**. Fried. Krupp, Ag., Grusonwerk, Germany. Between an intermediate lever which operates the sear and the trigger is arranged a bar. This trigger bar is controlled by a stop lever, so that the weapon may be adapted for single or for automatic continuous firing, or it may be made to lock the part in the safety position. Accepted December 7, 1905.

15,580 (1905). **Percussion Fuse Mechanism.** A. E. Edwards, London. (Agent for *Lieut. J. L. Sticht, U.S.A.*) The plunger of the percussion fuse set out in this specification is normally separated from the detonator cap by a shield and guard. The shield and guard are released by the shock of firing, and the rotation of the projectile after it leaves the rifling swings them aside out of the path of the hammer. These devices prevent accidental bursting of the shell. Accepted December 14, 1905.

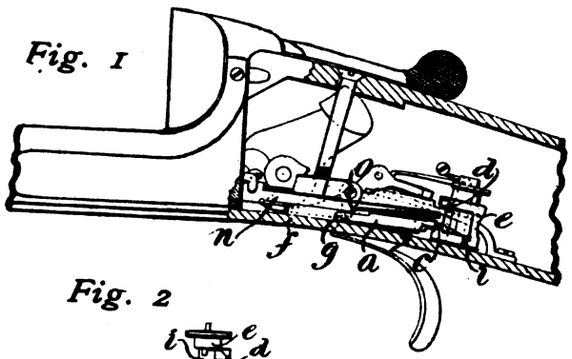
* This Specification is more fully described under "Selected Patent."

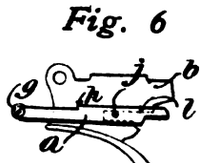
SELECTED PATENT.

THE BOSS IMPROVED SINGLE-TRIGGER MECHANISM.

11,278 (1905). J. Robertson, London. An improved type of the three-pull single-trigger mechanism set out in Patent No. 22,894 (1894) is dealt with in this specification. It has been discovered by the inventor that if from any cause an imperfect engagement of the sear with the bent of the lock tumbler should exist, a premature release of the tumbler might occur before the full lift of the trigger had taken place. Consequently the lift intended to discharge the first barrel would remove the intercepting part adapted to obviate the involuntary pull, and so allow the involuntary pull to discharge the second barrel. In order to prevent this possibility, a check or safety part is mounted on the trigger plate in such a position that it is actuated by the trigger blade in its upward movement, and is caused to present an obstruction to the turning of the capstan until the capstan is directly turned by the trigger blade at the completion of its upward movement.

This part *a* is illustrated in connection with the well-known Boss mechanism and with the slanting trigger which was the subject of Patent No. 11,400 (1905) in Figs. 1–5. Figs. 6 and 7 show the part attached to an ordinary straight trigger. The trigger blade *b* acts in conjunction with the two intercepting surfaces *c* and *d* upon the capstan *e* to discharge the two barrels through the medium of only one trigger, and to prevent the involuntary pull discharging the second barrel. The check or safety part *a* is pivoted to the trigger plate *f* at the point *g*. The rear end *h* of the trigger blade *b* passes beneath the check, as is illustrated in Figs. 3 and 5. The rear end of the safety part, when in its lowest





position, engages the intercepting surface *c* on the capstan *e*, and prevents the latter turning upon its pivot *i* until the upward movement of trigger blade is nearly completed. With the completion of the trigger lift, the rear end *h* of the blade *b* engages the check and removes it from the surface *c*, thus allowing the capstan to be turned in the manner fully explained in Patent No. 22,894 (1894).

The check is arranged slightly differently in the case of an ordinary straight trigger-blade (Figs. 6 and 7). The check *a* carries a pin *j* which projects into a slot *l* in the blade *b*. A certain amount of play is allowed for this pin in the slot, so that the trigger has to be raised a certain distance before the check is lifted. The check is returned to its position of engagement with the notch *c* by the sliding bar *n*. This bar is pushed rearwards when the gun is opened for reloading, and, besides recocking the capstan *e*, its shoulder *o* acts upon the shoulder *p* upon the check, and so depresses that part to its original position. Accepted December 21, 1905.

Arms & Explosives

A TECHNICAL AND TRADE JOURNAL.

Editorial and Publishing Offices: EFFINGHAM HOUSE, ARUNDEL STREET, STRAND, LONDON, W.C.

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CONTENTS.

CURRENT TOPICS.

The N.R.A. Report.—The annual report of the National Rifle Association announces a surplus of £883, odd shillings and odd pence on last year's working. Everthing connected with the ordinary military rifle shooting section of the Association's activity shows satisfactory progress, and the usual additions are announced having for their object the enhanced comfort of competitors and others attending the Bisley Meeting. Those aspects of the report which are mainly concerned with the shooting records having been anticipated by the issue of an advance copy of the scores immediately following the annual meeting, it is unnecessary again to refer to the results achieved. A good deal of new matter appears in the report concerning the rifle club movement. Up to the present 670 clubs, with a membership of 43,225, have been affiliated to the Association, the increase for the past year being 115 clubs. The formation of school rifle clubs has made great progress, and it is expected that now that the War Office has decided on a miniature pattern of service rifle the chief difficulty of initiating boys in the practice of markmanship will shortly be removed. The report refers to the futile efforts made to organise a miniature rifle shooting meeting in Birmingham. Even in the absence of details the want of enthusiasm shown in the Midland city is very regretable and not in accordance with the usual traditions of the recognised centre of gunmaking. The meeting held at Exeter was naturally a modest affair by comparison with what could have been accomplished at Birmingham. The average number of entries in the six main competitions was less than 90, but the meeting though of small compass, was very satisfactory from many points of view. Such gatherings cannot, of course, be regarded as setting the fashion in miniature marksmanship in the way that Bisley conditions control the practice carried on by volunteer marksmen. The expenses of the meeting amounted to £287, which works out at an average cost of very nearly £3 for every individual competitor in attendance. The small results attainable in provincial centres suggests the desirability of holding an annual Meeting within easy reach of London in addition to such small country gatherings as may be arranged from time to time.

Gun Definitions.—It is a somewhat curious aspect of the many books which concern themselves with the various branches of shooting that none of them should contain an up-to-date glossary of technical terms, describing the many ordinary words to which the gunmaker applies special meaning, and the many special words which have no meaning at all to the average man in the street. In a very interesting little pamphlet which has been issued by the firm of Joyce on the centenary year of the percussion system a praiseworthy and highly successful effort has been made to fill the blank. The glossary is divided into two sections, the first dealing with firearms, and the second with ammunition. In reading over the words which have been defined, and in examining the language which has been employed in making their meaning clear, one must appreciate the care and ingenuity which have been exercised in order to cover every use of a given word, whilst avoiding any illegimate extension of their proper significance. The late Mr. Gould some years ago was responsible for the authorship of a somewhat similar class of handbook; but while the general information imparted in the non-technical sections was of the best, he was markedly unsuccessful when dealing with the every-day terms used by the gunmaker. Another book, which doubt-

less owes its origin to a gunmaker trained in the old country, was published in America under the title of *The Gunsmith's Manual*. This volume contained many excellent definitions of terms known only to those in the trade. This book is in point of fact the only work which has ever attempted to deal with guns from the point of view of the workman's bench. Messrs. Joyce's series of names was not, of course, drawn up so much with a view to covering manufacturing technicalities as to deal efficiently with those words which are constantly cropping up amongst sportsmen, but whose meaning is seldom clear to the novice. It may be stated for the benefit of those who fear that the reading of definitions is at the best dry work that the book is mainly composed of six excellent chapters dealing with caps and sporting cartridges, written in first-class literary style and containing much sound and useful information.

The Sparkbrook Factory.—The notable services of Colonel F. W. J. Barker, R.A., at the Sparkbrook Government Rifle Factory in Birmingham have been brought to a close by the retirement of that able officer. Major Tisdall, R.G.A., his successor, is one of the few men who can be regarded as eminently fitted by previous experience to fill the vacant post. The name of Major Tisdall has been well known for several years past from the fact that he was Assistant Inspector of Musketry, working under the very able direction of Colonel Hopton, the Chief Inspector. He is well known in a somewhat intimate connection to the gun trade by reason of the fact that he was chosen by the Secretary of State for War to investigate the question of differential proof marking; and it was at his suggestion that the Board of Trade Conference was held. His personal record shows that, while he has attained very high recognition in the Army, he has been also known as a most industrious, energetic, painstaking, and trustworthy man. The War Office is undoubtedly to be congratulated on having available so suitable a man to fill such an important vacancy. Major Tisdall's past services have included careful investigation of the great variety of small-arms inventions which have been submitted to the Government. His views have always been regarded as extremely sound, and it may be hoped that the future will offer many opportunities for taking advantage of his exceptional knowledge. That Colonel Barker's term of employment was several times extended in recognition of his valuable services goes to show that the Sparkbrook appointment is regarded as one requiring exceptional grasp and a range of powers possessed by very few officers in the British Army.

What is Practical Shooting?—Mr. Walter Winans has ventured to set his face very strongly against the currently accepted methods of rifle shooting, with the patriotic object in view of emphasising the need for more practical methods of shooting instruction than at present exist. In upholding the advantages of shooting in the open country at a variety of marks situated in a natural background, he opens himself to the criticism that he is advocating a class of marksmanship which would add to the risks of sudden extinction if it were generally indulged in. He moreover says some very unkind things about target shooting as ordinarily carried on. Here again he seems to carry his remarks beyond the case he has established. A boy who is reared on a farm, and who shoots at every kind of living and dead mark which presents itself in the course of a day's ramble, must clearly learn many things about rifle shooting which are denied to the ordinary town dweller. On the other hand, speaking from a considerable amount of experience of the exact kind of shooting referred to, we can fairly state that its exponent will never know the full measure of himself and his rifle until he has engaged in deliberate shooting at a stationary card target. It is only by observing how easily wild shooting is produced by minor faults of manipulation that the sporting rifle shot can appreciate the extraordinary amount of care which can be imported into the shooting of a rabbit or other relatively large mark. A natural object of substantial size will be frequently missed, unless altogether exceptional pains are taken to ensure a satisfactory result. Target practice teaches a man these things far better than aiming under conditions which give no index of the actual points struck. We accordingly maintain that natural open-air conditions of shooting produce rapidity and quickness of aim at the expense of accurate holding and pull-off. Target shooting teaches the science of the rifle and a great many other things besides. Rapid firing contests, and various other more or less artificial means of producing natural conditions, will impart a considerable amount of aptitude for snap shooting under service conditions of shooting.

The New Cadet Rifle.—Sufficient seems to be known of the arrangements made in connection with the new cadet rifle to justify a few further remarks thereon. Seven weapons are said to have been submitted by various firms, who were encouraged by the prospect of a substantial order to devote time and energy to the working out of designs. Our own personal acquaintance with many of those so situated shows that sleepless nights were spent in ruminating, modelling, and generally shaping and harmonising the various parts and fittings of a rifle, in order to produce a cadet weapon worthy of submitting to the Government. With so many brains at work, it is certain that among the designs submitted there must have been many useful ideas, not possibly suitable matter for Letters Patent, but nevertheless the product of expert brain power, and therefore worthy of monetary recognition. It is also certain that when seven different combinations of people tackle the same job some must attain greater success in certain directions than in others, and, therefore, that the ultimate ideal is not to be found in any one model, but can only be achieved by a process of judicious selection and combination. The War Office has undertaken the last-mentioned duty, and we have cordially supported the wisdom of the course taken. It is said that the War Office has evolved its own model of what a cadet rifle should be. Now the question is to whom belongs the new design? As with cordite, and on many other historical occasions, the War Office has occupied the favoured position of inventing, after having acquired the best information of the best experts. We have taken some pains to ascertain the estimated cost of working out models of cadet rifles such as have recently been submitted in accordance with the Government specification. The average cost may be stated as in the region of £200. The question is, will a gratuity, say of £1,000, be voted for distribution *pro rata*, according to the amount of inspiration which has been derived from each source of expert knowledge. Bar this, poetic justice demands that orders shall be issued on the same *pro rata* basis.

THE SPITZER CARTRIDGE.

WHATEVER may be the mathematical laws underlying the behaviour of the Spitzer cartridge there can be no doubt that the whole of our War Office and private experts are devoting an immense amount of attention to the subject. The feeling which seems to be most general is that whatever may be the exact behaviour of the bullet at the longer distances, military opinion on the Continent assumes that the advantages gained at the shorter distances far outweigh any loss in trajectory and striking power which may be experienced beyond the 1,000 yards range. The lightening of the bullet must unquestionably pave the way for a very important increase of velocity. It is merely a question of experiments and arithmetic to show the precise distance at which the initial advantage is neutralised by the effect of air resistance. Errors of range estimation are notoriously the cause of most of the bad shooting which is experienced under practical conditions of marksmanship excluding of course the possibility of firing over a measured distance and correcting elevation in the light of the target results registered from the earlier rounds. It is immaterial to the explosive just what shape the front of the bullet may happen to be. The barrel has a given cross-section, and if the activity of the powder is suitably proportioned to the resistance of the bullet the combustion will be complete by the time the bullet has been expelled from the muzzle. The shape of the bullet, therefore, becomes a question of proper centreing in the rifling with reference to the shape and location of the cone, and any further problem is related to the science of exterior ballistics.

The reduced weight of bullet, whatever may be its shape, implies a certain amount of reduction in its length; and this reduction necessitates a diminution of the theoretical minimum twist of rifling necessary to produce an end-on flight. The question of velocity bears no relation to the pitch of the rifling, the spin of the bullet being increased in the same proportion that velocity becomes greater. The shape and formation of the lands is necessarily a factor to be considered in reference to enhanced velocity, since a shape of groove which would obtain a sufficient grip on a low velocity bullet might prove inadequate for one receiving a greater speed of spin in a diminished period of travel down the bore. We accordingly find that in harmonising the rifling with the essential conditions of steady flight through the air, there is plenty of opening for the exercise of skill and ingenuity. Supposing that this problem is adequately solved, the question still remains whether the factor of air resistance can be materially lessened by the adoption of an improved shape of point and shoulder. Supposing that the pratical difficulties of obtaining a true flight are overcome the novel conditions imported into the new cartridge must materially influence military conditions. Flatter trajectories with a greatly extended danger zone, and a reduced angle of descent, will do much to render the infantry arm a more deadly weapon than at present at the distances over which it is mostly used. It is on such subjects as this, and in connection with the stopping power of the bullet, that much expert work is being done, and we shall await with interest some definite announcement by those in a position to decide concerning our own arrangements for bringing the small-arm cartridge up to date.

HIGH-GRADE GUNPOWDER.

MR. DONALD M. D. STUART, whose name has been associated in the past with carefully thought-out views on the subject of mining explosives, has contributed a most important paper to the North of England Institute of Mining and Mechanical Engineers. A reprint of his paper has been forwarded to this office, and we have taken great pleasure in reading his excellent survey of a subject whose treatment necessarily involves the examination of a host of statistics and records. After carefully digesting the history of coal-mine explosives from the time when gunpowder was without a rival in the field, he discusses in a singularly lucid fashion many of the more urgent problems of the present day. Some of his remarks on the subject of low-grade gunpowder, as compared with the best quality brands, are very much to the point.

He refers to the proposal some years ago of the Gunpowder Trade Association to the effect that all powder used in coal-mines should be of the highest grade and made to an authorised standard. This was not accepted by the Home Office, with the result that during the last seven years the door has been left open for gunpowder of unknown composition and quality, of irresponsible and foreign make, and in its cheapness necessarily dangerous in the presence of fire-damp or coal dust, to be used in all mines except those in which gas in quantity, indicative of danger, had been found in the previous three months. The Woolwich testing station referred in the most condemnatory terms to the quality of this mixture "flattered by the name of blasting powder." In so far that it is the practice in some districts for the miners to purchase their explosive at local shops where there is no opportunity of distinguishing good from bad, the question of price per pound is the dominant consideration.

The line upon which Mr. Donald Stuart recommends that further research should be conducted is in the direction of more exact enquiry into the questions of temperature and pressure developed by explosives with reference to the ignition of gas and coal dust, and also the actual production of dust by the shattering effect of the explosive. He also specially emphasises the circumstance that due account must be taken of the time during which an explosive charge under test is in contact with the materials liable to ignition. The inference seems to be that, while the time of contact may be insufficient to cause ignition under the conditions of the Woolwich test, it is possible that in practical use the time element may be so modified as to produce quite different results. After surveying certain other aspects of the question, Mr. Stuart expresses the opinion that the Woolwich test has failed to evolve explosives of greater safety than high-grade gunpowder made up in the most recent forms. He suggests that the North of England Institute should take up the whole question, with a view to endeavouring to ascertain whether fresh methods of examination cannot be adopted, such as will increase still further the standard of safety in coal mines, taking, of course, due account of the large quantity of valuable practical experience which has been accumulated during the past six or seven years.

THE N.R.A. MINIATURE RIFLE DEFINITIONS.

THE issue by the National Rifle Association of a series of rules governing the weapons to be used at miniature rifle ranges will read very pleasantly to gunmakers who have hitherto been restricted by regulations the reverse of practical. The annoyance caused at each Bisley Meeting by attempts to restrict rifles within the scope of a series of definitions having little or no common-sense foundation may be regarded as permanently set aside. The new rules give every scope for the improving genius of the gunmaker, while at the same time guiding manufacture into lines eminently adapted to produce the best type of weapon for the shooter. The following definition of the "any" rifle represents a wise recognition of the arm fitted with aperture sights :—

Miniature Rifle.—Class A.—Any.—Any breech-loading rifle complying with the following conditions:—Weight of rifle, maximum, 8 lb., complete as when firing; calibre, maximum, ·325; pull of trigger, minimum, 4 lb.; sights, any except telescopic or magnifying.

A more comprehensive definition it would be impossible to imagine. The limit weight of 8 lb. gives the shooter an ample opportunity for employing a rifle substantial in substance, but not overweighted so as to be sneered at as a shooting machine. The maximum calibre of ·325 affords every opportunity for using a type of cartridge which is miniature only by comparison with full-size service ammunition. The allowance of any sights, except telescopic or magnifying, gives the shooter reasonable opportunities for exercising selection, without apparently opening the way for any abuse of the privileges granted by employing absurd devices. It might possibly happen that match sights, as used in the back position, might be employed on miniature rifles, but it has yet to be shown that the match rifleman's method of shooting gives exceptional facilities for steady holding and pull-off. Match sights certainly do assist the long-range marksman to adopt a comfortable position, but their chief advantage is probably due to the fact that for long-range shooting the backsight must needs be so high that the shooter is unable in the ordinary prone position to support his cheek on the stock. Granting moderate distances and an elevation which allows the head to be supported on the stock the advantage conferred by match sights would be very slight.

The Class B group of rifles for miniature shooting is styled "military," this term implying not only a strictly military pattern of rifle, but any type of weapon which can reasonably be held to reproduce the conditions of military marksmanship on a small scale. We thus have the following definition for sub-section (1) of the military class, viz. :—

Class B.—Military.—(1) Any service rifle or miniature service rifle approved by the War Office with a calibre not exceeding ·310, firing miniature ammunition as defined below.

This sub-section obviously covers the use of reduced charges in ordinary service rifles. The miniature service rifle clearly refers to the cadet weapon, on whose design the War Office has been engaged for some time past. The next two sub-sections of the military class of rifle may now be quoted :—

Class B.—Military.—(2) Any service rifle fitted with a Morris or other tube.

(3) Any rifle of service pattern, provided with a barrel bored, chambered and rifled for the ·22 short, long or long-rifle rim-fire cartridge, the ·297-230 long or short Morris tube, or any other miniature ammunition which has received the approval of the Council. The bolt may be modified to fire and extract the cartridges, and the magazine may be omitted.

The above sub-sections being self-explanatory we may now pass to the next section, which represents an innovation which should be welcome, not only to the gunmaker, but also to the shooter.

Class B.—Military.—(4) Any "Class A" rifle with a calibre not exceeding ·310, provided that the general shape of the foresight and the notch in the backsight are the same as those of a Government pattern rifle, and that the V of the backsight when in position for aiming is not less than 23½ in. from the heel of the butt. The backsight notch may be mounted so as to be capable of lateral adjustment in addition to the usual vertical adjustment. The foresight may only be made adjustable to the extent of the usual driving fit in a dovetail slot.

This recognition of a purely miniature type of weapon, and its admittance in competition with military arms firing reduced charges, represents a very important reform. The clause specifying open sights is obviously fair and necessary. The demand that the minimum distance between the butt and the backsight shall be 23½ in. must not be regarded as a restriction, but rather as a useful indication that open sights cannot be used to advantage unless the backsight is a reasonable distance forward of the eye. The precise value 23½ in. is derived from a measurement of the short Lee-Enfield rifle, this being regarded as the shortest distance which should be encountered on a miniature rifle, if practice with it is to be looked upon as a fair representation of military conditions. The allowance of complete freedom to provide lateral as well as vertical adjustment of the backsight merely indicates that the National Rifle Association is desirous of seeing incorporated into the miniature rifle just those advantages and conveniences which are embodied in the design of the backsight of the new short service rifle. Special clauses permit the use of a contrivance satisfying the same purpose in respect to the three preceding sub-sections. The actual wording is as follows :—

Class B.—Military.—Sights in sub-sections 1, 2 and 3 must be the same as for the same pattern of rifle as issued for service, except (a) that the foresight may be made a driving fit into a dovetail slot, or else that the backsight notch may be so mounted as to be capable of lateral adjustment; and (b) that the height and width of the foresight block may be of any dimensions.

The pull of trigger for all classes is specified as a minimum of 4 lb. With reference to the question of ammunition the National Rifle Association is again to be congratulated on having abandoned all idea of a cost limit, and in having adjusted the maximum limits of strength with due regard to practical conditions. That is to say the previous limit of 140 grains weight of bullet and 1,450 f.-s. velocity referred to a cartridge which in only very special circumstances could be used at short ranges and then with all kinds of attendant inconveniences, such as undue noise, energy of impact and cost. A cartridge with these ballistics is obviously suitable only for 100 to 300 yards shooting on outdoor ranges properly isolated and protected. The need for specifying two grades of ammunition according to the class of range in which it is to be used opened up the difficulty that a hard and fast delimi-

tation based on weight and velocity would be very difficult to apply to the wide range of calibres having ·325 for a maximum. The smaller bore cartridges are characterised by low bullet weight and high velocity, while the larger calibres have heavy bullets and low velocity. An energy basis of limit has accordingly been adopted, but for convenience sake it has been given in the old terms of bullet weight and velocity. Two grades of cartridge are specified, viz., indoor and outdoor. There is, however, nothing in the rules which could prevent a club with an outdoor range from limiting their members to the use of the indoor grade of ammunition. The actual wording of the new regulations is as follows :—

Ammunition.—A.—Indoors.—With a bullet not exceeding 80 grains in weight observed velocity must not exceed 1,200 f.-s. over 20 yards (energy equivalent 222 ft. lb.). With bullet exceeding 80 grains, but not exceeding 100 grains in weight, observed velocity must not exceed 1,000 f.-s, over 20 yards (energy equivalent 256 ft. lb.).

B.—Outdoors.—Weight of bullet, maximum 140 grains; observed velocity, 1,450 f.-s. over 20 yards (energy equivalent 653 ft. lb.).

Altogether we find no praise too great for the absolutely fair and reasonable spirit in which the requirements of the shooter have been harmonised with trade conditions. Although editorially speaking, our favourable comments may be open to the criticism that the new rules are pleasing because they carry out ideas frequently urged in past issues of this paper, we feel that the points at issue are so obvious as to leave no opening for being led astray by preconceived notions. Those gunmakers who have specially associated themselves with efforts to cater for the new rifle club movement have now complete freedom to develop the best and most useful designs. Competition amongst them will merely produce a gradual evolution of the best type, and it will be left to the shooter to decide on the rival merits of competing systems. His verdict in the long run must be sound and to the point. The new miniature rifle regulations must inevitably exercise an immense influence on the design and adjustment on the military service rifle. Facts as to sighting, balance, adjustments and the general optical conditions involved in open sights will all be subjected to an intensely searching practical test. The best system will be made obvious without theoretical complications, and the way should in due course be quite clear for importing at some future date into the service military arm those refinements of design which have been elaborated under miniature conditions of shooting. The gunmaker will thus be able to serve his country in a most useful manner, while carrying on what there seems to be good reason for supposing will be a profitable side line of business. Developments on wrong lines will inevitably come to grief, and the balance of trade must in due course transfer itself to the productions of those gunmakers whose weapons are conceived on the soundest principles of design and construction.

The prevailing feeling that there is not quite enough shooting going on beneath all the smoke of the rifle club movement probably reflects the true conditions. If the great variety of explanations put forward are carefully sifted it will be found that the absence of a suitable cadet rifle is the greatest weakness of the present situation. Let us hope that the combined efforts of the shooting societies, the War Office and the gunmaker may produce the right thing at any early date. When once the accepted pattern of rifle has been established it will take but a very short time to illiminate the errors of the early designs.

REVIEW.

Practical Rifle Shooting. By Walter Winans. Published by G. P. Putnam's Sons, New York and London. Price 1s. net.

In his shilling handbook on practical rifle shooting Mr. Walter Winans sets out to do his share towards emphasising the need for extending the practice of rifle shooting amongst all sections of the community, and at the same time showing in the light of his own practical experience how, what he regards as the right kind of practice, can best be obtained. Throughout the whole of the book he draws a hard and fast distinction between practical rifle shooting and what he apparently regards as its antithesis, viz., target shooting. When dealing with the question of sights on a rifle the author introduces what must be regarded as a somewhat novel theory on the subject of defining one's sights. "The hind sight," as he terms the backsight, should apparently be fixed on the barrel at a distance from the eye determined by the closest distance from which printed type can be viewed without causing the letters to appear blurred. Such a theory is in need of further elucidation in order to relate it to the practical circumstance that in the act of firing the focus of the eye is fixed, either on the target, or at some intermediate point between the foresight and the object aimed at. The amount of blur existing under such conditions seems to be related rather to the distance of the backsight from the eye than to the precise focal distance of the shooter's eye. One would in fact be inclined with a beginner to let him adopt the maker's own specification of rifle, rather than to alter its adjustments on a purely empirical basis. Then again when we read that for a beginner the foresight should consist of a white bead at least a quarter of an inch in diameter, one is is inclined to suspect that an altogether specialised kind of tuition is in store.

On the matter of length and formation of the stock the author recommends much the same elaboration of fit which is found necessary in a shot gun, where aim must be taken in the fraction of a second. This again seems a somewhat undue complication of the early lessons in marksmanship. There is in fact much to be learned before refinements of this kind need be considered. Mr. Winans makes a very great feature of utilising a white bead foresight. This is indeed a matter worthy of very careful consideration, in that practical experience shows that few natural backgrounds afford a first-rate definition of a black foresight during those hours of the day, or those conditions of weather, when light is deficient. The analogy of the sporting rifle must not, however, be carried too far; because these weapons are frequently employed under conditions which hardly represent average military use. The great popularity of the ivory bead on a sporting rifle fitted with an aperture backsight merely indicates that the white bead restores the deficiency of illumination which is caused by using a peephole to limit the amount of light entering the eye. A certain amount of bright illumination on the foresight is undoubtedly an advantage, but it is a practical question involving many important considerations whether the entire visible area of the foresight should be white. A black foresight with a bright glint in the centre would meet most of the criticisms brought against the ordinary dead-black sight. Certain other features of Mr. Winans' book are dealt with in another portion of this issue.

ROUND THE TRADE.

The International Pigeon Shooting Meeting at Florence will take place from the 16th to the 19th of April next inclusive. The programme includes the usual list of substantial prizes.

The firm of Alexander Henry & Company have issued a strong disclaimer, showing that the present proprietors of the business are in no way concerned, directly or indirectly, with the Alexander Henry who has lately got into trouble.

Contemplated changes in the new short rifle for the purpose of getting over the disadvantages of its short length include a lengthened bayonet, and a modification in the form of a back-sight notch, and the foresight bead, with a view to improving the definition of the sights.

The year's results of the Vickers-Maxim Company have recently been announced as providing for a final dividend, making a total distribution for the year of 15 per cent. as against 12½ per cent. for the previous twelve months. The carry forward has also been increased by a very material amount.

An explosion took place on the 2nd ult. at one of Messrs. Curtis's & Harvey's gunpowder mills near Hounslow. The casualties were inconsiderable on account of the precautions taken to limit the number of hands in the neighbourhood of the buildings which suffered. Two men were, however, injured, one seriously.

Signor Colombo Ricci unsuccessfully appealed to the Judicial Committee of the Privy Council for an extension of his Letters Patent for certain improvements to the Maxim gun. The Attorney-General, on behalf of the Crown, opposed the application, and the Lord Chancellor expressed, on behalf of their Lordships, their inability to advise an extension of the patent.

In spite of the somewhat extraordinary opposition, which was occasioned by the request of the directors of the Birmingham Small Arms Co., Ld., to be allowed to build up a reserve balance independently of all moneys shown in the annual accounts, the shareholders confirmed their previous good opinion of the Board by granting the whole of the powers asked for. No moneys may be appropriated to the fund until a dividend of 10 per cent. has been paid.

On Tuesday, the 6th February, the Directors of Messrs. Curtis's & Harvey entertained the managers of their various factories to dinner at the Café Royal, London, when advantage was taken of the opportunity to make a presentation of silver plate to Mr. John Knights, the manager of their Hounslow factory, as a memento of his completion of 50 years service at these mills. Mr. Knights evidently intends to make the record already established the more difficult to beat, for in answering the congratulations showered upon him, he promised to do his best for the Company as long as health and strength remained.

The Stevens Arms Company have introduced, we cannot say how recently, an extra limb in their well-known model of miniature rifle which keeps the breech lever open in such a way as to prevent its partial closing, and so cause interference with the operation of re-loading. Another item of information somewhat allied to the question of Stevens rifles is that the South British Trading Co. now hold an ample stock of Peters ·22 calibre rim-fire ammunition containing semi-smokeless powder. It will be good news to rabbit shooters that the supply of material includes a quantity of hollow-pointed bullets of the L.R. type.

The Financier and Bullionist contained in a recent issue an article bearing evidences of inspiration, whose object is apparently to prepare the shareholders of the National Explosives Company for an unfavourable balance sheet. In discussing the conditions of this industry it is clearly shown that competition is exceedingly severe, largely by reason of the fact that the various manufacturing concerns are capable of producing material far beyond the aggregate consumption. The break-up of the understanding between the manufacturers has given the consumer the benefit of inordinately low purchase rates, and the companies concerned appear to be unable for the moment to set things on a better footing.

The Colt Company will shortly be in a position to issue a new Browning automatic pistol firing a ·45 calibre bullet weighing 200 grains. The weight of the pistol is slightly over 2 lbs. when empty, and when the magazine contains its full completement of seven cartridges the total weight becomes 2 lbs. 5 ozs. The barrel is 5 ins. long and the length of the pistol over all is 8 ins. The mechanical design of the present pistol has been improved by the addition of a series of notches on the barrel which engage with a series of projections in the frame, thereby producing an efficient stop to the backward motion of the barrel however sharply it may be operated by the recoil movement.

The annual report of the New Explosives Company shows a net loss on last year's working of £1,346, after deducting debenture interest, income tax and all trading expenses. The explanation for this low water level of trading result is ascribed mainly to two causes. Firstly, a great reduction in Government orders for cordite, and secondly, the keen competition which has resulted from this reduction of orders. Manufacturers are in fact ready to take contracts at cost price, rather than allow their works to stand idle. The report concludes with a sympathetic reference to the death of the late chairman, Mr. F. Machell Smith, who for so many years ably supervised the Company's interests. Mr. E. H. Hindley has been elected chairman.

The firm of Cogswell & Harrison, Ld., made application before the Justices of the Peace at Staines on the 26th ult. for permission to erect a powder factory on their estate at Colnbrook. The applicants were represented by counsel, and were supported by Mr. W. F. Reid and Mr. F. W. Jones, as expert witnesses. The opposition was very strong, being represented by counsel and several solicitors. Nearly the whole of the tenants of the immediately surrounding lands opposed the application; but the Bench adopted the view of the applicants to the effect that the Home Office made all needful provision for the safety of the neighbourhood, and that a factory for making explosives was no more objectionable than any other kind. At any rate the application was granted without any qualifying clauses or comments.

Messrs. Lane Bros., the well-known makers of air-guns, have had the enterprise and ingenuity to devise a new form of air-gun slug, which can hardly help being highly appreciated by many users of this popular type of weapon. The slug contains a minute charge of match composition, whereby the bullet goes off with a bang when striking a hard substance. This explosive effect will doubtless be popular in that the lack of noise in the discharge of the missile will be compensated by a report produced in the act of striking an iron plate or other solid target. For air-gun galleries, and for scaring unwelcome visitors to back gardens, without the cruelty which is associated by actually hitting them with a pellet, the new Bango bullets should prove a success. The Home Office aspect of their issue has been thoroughly threshed out, and no difficulties need be anticipated in that direction.

The profit shown on the balance sheet of Messrs. Eley Bros. amounts to £28,852, which, with the carry forward, makes a total of £30,558 available for distribution. Interest on debentures and loans and directors' remuneration absorb £4,355. A dividend of ten shillings per share is recommended, this being the same five per cent. distribution as last year. In addition it is proposed to write off the £800 from the assets entitled clay bird patents, to transfer £11,068 to reserve, and to carry forward the remaining £1,834. A revaluation of the item £64,923 for machinery and plant has made it necessary to write off in depreciation the sum of £24,857, leaving the balance sheet item, with the additions for 1905, at £45,680. The report announces the resignation from the directorate of Mr. J. C. Irvine, and it also mentions that Mr. T. A. Welton does not seek re-election as auditor, and that the Board suggests that Messrs. W. B. Peat & Co. be elected to the position.

THE NEW HEAT TEST.

THE issue by H.M. Inspectors of Explosives of a revised version of the official heat test governing the stability of explosives is an event of considerable importance to the whole industry. The prescribed alterations from previous practice are slight in themselves, and in no instance do they represent anything in the nature of a revolution.

The first page which deals with "apparatus required" introduces no new points, but the next heading "materials required" contains some new provisos, due we believe to Mr. William Cullen having pointed out the influence on a heat test exercised by the stoutness of the filter paper used. The new wording is shown in the following extract by italics:—

"Strips, or sheets, of *smooth* white English filter paper, previously washed with water and re-dried, are dipped into the solution thus prepared, *weighing, air dry, about 6·5 grams per 100 square inches*, etc., etc."

In a footnote the following very important new proviso should be noted:—

"After preparation the paper should be kept in the dark for a month before being taken into use. After that, if carefully kept in the dark, it will remain good for six months or more, but should be tested from time to time as above."

The special instructions for testing Dynamite, Blasting Gelatine, and other explosives of the first division of the nitro-compound class are sub-divided into three sections, viz., Dynamites, Blasting Gelatines and propellants of the Cordite type. With respect to Dynamite the instructions show how a sufficient quantity of the nitroglycerine is to be collected into a graduated measure without the presence of water being apparent. The fifty grains which are set aside for testing are to be inserted in the usual fashion into a test tube, with test paper, thermometer and all the other well-known paraphanalia of the test. The following sentence is not quite clear by reason of the use of the word "is":—

"The test is complete when the faint brown line which after a time makes its appearance *is* at the line of boundary between the dry and the moist part of the paper equals in tint the brown line of the standard tint paper."

"The nitroglycerine under examination will not be considered *to have satisfied the test* unless the time necessary to produce the standard tint as above described is at least 15 minutes."

The sub-class for the gelatines prescribes the manner of incorporating the 50 grains of explosive with twice its weight of French chalk and inserting the same in a test tube. The instructions then say:—

"The test-paper is then to be inserted and the heat is to be applied in the manner prescribed above for the dynamite heat test, and the sample tested is to withstand exposure to 160° F. for a period of ten minutes, before producing a discolouration of the test paper's corresponding tint to the standard colour test which is employed for governing the results of the dynamite heat test."

"Non-gelatinized nitroglycerine preparations, from which the nitroglycerine cannot be expelled by water, are tested without any previous separation of the ingredients, the temperature being as above (160° F.) and the time being seven minutes."

The Cordite and Ballistite sub-class require the same apparatus as for the other nitro-compound explosives, except for the use of a sieving process to govern the size of the granules nto which the material must be separated to make it ready for the test. Previous issues of instructions have specified a nest of sieves "similar to those used at Waltham Abbey," a description that could not carry meaning to everyone. The vagueness so occasioned is now removed by the following very ample foot-note:—

"A nest of two sieves with holes drilled in sheet copper. The holes in the top sieve have a diameter = 14 B.W.G.; those in the second = 21 B.W.G. If too hard for the mill, it may be softened by exposure to the vapour of acetone, or reduced to the necessary degree of sub-division by means of a sharp moderately coarse rasp. Should it have become too soft in the acetone vapour for the mill, it should be cut up into small pieces which may be brought to any desired degree of hardness by simple exposure to air. Explosives which consist partly of gelatinized collodion cotton and partly of ungelatinized guncotton are best reduced to powder by a rasp, or softened by exposure to mixed ether and alcohol vapour at a temperature of 90° to 100° F."

For the information of those of our readers who have not the Birmingham wire gauge sizes before them we may state that No. 14 has a diameter of ·083 in. and No. 21 ·032 in. The method of dividing the Cordite into granular portions is then explained at length. Under the new conditions the material must be passed through the mill *once only*, whereas previously it had to be so treated more than once. The following appears to be new matter:—

"If the mill is properly set, the greater portion of the ground material will be of the proper size. If the volatile matter in the explosive exceeds 0·5 per cent. the sifted material should be dried at a temperature not exceeding 140° F., until the proportion does not exceed 0·5 per cent."

Then follows the description of the method of applying the test. The sentence referring to the appearance of the faint brown line here reads quite unambiguously by reason of the omission of the superfluous "is" quoted higher up. The time limit preceding the appearance of the brown line is 15 minutes for the Cordite sub-class."

The guncotton series of explosives opens with the treatment to be accorded to compressed nitrocellulose, tonite, etc. The process of reducing to a fine state must now be conducted by rubbing *through a sieve with a clean hard brush*, and not with the fingers as before. In describing the preliminary treatment of the sample the *brush* is again specified as the medium for rubbing into a fine state of division. The details of the test itself conclude with the usual reference to the brown line, again in language slightly different from the previous corresponding sentences, but amounting to the same thing. The following specifies the time limit:—

"The interval of time between the first insertion of the tube containing the sample of guncotton in the water at 170° and the production of the standard tint constitutes the test, and this interval of time must not be less than ten minutes, or the sample will not be considered to have satisfied the test."

The gelatinized preparations are now amplified by the added words "and semi gelatinized." The instructions under this head suffer, as did the previous sheet from want of clearness. It reads "Twenty-five grains introduced into test tube of the dimensions prescribed for the dynamite heat test, then proceed as for Blasting Gelatine, etc., taking the temperature at 180° F. and the time as 15 minutes." The mode of procedure with Blasting Gelatine refers to the use of French chalk, this apparently being the only special treatment accorded thereto. The similarity to the Blasting Gelatine test only commences at the point of inserting into the test tube, and therefore does not include the French chalk

treatment, a point which should be made more clear when the next sheet is issued.

The sub-class for nitrocellulose explosives, not included in the two preceding classes, refers to Schultze, E.C., and other analagous explosives. The instructions read:—

"Sufficient of the sample, without further mechanical division, is dried in the oven as above, and then exposed for two hours to the air. The test as directed above for Compressed Nitrocellulose, etc., is then applied, the minimum duration of test being the same, viz., 10 minutes."

The heat test for Picric Acid which has been regarded as somewhat of a chemical anomaly has now disappeared, and the following requirements take its place:—

"(1.) The material shall contain not more than 0·3 part of mineral or non-combustible matter in 100 parts by weight of the material dried at 160° F.

"(2.) It should not contain more than a minute trace of lead.

"(3.) One hundred parts of the dry material shall not contain more than 0·3 part of *total* (free and combined) sulphuric acid, of which not more than 0·1 part shall be *free* sulphuric acid.

"(4.) Its melting point shall be between 248 deg. and 253° F."

Ammonite, Bellite, Roburite, and other similar explosives are required to stand the same heat test as Compressed Nitrocellulose. No tests were previously laid down for chlorate mixtures, and the following new matter relates thereto:—

"The material must not be too sensitive and must show no tendency to increase in sensitiveness on keeping.

"The material must contain nothing liable to reduce the chlorate.

"Chlorides calculated as Potassium Chloride must not exceed 0·25 per cent.

"The material must contain no free acid, or substance liable to produce free acid.

"Explosives of this class containing nitro-compounds will be subject to the heat test as if they belonged to Class III."

The balance sheet of the Webley and Scott Revolver and Arms Co., Ld., is accompanied by a second document showing the details of a scheme for capital reduction which represents the result of a compromise with the body of shareholders which opposed the previously suggested re-arrangement of assets. The profit for the nine months ending the 30th September last, after making ample provision for the usual repairs and depreciation, amounts to £3,873, which, with the amount brought forward from the previous year, leaves £5,284, which has been applied for a four per cent. preference dividend. In connection with the proposed reconstruction the whole of the property and assets of the Company have been re-valued on an independent basis, and it must be a source of satisfaction to the present management of the Company to find that the items for which they are responsible, and in respect to which depreciation has been written off from year to year, stand under the new valuation at substantially the old figures, the balance sheet amounts having in some instances been actually increased. The writing down of assets is accordingly confined to those items of property, such as goodwill and so forth, which the Company took over from the promoter about nine years ago, at the time of its formation. Briefly stated it is proposed to reduce the capital by the sum of £117,250, by issuing to the preference shareholders one £3 10s. cumulative five per cent. fully-paid preference share and one fully-paid ordinary share of £1 10s. in exchange for each £5 preference share now held, and by issuing to the ordinary shareholders one fully-paid share of £1 10s. in exchange for each £5 ordinary share now held. The capital will then be as follows:—33,500 five per cent. cumulative preference shares of £3 10s. each = £117,250; 67,000 ordinary shares of £1 10s. each = £100,500, making a total of £217,750.

SIR WILLIAM WHITE ON MODERN ARTILLERY.

THE able series of lectures before the Society of Arts, which the late Chief Constructor to the Navy has recently brought to a close, contain many elements of interest for the expert as well as for the novice. The altogether exceptional experience, with which Sir William White must be credited, is coupled with a ready faculty for debate, and a wonderful power of summarising generalities, and thereby separating radical principles from the details from which they are evolved. In reviewing early developments Sir William White showed that the progress made was for a long time very slow. The largest naval gun of 1599 was of the same calibre as the 68-pounder of 1859, and threw a 60-lb. projectile. The long period of stagnation in naval artillery ended when the building of iron-clads began. The highest muzzle velocities obtained with muzzle-loading guns were about 1,600 feet per second, but with the introduction of breech-loaders, velocities of 2,000 feet per second were obtained with 6-inch and 8-inch guns. About 1881, when the Inflexible was commissioned, the breech-loading system was fully approved; and since that date remarkable progress had been made in the design and manufacture of guns, gun-mountings and projectiles. The largest breech-loading guns mounted in British ships are 16¼-inch 110-ton guns, 47 feet long, throwing 1,800-lb. projectiles, with a muzzle velocity of nearly 2,100 feet, capable of penetrating 34½ inches of iron at 1,000 yards.

Since 1894 the 12-inch calibre has been preferred, and great improvements made in the design. The earliest 12-inch guns were about 27½ feet long, and weighed 45 tons, the projectiles weighed 714 lbs., and the muzzle velocity was about 1,900 feet per second, the thickness of iron penetrable at 1,000 yards being 21½ inches. The 50-ton 12-inch guns now carried are 41½ feet in total length (40 calibres in bore), the muzzle velocity is about 2,600 feet per second, and the penetration of iron at 1,000 yards 38 inches. The projectiles weigh 850 lbs. In the Dreadnought the 12-inch guns are to be 45 calibres, with 2,850 feet per second muzzle velocity, and the penetrating power correspondingly increased.

The great reason for long-range fighting was to be found in improvements made recently in the speed and accuracy of torpedoes, so that instead of 800 yards being taken as their full effective range, and about 2,000 yards as minimum fighting range, the former was now fully 2,000 yards and the minimum fighting range about 4,000 yards. Taking all the conditions into account, improvements in gunnery have practically matched those in torpedoes.

The lecturer made reference to particulars of the Dreadnought's armament just published. A diagram was shown, based on these accounts, and the popular estimate that, because the Dreadnought is to carry ten 12-inch guns, she will be equal to two or three earlier battleships each carrying four 12-inch guns, was declared to be crude and misleading. The disposition of the armament was also shown to have limitations and drawbacks arising from the desire to increase bow-fire and broadside-fire. The lecturer dissented from the opinion that only heavy guns would count in future naval engagements, and drew attention to the comparatively small supplies of ammunition carried with heavy guns.

SUBMARINE EXPLOSIONS.

BY C. E. BICHEL.

(Translated from "Marine Rundschau" Nov., 1905, by Axel Larsen).

Concluded.

Before considering in detail the absolute and comparative results obtained from experin ents under water with explosives commonly used for military purposes, it may be well to refer in brief to their chief characteristics from a military point of view. *Guncotton* is so well known that it may be passed over without further mention than that the material used for these experiments was of the kind commonly supplied, and that it had a density of 1·21.

Picric acid possesses a very high potential, but has other properties of a less satisfactory nature. Both its tendency to enter into combinations with metals and salts through mere contact, forming corresponding picrates, picramates and various reduction-compounds all of which are extremely sensitive and chemically unstable, and the poisonous vapours given off by it during manufacture and melting are causes of unavoidable trouble and risk. and unless such direct metallic contact can be obviated or rendered innocuous, the employment of this material for military purposes is practically prohibitive.

Trinitrotoluol, on the other hand, has none of the disadvantages of picric acid, and, if chemically pure, *i.e.*, with a melting point of 81° to 81·5° C., it is eminently suitable for military use, especially when compressed to a density of from 1·6 to 1·70. As has been stated already, this can be accomplished without diminishing its aptitude of detonation.

Chemically pure picric acid shows almost the same absence of sensitiveness as Trinitrotoluol, yet the latter has proved itself to be the least sensitive of all known explosives. The accompanying table of results obtained with falling weights demonstrates this. It is obvious that this property is of considerable importance, as it implies freedom from "prematures" and general safety of handling in respect of torpedoes and mines. With a detonator containing 2 grammes of fulminate, embedded in a priming charge of loose crystalline Trinitrotoluol, the detonation of the entire compressed bursting charge is perfect.

When chemically pure, Trinitrotoluol may be stored with absolute safety for any length of time. During melting and compressing no noxious vapours are given off, and the material may be handled without any evil effects to the skin and respiratory organs of the workmen. It remains unaffected by direct contact with metals, even in the presence of moisture, and is absolutely test-proof, *i.e.*, it parts with some of its nitrogen only when heated to a temperature considerably higher than its melting point. Lengthy exposure to the light causes a slight discolouration of the surface but the chemical stability remains unimpaired. Trinitrotoluol is insoluble in cold water; at a temperature of 40° C. minute traces only pass into solution. If the temperature of the water is raised to 90°C. the material melts; 1 litre of water will in that case absorb 1·25 grammes of Trinitrotoluol. Being practically non-hygroscopic, it requires only such care in packing and storing as is usually exercised in the treatment of valuable goods. Unlike guncotton which readily absorbs water, compressed Trinitrotoluol is impermeable thereto.

The frame used for the shot-firing trials under water at first carried three dynamometers, two of which were placed on the same level as the central charge, the third being suspended vertically above it. Ultimately, however, the latter apparatus had to be dispensed with as it gave unreliable results. Owing to insufficient depth of the water this dynamometer could not be lowered deeper than two metres below the surface, which caused the intervening water to escape upwards more quickly than in a horizontal direction and thus to produce irregular effects. The lower dynamometers gave fairly concordant readings. As it was only intended, in the first instance, to obtain comparative results, the springs of the apparatus were not graduated. This omission, however, will have to be rectified in addition to certain other modifications of construction, in order to arrive at absolute values, both as regards the indicated maxima of percussion and pressure, and the time-interval between the two curves.

TABLE SHEWING COMPARATIVE SENSITIVENESS TO SHOCK CAUSED BY FALLING WEIGHTS.

Explosive.	Weight=100 gr.		Weight=250 gr.		Weight=500 gr.		Weight=1 kilo.		Weight=2 kilos.		Weight=5 kilos.		Weight=20 kilos.	
	Drop in cm. causing		Drop in cm. causing		Drop in cm. causing		Drop in cm. causing		Drop in cm. causing		Drop in cm. causing		Drop in cm. causing	
	Expl.	No Expl.	Expl.	No Expl.	Expl.	No Expl.	Expl.	No Expl.	Expl.	No Expl.	Expl.	No Expl.	Expl.	No Expl.
Nitroglycerine	10	5	5	—	5	—	5	—	5	—	5	—	5	—
Gelatine Dyn.	10	5	5	—	5	—	5	—	5	—	5	—	5	—
Dinitroglycerine ..	15	10	15	10	5	—	5	—	5	—	5	—	5	—
Gel. Dyn. with do. ..	35*	30	20	15	10	5	5	—	5	—	5	—	5	—
Trinitrotol, cryst. ..	+200	200	+200	200	+200	200	190*	180	100*	90	60*	50	5*	—
do. compr. ..	+200	200	+200	200	+200	200	+200	200	160*	150	90*	80	5*	—
Picric Acid, cryst. ..	+200	200	+200	200	+200	200	200*	190	110*	100	60*	50	5	—
do. compr. ..	+200	200	+200	200	+200	200	+200	200	150*	140	90*	80	5	—
Guncotton, dry ..	40*	30	20*	15	10*	5	10	5	10	5	5	—	5*	—
do. with 15% water	+200	200	80*	70	20*	10	20	10	15	10	10	5	5*	—
Fulminate of Mercury .	10	5	5	—	5	—	5	—	5	—	5	—	5	—

* Partial Explosion. No drop given under 5 centimetres. + 200 means more than 200.

Dr. Blochmann's apparatus was however constructed so as to release and start the revolving drum at the same moment as the shots were fired, an arrangement which could but result in variable rotary speeds and, consequently, in variable indications of time interval. The diameter of the drums likewise proved to be too small. These defects are, however, easily rectified.

The adjoined tabulated results (Table II.) demonstrate that the first (percussion) maximum for Trinitrotoluol is about 27 per cent., and the second (pressure) about 7·5 per cent. higher than those registered for dry and wet guncotton.

TABLE II.

Explosive.	Gravimetric density.	Volume of Charge.	Weight of Charge.	Ordinates of the first Maximum.	Ordinates of the second Maximum.
		Cubic cent.	Grammes.	mm.	mm.
Guncotton, dry— $C_{12}H_{15}(NO_2)_{15}O_{10}$ ..	1·20	450	540	31·5	35·4
Do., containing 10% of water— $C_{12}H_{15}(NO_2)_{15}O_{10}$ + 10% H_2O ..	1·20	450	594	31·0	35·0
Picric Acid— $C_6H_2(NO_2)_3OH$	1·44	450	650	31·0	30·0
Trinitrotoluol— $C_6H_2(NO_2)_3CH_3$	1·61	450	720	39·9	37·8

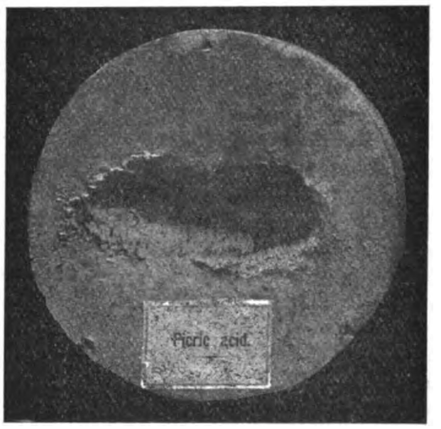
These results tally fairly well with values previously obtained by theoretical calculation although the densities of the two explosives were in that case different from those now used. As certain fallacies are inseparably connected with the theoretical method of gauging phenomena of explosions it was deemed desirable to check the results by practical experiments under water.

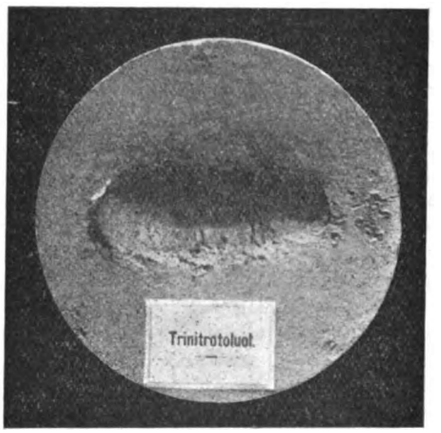
Another means used for checking the correctness of these values was by lead-block expansion (Trauzl test), the rate of detonation as well as the temperature of explosion for Trinitrotoluol, picric acid and guncotton lying within sufficiently close limits to render this test reliably comparative. In order,

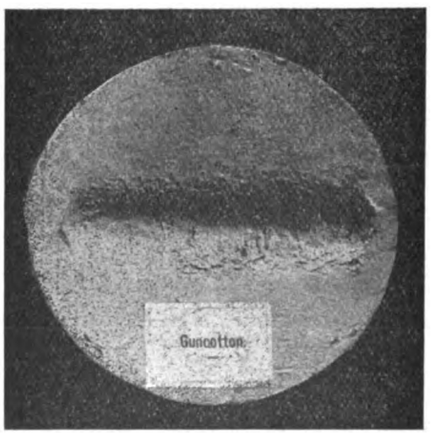
TABLE III.

Explosive.	Density.	Volume of Charge.	Weight of Charge.	Net Expansion.
		Cubic cent.	Grammes.	Cubic cent.
Picric Acid	1·415	49·5	70	2,390
Trinitrotoluol	0·958	49·5	47·5	1,330
	1·415	49·5	70	2,250
	1·610	49·5	80	2,700
	1·718	49·5	85	2,873
Guncotton, dry	0·475	49·5	23·5	230
	1·210	49·5	60	2,145
Ditto, with 7·4 % of water ..	1·210	49·5	60	2,081

however, to ensure perfect detonation of the charge which, in the case of Trinitrotoluol, would require a volume of at least 50 cubic centimetres, the standard dimensions of the Trauzl lead-block (20 centimetres by 20 centimetres) had to be increased, a ball-shaped block of 40 centimetres diameter and having a 30 millimetre bore-hole of half this depth, being ultimately employed. The charges were stemmed in the usual manner prescribed for this test. As shown in Table III., the expansions obtained for Trinitrotoluol of 1·61 density were 26 per cent. larger than for dry guncotton and 30 per cent. larger than for wet guncotton; with a density of 1·71 the







superiority of Trinitrotoluol over dry guncotton was even increased to 34 per cent. These results can easily be verified by repeating the Trauzl test with lead-blocks cast as above described. The accompanying reproductions of photographs

show the relative plastic effects of cartridges exploded on lead discs, thus illustrating the percussive force referred to in the first part of this article. It will be seen that the depth of the furrow struck in the metal varies with the rate of detonation of the explosive.

This article cannot be brought to a close without expressing thanks to Messrs. Chas. Griffin & Co., Ld., for the use of certain of the blocks which have appeared.

A USEFUL TABLE OF PATTERN.

IT will be remembered, no doubt, by many of our readers that the *Field* published, and Messrs. Curtis's & Harvey reproduced in their *Notes on Shooting*, a very useful table, showing the proportional patterns obtainable with many combinations of charges. The system of classification adopted was to divide the degrees of spread in a gun according to the percentage of pellets falling within a 30-inch circle at 40 yards. Each section of the table related to a given per cent. of pattern, the rate of advance being 5 per cent. at a time. The nominal full-choke result of 220 pellets in the 30-inch circle was not exactly covered either by the 70 or 75 per cent. section of the table, the former giving 213 pellets and the latter 228. The improved cylinder pattern was likewise 137 pellets, according to the 45 per cent. degree of distribution, instead of the usual figure of 140. In a similar fashion the half-choke result gave 182 pellets instead of the nominal 180.

Character of Boring.	Weight of Charge in oz.	Pellets in 30 in. circle at 40 yards for different sizes of shot.						
		3	4	5	5½	**6**	6½	7
FULL CHOKE, 72 %	1¼	127	155	198	217	245	271	308
	1 3/16	120	148	187	206	232	258	292
	1⅛	114	140	177	195	**220**	244	277
	1 1/16	108	132	168	185	208	231	261
	1	101	124	158	174	196	217	246
	15/16	95	116	148	163	184	203	231
	⅞	89	109	138	152	171	190	215
	13/16	82	101	128	141	159	176	200
HALF CHOKE, 59 %	1¼	104	127	162	178	200	222	252
	1 3/16	98	122	153	168	190	211	239
	1⅛	94	115	145	159	**180**	200	227
	1 1/16	88	108	137	151	170	189	213
	1	83	102	129	142	160	178	201
	15/16	78	95	121	133	150	166	189
	⅞	73	89	113	124	139	156	176
	13/16	68	83	105	115	130	144	163
IMPROVED CYLINDER, 46 %	1¼	81	99	126	138	156	173	196
	1 3/16	76	94	119	131	148	164	186
	1⅛	73	89	113	124	**140**	156	176
	1 1/16	69	84	107	117	132	147	166
	1	64	79	100	111	124	138	157
	15/16	60	74	94	104	117	129	147
	⅞	57	70	88	97	109	121	137
	13/16	53	64	82	90	101	112	127
CYLINDER, 36 %	1¼	63	78	99	108	122	136	154
	1 3/16	60	74	94	103	116	129	146
	1⅛	57	70	89	98	**110**	122	138
	1 1/16	54	66	84	92	104	115	131
	1	51	62	79	87	98	108	123
	15/16	47	58	74	81	92	102	115
	⅞	44	55	69	76	85	95	108
	13/16	41	51	64	71	79	88	100

The nearest to the true cylinder result worked out at 106 pellets instead of the nominal 110. Although these differences are very slight in themselves, it has occurred to us that it would be interesting to work out a new table based on the exact conventional figures, and we accordingly append the same herewith.

Everyone who carries out pattern experiments with guns, and all who come into contact with sportsmen desirous of knowing the probable pattern results from a given gun with any one of the many combinations of charge which can be used, will find this table of considerable value as a means of saving a great deal of arithmetic. It does not, of course, follow that any particular series of experiments will exactly carry out the figures of the table, but if the gun is normal in its behaviour the tendency will be for the average results of a large number of experiments to reproduce the nominal figures. The average arithmetical average pattern is in fact a better index of a gun's characteristic behaviour with variations from the standard charge than any individual series of experiments. This must be so, because each test is liable to contain a certain number of special conditions. The powder may be unduly strong or weak according to the time of year. The wadding may be abnormally hard or soft. The turnover may not be a true average of all turnovers; and unless very special precautions are taken the charge and size of shot may be sufficiently different from standard to give a surplus or deficit on the theoretical total pellets in the charge. A practical test would doubtless substantially confirm the results tabulated in the adjoining column, and the typical of a series is, therefore, the one which most closely conforms with the value shown at the intersection of the vertical line which relates to the size of shot and the horizontal line denoting the weight of charge. The range of charges covered by the table includes all combinations likely to be employed, starting with the 2¾-in. chamber pigeon gun, and going down to the 20-bore gun taking the 2½-in. nominal length of cartridge case. No patterns are stated for shot sizes smaller than 7, this being largely due to the fact that when the pellets become very small there are few guns which give proportional results. More than this, the 40 yards result with No. 8 shot is of very little interest, because this size is mainly associated with short distance shooting at small birds, such as snipe and quail.

APPLICATIONS FOR PATENTS.

JANUARY 29—FEBRUARY 17, 1906.

2,240.* Targets. G. Easdale, Z. C. & H. G. Ketchum.
2,289.* Ammunition. E. Cadenaccio.
2,292. Small Arms. C. Wick.
2,513.* Ammunition. Fried. Krupp, Akt.-Ges. (Date of application in Germany, April 10, 1905).
2,577. Targets. W. J. Geary and J. Little.
2,586. Small Arms H. T. Ashton.
2,647. Ordnance. F. J. Jackson.
2,814. Ordnance. W. A. Burns.
2,819. Explosives. O Silberrad.
2,820. Explosives. O. Silberrad.
2,829. Ammunition. A. J. Davidson.
2,863. Air Guns. C. Gardner and L. B. Taylor.
2,895.* Ammunition. P. Devillers.
2,985.* Explosives. S. Laszczynski.
3,005. Explosives. H. C. L. Bloxam and Maganite Explosives Syndicate, Ld.
3,007. Receptacles for Ammunition. O. Imray.
3,087.* Ordnance. Fried. Krupp, Akt.-Ges. (Date of application in Germany, April 10, 1905).

3,093. Ordnance. A. T. Dawson and G. T. Buckham.
3,094. Gun Mountings. A. T. Dawson and G. T. Buckham.
3,097. Ordnance. A. T. Dawson and G. T. Buckham.
3,100. Ordnance. A. T. Dawson and G. T. Buckham.
3,126. Ordnance. Sir W. G. Armstrong, Whitworth & Co., Ld., and F. G. D. Johnston.
3,142.* Small Arms. J. Lauber.
3,247. Target. A. C. Fawcett.
3,329.* Ammunition. E. M. Johnson.
3,336. Small Arms. A. T. Dawson and G. T. Buckham.
3,359. Ammunition. T. Page-Wood.
3,464. Small Arms. J. Betteridge.
3,659. Small Arms. C. H. R. Norrington.
3,661.* Explosives. W. Nikolsky.
3,685.* Ammunition. E. Ohl.
3,736. Torpedoes. A. Elgar.
3,783. Fuses. O. L. Peard.
3,784. Fuses. O. L. Peard.
3,966 Ammunition. King's Norton Metal Co., Ld., T. A. Bayliss and E. Whitworth.
3,981.* Small Arms. G. B. Osterhaut.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

FEBRUARY 1—22, 1906.

COMPILED BY HENRY TARRANT.

29,305 (1904). **Range Finder**. G. M. Lawford, D. S. Capper, and D. Kirkland, London. A range finder consisting of two telescopes mounted upon a graduated base is dealt with in this specification. The telescopes are so disposed that whilst the lines passing through their axes always make the same angle at the point of intersection, one may be moved along the fixed base towards the other, so as to vary the distance of this point. The base is graduated so that the range may be conveniently read off. Accepted January 31, 1906.

866* (1905). **Back Sight for Rifles**. J. T. Peddie, London.

2,730 (1905). **Automatic Small-Arms Mechanism**. Major H. F. Woodgate, London. By means of a combination and arrangement of levers attached to the breech bolt and barrel of an automatic arm, part of the energy of recoil is stored in a long spiral spring running parallel with the barrel. When the barrel and breech together have recoiled to the fullest extent the spring draws the barrel away from the bolt back to its original position. When it reaches this position the system of levers acts so as to communicate the remaining energy in the spring to the bolt and to return this part. Accepted January 18, 1906.

3,495 (1905). **Torpedo Propulsion**. Sir W. G. Armstrong, Whitworth & Co., Ld., and W. H. Sodeau, Newcastle-on-Tyne. The patentees describe a method of keeping constant the quantity of fuel designed to heat the compressed air forming the motive power of torpedoes. The combustion takes place in an enlarged portion of the pipe which conveys the air to the engine. Accepted February 1, 1906.

7,933 (1905). **Torpedo Mechanism**. Sir W. G. Armstrong, Whitworth & Co., Ld., and Commander C. W. Lloyd, Newcastle-on-Tyne. (Partly communicated by *A. J. van Stockum, Holland*). The position of the horizontal rudders, and thus the depth, of a torpedo is controlled by a vessel containing mercury and having its ends closed by vertical diaphragms rigidly connected together. Accepted January 25, 1906.

8,287 (1905). **Percussion Primer for Ordnance**. C. Holmström, London, E. Middleton, Sheffield, and G. A. Kohler, London. A perforated plug is screwed into the magazine of a percussion primer. The plug possesses a protuberance which is driven back when firing occurs into a seat constructed for it in the bottom of the primer. The gases are thus prevented from escaping rearwardly. Accepted January 25, 1906.

8,290 (1905). **Breech Mechanism of Ordnance.** C. Holmström, London, E. Middleton, Sheffield, and G. A. Kohler, London. The transversely sliding breech block type of quick-firing and howitzer mechanism is modified so as to improve the cartridge-ejecting mechanism, to retain the cartridge in place when the gun is loaded at a high angle, to improve the firing mechanism, and to prevent the gun from being fired unless the breech is properly closed. Accepted January 18, 1906.

8,693 (1905). **Instrument for Facilitating "Ranging" of Ordnance**. A. W. Ryland, Preston. By means of a board marked out with graduations in minutes right and left, and provided with two arms or pointers, the position of the fall of a projectile as reported by two trained observers may be indicated for the convenience of the gun layers. Accepted January 25, 1906.

8,718 (1905). **Automatic Small-Arms.** M. F. Smith, U.S.A. The automatic small-arm mechanism which was dealt with in patent No. 25,609 (1904) has been improved upon. The breech bolt is thrown back by a rod operated by the recoil, or it may be worked by hand. The travel of the breech bolt may be stopped at a certain point, so that a cartridge is not loaded from the magazine, but may be inserted by hand. Other modifications are set out. Accepted February 1, 1906.

10,361 (1905). **Small-Arm Sights.** F. D. Hopkins, U.S.A. The front sight described in this patent is used in conjunction with a rear sight of the Lyman type, and is adapted to allow of the use of both eyes when aiming. The front sight consists of a circular field upon which is painted a central spot. The colour of the field contrasts with the colour of the spot. The left eye sees the objects whilst the right eye aligns the sights. Accepted January 18, 1906.

10,941 (1905). **Breech Adaptor for Small Ammunition.** J. Hassell, London. The type of breech adaptor to allow of the use of smaller ammunition than the weapon to be used was intended for described in Patent No. 7,927 (1889), is modified. A breech lining following the style of the large cartridge used is adapted to receive the small cartridge at its neck. The ordinary striker communicates its motion to the small cartridge cap through a bolt held within the casing by a series of spring clips. Accepted February 1, 1906.

11,726 (1905). **Range Finder**. Dr. A. König, Germany. Coincidence telemeter construction is dealt with in this patent. The optical construction of the telescopes which lie at either end of the fixed base and through which the images of the distance object are transmitted to one common eyepiece, and the construction of the separating prism, are modified. Accepted February 1, 1906.

11,817 (1905). **Improvements in Air Gun Parts**. The Birmingham Small Arms Co., Ld., and A. H. M. Driver, Birmingham. The barrel and breech piece of air rifles of the fixed barrel type have been assembled by screwing, and loss of air has been experienced by reason of its escape through the screwed joint. This disadvantage is obviated, and a reduction in cost of production is obtained by making the barrel and the breech piece solid with one another, and from one single bar of steel, by forging and drawing down processes. Accepted January 11, 1906.

12,034 (1905). **Divided Breech Mechanism of Ordnance.** Sir W. G. Armstrong, Whitworth & Co., Ld., and A. G. Hadcock, Newcastle-on-Tyne. An amount of jar has been experienced when rapidly removing or returning the divided breech screw with a "single motion" hand lever. To avoid this jar, which is due to the sudden change of motion between the swinging of the breech gear and the turning of the breech screw, means are established of gradually starting the turning of the breech screw when closing the breech during the last part of the swinging movement. The threads of the screws are not cut away, but are cut on a new system. Accepted January 11, 1906.

12,658 (1905). **Removing Gases from Ordnance.** F. Bohn and F. Bündgens, Germany. In order to prevent the escape of the gases of combustion into an armoured turret a hood is arranged over the breech and a suction is set up in that proximity, so as to withdraw the escaping gases, and to lead them out into the outer atmosphere. Accepted January 25, 1906.

13,116 (1905). **Ordnance Firing Mechanism**. Lieut. A. T. Dawson and G. T. Buckham, London. Patent No. 19,148 (1904) dealt with a pistol grip of the type used mechanically to fire ordnance, and which is operated and occupies the position usually associated with an electrical firing pistol grip. The present improvements relate to the spring racket device and

to the manner in which the trigger and firing rods co-operate to fire the gun when the trigger is pulled, and to re-energize the spring racket device when the gun recoils. Accepted January 25, 1906.

14,587 (1905). **Charger Guides of Magazine Rifles**. The Birmingham Small-Arms Co., Ld., and G. Norman, Birmingham. The charger guides, which are adapted to hold the clip when cartridges are being loaded into the magazine of the Lee-Enfield rifle, are formed upon opposite sides of the loading aperture in the breech body. One guide is so formed as to provide a clearance upon its inner side for the free passage of the bolt head. Accepted January 18, 1906.

14,676* (1905). **An Improved Clay Bird**. W. W. & H. T. Watts, Hendon, and K. D. G. Browne, Castlebar, Ireland.

15,601 (1905). **Automatic Small-Arms Mechanism** C. Freeman, U.S.A. The automatic arm described in this patent has a fixed barrel. To the movable breech bolt is attached what is called a momentum block. The bolt is locked momentarily after a short, sharp backward movement, and the impulse of recoil is communicated to the momentum block. The movement of this block completes the automatic working of the breech. Any length or size of cartridge may, it is claimed, be used with this system. Accepted January 25, 1906.

16,288 (1905). **Indicating Flight of Projectiles**. J. B. Semple, U.S.A. Pressure is applied to a substance contained within a projectile, so that the substance is discharged into the air during the flight of the projectile. Its trajectory may in this manner be clearly seen. Lampblack and oil may be used during the day, and zinc ethyl or a solution of phosphorus in carbon bisulphide, both of which ignite when exposed to the atmosphere, during the night. Accepted January 18, 1906.

19,402 (1905). **Composition for Percussion Caps**. F. Gehre, Germany. Instead of fulminate of mercury generally used in filling percussion caps, dinitromesytiles or trinitromesytiles, dinitropseudocumol or trinitropseudocumol, or dinitroxylol or trinitroxylol in the solid state is employed. Either of these nitro-substances used is given a thin coating of fulminate of mercury when loading into the cap. Accepted January 11, 1906.

19,842 (1905). **Removing Gas from Ordnance**. C. V. Alsop, U.S.A. In order to prevent "back flare," and to withdraw the gases of combustion and vapours which remain in the gun immediately after firing, a suction apparatus is connected with the muzzle of the gun. This sucker is operated by the gun's recoil, and the gun is cleared by it before it is finally brought to rest. Quick firing is thus enhanced, and discomfort in the turret obviated. Accepted January 11, 1906.

19,893 (1905). **Safety Device for Automatic Arms**. J. Tambour, Paris. A limb vertically arranged within the lock of an automatic small-arm is caused to secure the striker and trigger against movement until it is released by pressure of a hand upon a lever situated in the known manner beneath the grip of the weapon. Accepted January 11, 1906.

20,239 (1905). **Safety Catch for Small-Arms**. J. Tambour, Paris. A lever adapted to be pressed is arranged upon the top strap of a small arm. The lever communicates with a trigger or hammer locking device in the lock mechanism. This safety device is shown in the specification in connection both with hammer and hammerless guns and also in several variations of construction. Accepted January 25, 1906.

20,310* (1905). **Manufacture of Nitroglycerine**. C. L. Reese, U.S.A.

20,732 (1905). **Automatic Pistol Mechanism.** O. Imray, London. (Agent for *Colt's Patent Fire Arms Manufacturing Co., U.S.A.*) The automatically operated pistol mechanism described in Patents Nos. 9,871 (of 1897) and 9,711 (of 1902) is modified in order to solidify and simplify the construction. The movement of barrel and breech and their connection and parting are principally dealt with. Accepted February 1, 1906.

21,036 (1905). **Construction of Ordnance.** E. J. Blood, U.S.A. A piece of ordnance is built up of a barrel surrounded by a sleeve, both reduced from breech to muzzle. A series of tension plates are secured around and hold the sleeve. The breech block screws into the barrel and sleeve. The construction of the gun is such that it may be taken to pieces for transport. Accepted January 25, 1906.

21,929 (1905). **Recoil Brakes for Ordnance.** Rheinische Metallwaren und Mf., Germany. In Patent No. 27,093 (1903) was set out a hydraulic recoil brake for guns recoiling on their carriages, in which the channels for the braking fluid were automatically increased or decreased according as the angular position of the gun relative to the horizontal plane varied. The present arrangement allows of these channels being closed, and the method is described of rotating the piston rod to effect this. Accepted February 1, 1906.

25,551 (1905). **Hand Guard for Sporting Guns.** Fred Greener, Birmingham. A hand guard of ordinary construction is modified so that two horn-like projections are made to stand up upon the top of the barrel. These horns act as a rough rear sight. Accepted January 25, 1906.

25,780 (1905). **Ammonium Nitrate Explosives**. G. Reschke, Germany. In Patent No. 21,189 (1902) an explosive was dealt with composed of ammonium nitrate, curcuma or turmeric, dinitrobenzol and copper oxalate. The last-named substance increases safety against fire damp, and it has been discovered that it possesses this property not only in combination with a mixture of turmeric and dinitrobenzol, but also in combination with each of these substances separately or with other carbon-containing substances, such as woodmeal or dust, napthaline, or colophonium, with or without the addition of a nitro-compound. Accepted January 11, 1906.

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

SELECTED PATENTS.

NITROGLYCERINE MANUFACTURE.

20,310 (1905). C. L. Reese, U.S.A. The process adopted in the manufacture of nitroglycerine which is set out in this patent specification is intended to accelerate the separation of the nitroglycerine from the acids remaining after nitration. The acids and glycerine in association are treated with a reagent which changes any emulsifying or colloidal substance to a non-colloidal condition.

In the manufacture of nitroglycerine, it is well known that the glycerine is admitted into a bath containing a mixture of nitric and sulphuric acids. In this bath the nitration takes place, and the nitroglycerine is formed and is suspended as an emulsion in the remaining acids. The emulsion and acids are allowed to stand in a vessel of suitable description to permit the nitroglycerine to rise to the surface whilst the acids settle by gravity. This process of separation is very slow, and it is the object of the patentee to quicken it.

It has been discovered by the patentee that when gelatinous or colloidal silica is present in glycerine in the form of soluble silica, or as a glycerosol, or a glycerogel, or when soluble silica is present in the acids used the time of separation is materially increased. In many cases, it is stated the glycerine or acids contain one or more of these, and very minute quantities are known to retard separation. If a reagent is used which will dissolve or change the silicious or other colloidal material to such a form as to neutralize their emulsifying effects the rapidity of separation will be increased. Even if soluble silicate is added to the glycerine, to the mixed acids, or to the separate acids, together with the proper reagent such as fluoride or hydrofluoric acid so as to combine with the silica and form silica tetia fluoride, the time of separation is shortened.

The patentee has used many reagents, and has worked principally with the haloid group. Excellent results have been obtained by using a compound of fluorine, preferably sodium fluoride, or a fluoride of the alkalis. The reagent has been added to the glycerine before its entry into the nitrator, or in the process of manufacture to the mixed or separate acids, or to the admixture of glycerine and acids in the nitrating tank. The quantity of reagent to be added

either to the glycerine or to the admixture in the tank has been determined approximately to be ·001 per cent. of sodium fluoride. Accepted February 1, 1906.

REAR SIGHT FOR RIFLES.

866 (1905). J. T. Peddie, London. This specification deals with the construction of a rear sight for rifles and particularly to the method of counteracting side divergence of the projectile due to windage or other such cause. The micrometer screw arrangement generally used for this purpose is dispensed with, and in its stead the bed of the sight is arranged to be shifted from side to side in a dovetailed groove of accurate form. It is moved without the aid of a screw and is locked in any desired position by means of a cam roller.

Reference to the drawings reproduced below will convey an idea of the construction of this sight. The base *a* is provided with the arc-shaped dovetailed groove *b* at its rear end (Fig. 1). Forward a U-shaped dovetailed groove *c* is cut. The bridge-piece which carries the inclined guides *d* and the leaf *e* (Fig. 2) is provided with the circular dovetailed bearing *f* and the arc-shaped dovetailed bearing *g*. The bearing *f* is adapted to be drawn into the U-shaped slot *c* and to act as a pivot, whilst the rear bearing *g* is entered into its corresponding groove *b*.

The base *a* is marked with a scale *h* and the bridge-piece is provided with an index mark *i*. The lateral position of the sight proper is always clearly indicated by means of index and scale. The bridge-piece may be locked in any position on the base by the smal

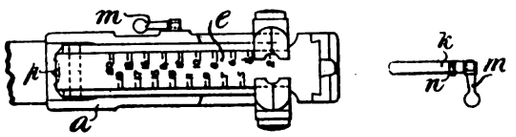
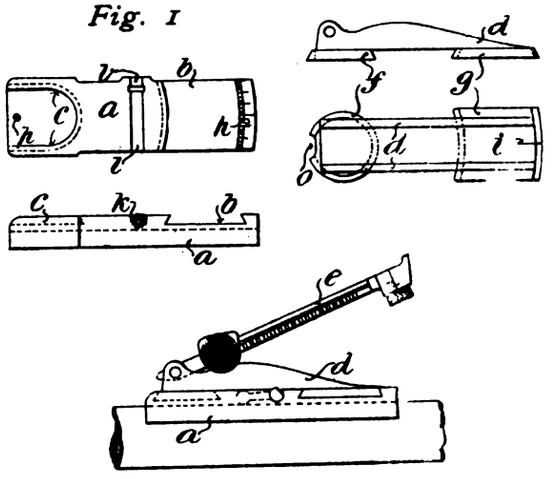


Fig. 2

Fig. 1



cam roller *k*. This roller is arranged to lie between the bridge-piece and the base in an open slotted bearing *l* in the base. When it is desired to lock the bridge-piece in a specified position the roller is merely turned by means of the small finger piece *m*, and the cam-shaped collar *n* arranged upon the roller is caused to force the dovetails tightly together

The circular dovetailed bearing *f* has a recess *o* cut in its front, and into this recess a pin *p* projects. The lateral movement of the bridge-piece is limited by this pin, and until it is removed the bridge-piece cannot be taken away from the base. Accepted January 16, 1906.

AN IMPROVED CLAY BIRD.

14,676 (1905). W. W. & H. T. Watts, London; and K. D. G. Browne, Castlebar, Ireland. The invention described in this patent is intended to render the ordinary clay bird more interesting to the shooter as a flying target, and to give him an exact indication as to the position the bird occupies when it is broken so that a value may be placed upon the shot. The clay bird when broken releases a second part so weighted that it falls to the ground—fluttering down gradually so that its descent may be clearly followed. The falling part is provided with a tassel of twisted

Fig. 1

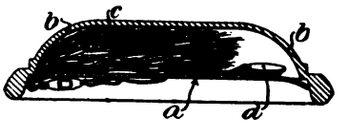


Fig. 2

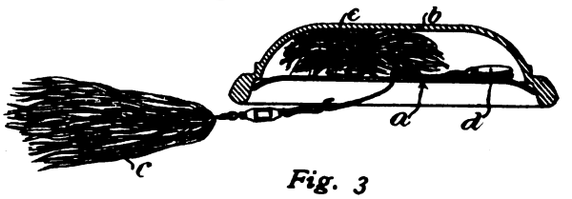
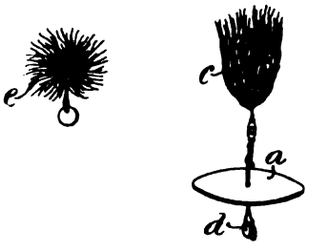


Fig. 3



wool or of a bunch of feathers. This tassel may be arranged to float out behind the bird when it is thrown into the air from the trap. By this means it is given an appearance which approaches nearer to that of a bird.

In the illustrations appended the tassel is shown enclosed in Fig. 1, and floating behind the bird in Fig. 2. The falling part is indicated in Fig. 3. The thin disc *a* is constructed either from cardboard or thin metal, and is made of a size to fit within the clay bird *b*. To the disc is attached the tuft *c* of some coloured material which may readily be seen when in the air. The disc is weighted by the leads *d*. When the bird is broken in the air the weights operate to hold the disc from further onward movement and to bear the tuft, parachute-like, gradually down to earth. It drops almost immediately beneath the point where the bird was hit, and the disc and tassel having a retarding influence it may be easily seen during its fall and eventually recovered.

The disc *a* is made of some springy substance so that it may be pressed into or fitted over the clay bird. If the clay bird is only slightly fractured the disc and tassel are released. The disc might naturally be secured by any other suitable means. The tuft may either be enclosed as in Fig. 1, or allowed to hang out behind as in Fig. 2. In addition to the exterior tuft as in the latter case, a supplementary tassel *e* may be enclosed within the bird. This would fall independently of the parachute. Accepted January 25, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Sale of Sparkbrook Factory.—The Birmingham newspapers created something in the nature of a scare when they announced that the Sparkbrook rifle factory had been sold to a private firm. The news was at first received with incredulity; but, item by item, convincing evidence in favour of the rumour came to hand, so that it was hardly a surprise when Mr. Haldane informed Mr. Jesse Collings in the House of Commons that the arrangements for the sale had been completed. A subsequent question produced confirmation of the further rumour that the bargain had been clenched by a definite promise that 25 per cent of the orders for service rifles which are given out to the private trade had been guaranteed to the purchasers for the three financial years ending in March, 1909. This implies that the new owners of the factory will take possession on the first day of the current month. The Birmingham papers seem to be well informed on the subject, and we may accordingly accept as authentic the announcement that the purchasers of Sparkbrook will rank as vendors to a company entitled The Imperial Small Arms Co., Ld., with a nominal capital of £250,000. It is curious that a factory, which was formerly in private occupation, has now reverted to the same status. The war to the knife which existed between the National Arms Company and the B. S. A. Company was concluded by the decision of the directorate of the former concern to "cave in" to competition. Those with early information rushed in and bought B. S. A. shares; and since then the prosperity of the Birmingham Small Arms Company is one of the most cheering features of an industry which as a whole is none too prosperous. The removal of competition, together with wise extensions and careful adminstration, have made the B. S. A. Company immensely powerful, both from a financial and engineering standpoint. Modern industry provides many openings for the employment of a first-class outfit of machine tools and equipment. It is accordingly to be hoped that this new element in the Birmingham gun trade will prove a source of added strength rather than a source of destructive competition.

Rifle Shooting Advocates.—The stimulation of rifle clubs is now taking many forms, and amongst these must clearly be included the energetic canvass of the subject by *Fry's Magazine*. The editor of this journal is a man of such wide authority as a cricketer that his views on rifle shooting necessarily carry a great amount of weight. That Mr. Fry is more a cricketer than a rifle shot was apparent to those who read his description of the sport as lying down in a hot sun and blazing at a dead target, or words to the same effect. Since writing in these discouraging terms he has possibly learnt that, even if the target is dead, the bullet or the rifle or the shooter's own nerves are possessed by the devil, and that rifle shooting is rendered actively interesting by the shooter's efforts to obtain the mastery over his unwelcome adversary. However, *Fry's Magazine* is now seriously engaged in bringing itself and its readers up to date on the subject of miniature marksmanship. Mr. Marks, in a recent number, catalogued the various competing models of miniature rifle, and with characteristic urbanity he had a good word for all of them, and he said hard things of none. Mr. Newitt has followed in the most recent number with a spirited justification of the Society of Miniature Rifle Clubs, and a characteristic snub of the National Rifle Association. A new sport must of course be initiated with a judicious blend of the pugnacious and the argumentative attitudes. The National Rifle Association, secure in its record of a difficult task

splendidly performed, can afford to adopt a reticent attitude towards the fulminations of its younger rival. For our own part we should like nothing better than to see the junior body established upon a firm basis adapted to the special conditions of its environment. Certain differences of view and treatment must necessarily exist, and *Fry's Magazine* is clearly performing a valuable public office in making itself the medium of socialism in rifle shooting. It is to be hoped that the proprietors of that journal will reap a sufficient harvest from their new department to justify them in continuing to give it a front position in their magazine. Success can only be attained by consistently advocating the best interests of the shooter, praising only those methods, appliances and arms which are conceived on the right lines and fulfil the requirements of those putting them to practical test.

A Chapter in the History of Sporting Rifles.—On another page some rather interesting but necessarily very general dates and particulars are given, which represent a summary from available information showing the various stages in the development of the present cordite high-power rifle, from the small beginning represented by the sporting edition of the ·303 Lee-Enfield. As in so many other instances of progress, a small idea gradually took an important shape, and a new era was initiated having far-reaching effects. The past history of firearms shows many instances where the gunmaker has initiated a revolution sometime before its military application was realised. In the case, however, of cordite express rifles, the powder proved a necessary precursor of the gun to fire it. The gun trade has many reasons for feeling proud of Mr. John Rigby, and it is interesting to observe from a careful examination of contemporary records that his firm can fairly claim to have initiated the express rifle in its modern high-power form. When the Smokeless Powder Company was busily engaged in adapting nitro powders for sporting rifles it seemed impossible to suppose that the comparatively large bore express rifle could be made of sufficient strength to withstand the chamber pressure necessary for the military ballistics which were regarded as a monopoly of bolt-action rifles. Since then we have learnt what necessity can produce in the way of a powerful drop-down action, and the developments which initiated the new order of things show how the work was divided between the firms whom we must regard as specialists in rifle construction.

The Dublin Explosion.—The very unpleasant effect which was produced by the news that a serious explosion had occurred at the premises of Messrs. Trulock, Harriss & Richardson in Dublin cannot be palliated unless the official report of H.M. Inspectors of Explosives shows that the unblemished record of nitro powders remains unaltered thereby. One can hardly conceive how anything more serious than intense flame can proceed from the accidental ignition of modern smokeless powder, and it is, therefore, all the more remarkable that so serious an accident as the one reported could possibly have happened during the present epoch, when black powder is so little in demand. It is of course possible that in a poor country like Ireland, where obsolete methods would still survive amongst the humbler ranks of shooters, more black powder may be used than would seem likely on first examining the question. It is, therefore, possible that careful enquiry may show that the premises contained a sufficient quantity of the older explosive to account for the violence of the explosion, about which there seems to be no question. Under certain circumstances nitro powders, when stored in bulk, might conceivably produce something stronger than ordinary combustion. The regulations for the storage of these compounds, as laid down by the explosives department of the Home Office, emphasise in the clearest possible manner the kind of precaution which must be taken, not only to isolate the store of powder from fire risk, but to render highly improbable all possibility of an explosive effect. Although the reports of the accident in the local press doubtless emphasise the sensational aspects of the case, there can be little doubt that a succession of explosions occurred, the whole intermingled with a number of minor reports, doubtless resulting from the communication of fire to a stock of cartridges. The gun trade has been singularly free from this class of accident during the past ten years—a result which is partly attributable to the extended use of the safer nitro explosive and partly to the better organisation of cartridge-filling rooms. It is to be hoped that the circumstances of the present accident when fully revealed will in no way detract from the feeling of confidence with which we regard the arrangements which hitherto have been regarded as fully safeguarding the public safety.

Practical Rifle Shooting.—Mr. Walter Winans' dictum as to what constitutes practical shooting brought forward an enterprising challenge from Major Richardson, who offered to pit a team of practised marksmen at stationary objects in competition with a team to be chosen by Mr. Winans, trained in his way, but never having taken part in certain specified Bisley contests. The two teams were to compete at moving targets. The challenge was refused, but the fact of its having been lodged emphasises the widely-held view that a shooter who has attained efficiency in any particular branch of the recognised forms of marksmanship is instinctively a fair shot under snap shooting conditions. The mere fact of constantly handling and carrying a rifle and bringing it to the shoulder represents an essential element in the process of training for rapid shooting of whatsoever form. The first thing which strikes the onlooker when watching a man who picks up a rifle is the relative ease or discomfort which is visible in his every action. In the celebrated Deeley litigation it was a matter of more than passing interest to pick out amongst the various counsel employed in the case those who were sportsmen and the others who had probably never fired a shot. Sir Richard Webster, now Lord Alverstone, compelled the admiration of all onlookers by the perfectly natural and easy manner in which he held a gun while demonstrating the points in his argument. Mr. Fletcher Moulton by comparison never seemed to catch hold of a gun at the right end; the thread of his discourse was occasionally interrupted by futile efforts to lay a gun down in a stable position. In such small matters as this every one of us must have noticed the great influence which is exerted on shooting form by the sub-conscious process of education which has been undergone by everybody who has taken up shooting in one or other of its various forms. Snap shooting is only a variation of the many-sided question of gun manipulation generally. There are in fact very few shooters of ordinary enthusiasm who do not practise the very kind of self-education which Mr. Winans recommends as the one and only essential of practical marksmanship.

TWO MISS-FIRES.

Two items concerning War Office progress are not inaptly described by the heading adopted for this article. The first is the curious lapse into obscurity of M.D.S. cordite, and the second is the continuance in obscurity of the Small Arms Committee, which seems destined to continue in the chrysalis stage of arrested development. In the general rejoicing which heralded the conspicuous success of M.D.S. cordite in the ·303 rifle at Bisley last year very few critics had sufficient discrimination to emphasise the distinction which exists between the commercial cartridge and the highly refined and pampered ammunition which is supplied to the long-range marksman. It is quite admissible, and even necessary, in the match cartridge to measure the explosive charge with the same degree of exactitude which is accorded to the selection of the other components. Assuming, therefore, that the charges of M.D.S. cordite were all hand-weighed, the entire question of this explosive's adaptability to charge separation by the system of cutting off a given length from the stranded rope was set on one side. We may have been wrong and we may have been right in our original assumption, but the fact remains that it has never yet been proved that the new hard strip cordite can be loaded on the same system as Cordite. It would be quite easy to cut the explosive up into squared leaflets, and separate the charges by bulk, but this would involve an immense change from existing methods of loading, going in fact far beyond the scope of a mere alteration of composition. Such problems must of necessity have entered into the calculations of the War Office experts, upon whom would rest the responsibility of recommending the change. The question of igniting the new explosive is also one which goes beyond the behaviour of a highly dense loading, such as the Palma cartridge represents. We have in our possession a complete charge of M.D.S. cordite which failed to ignite in an express cartridge. The violence of the initial explosion was sufficient to blow many of the strips into small fragments, and yet the bulk of the charge, while blackened and changed in colour, nevertheless failed to ignite. For the moment, therefore, we may treat the new M.D.S. cordite as something between a miss-fire and a fizzle.

In the matter of the Small Arms Committee we must again assume that promising results have been followed by lack of stamina in the adolescent stage. The right hand of friendship, sympathy and good wishes was extended to the new Small Arms Committee when the first nominations were announced. Since then the Committee seems to invite a well-worn witticism to the effect that it has become a standing committee because it never sits. The cadet rifle, which was at first supposed to be the fruits of the Small Arms Committee's labours, was in fact the baby of a joint conglomeration of persons formed from several bodies acting under the auspices of the Director of Ordnance, with Mr. Ashton and Mr. Speed as godparents to the new baby. We may at any rate assume this indirect fathership of the cadet rifle, and that patent No. 25,403 (1905) is its birth certificate. So long as the proper work of a small arms committee is allocated to outside bodies we may regard its existence as going very little further than page 52a of *The Monthly Army List*. Several modifications and changes are in course of being made in our small arms equipment, notably the approval of a new bayonet, and tests with various alternative shapes of front and back sights.

ANOTHER MISS-FIRE.

The failure to arrange a scheme of price maintenance for the protection of the gun trade from the cutting propensities of some of their number, and especially others not properly described as gunmakers, has arisen from a peculiar hitch in the arrangements which is hardly open to a full explanation. An understanding was concluded between the three ammunition manufacturers, having for object the determination of prices for certain leading lines of manufacture. The arrangement in question seems not to have been so carefully thought out in all its bearings as was desirable with so many diverse interests at stake. The first essential principle of a price arrangement between manufacturers of proprietary articles is obviously that each grade of goods shall be specifically described and that each firm shall market them on an agreed common basis of price. This aspect of the price arrangement appears to have been settled without paying sufficient regard to the specialities of each manufacturer. The consequence was that certain grades of goods were freed from the laws of healthy competition. Just as much as the disproportionate treatment accorded to one make of cartridge favoured one firm, so it produced an adverse effect elsewhere. Consequently the basis agreement between the manufacturers contained unsound elements tending to put a premium on evasions such as no agreement can prevent if the parties thereto are out of sympathy with its spirit.

Another aspect of the important but futile negotiations was similarly mismanaged. The gun trade, as prime movers in the endeavour to promote fixed minimum retail prices, naturally assumed that the manufacturers would be able to fix amongst themselves a means by which the various channels of distribution should be properly assured of their due ratio of profit. Unfortunately the ammunition combine did not sufficiently consider the position of the powder maker. The various manufacturers of nitro powders have gradually built up a loading business which represents an important factor in the situation. They at any rate buy cartridge components, that is, cases and wads, from the ammunition manufacturer by the million; and having to supply the retailer with finished cartridges at the same prices as the maker of cartridges and cartridge components they naturally expected better terms than their customer the gunmaker who buys 25,000 cases during the year. No solution of this apparently simple problem was deemed necessary, and the cartridge maker was left to suffer in proportion to the amount of business he had been in the habit of doing with a class of customer in a position to resent bad treatment. The powder maker can enforce his claims to special consideration by the obvious rejoinder that his large consumption would quite easily enable him to take up the manufacture of 12-bore cartridge cases and wadding. Price maintenance has accordingly gone to the wall, not because there is any difficulty in securing retailers from unfair competition by their own class, but because the higher powers have been unable to define their position on a sufficiently equitable basis to constitute a fair working arrangement. Another reason why the powder maker deserves consideration is that he can always fall back on the foreign manufacturer if he fails to secure reasonable treatment in his own country. The money is safe, the orders are given in large quantities, and the foreign manufacturer is capable of a standard of work whose excellence it would be foolish to ignore.

THE PLATING OF GUNS.

ALTHOUGH the gunmaker views with a certain amount of suspicion anything which may be characterised as an attempt to obtain his recognition of the factory-loaded cartridge, many things have happened lately which make it increasingly necessary to examine the connection which exists between the standard cartridge and the behaviour of a gun under test at the plate for the regulation pattern. More than one firm has lately experienced a certain amount of trouble and anxiety in getting guns just right. Systematic enquiry has shown that the source of the trouble arises to a certain extent from being more critical of the gun's behaviour than the quality of the cartridges used in the test justifies. The gunmaker sets himself to the task of obtaining a very high standard of result. The patterns obtained must be extremely regular, a comparatively small amount of choke must produce a considerable improvement above an ordinary cylinder pattern, and there must be a considerable degree of freedom from the occasional scatter shots which are so open as to be worthless. When the barrel department has produced a true and uniform bore averaging in diameter ·732 in., and the action filer has cut a true chamber measuring not less at the nose than ·802 in. there remains only the cone to consider.

Experience fully confirms an opinion which has been expressed in these columns, viz., that the length of the cone shall not exceed ¼ in., with $\frac{3}{16}$ in. as the best average dimension. A very slight lead may be cut beyond the cone, having for object the smoothing of the passage of the wads and charge into the barrel. Theory suggests that the greatest diameter of this lead should not exceed ·740 in.

When all these requirements have been met there really remains nothing to do to the barrel to ensure a high standard of shooting, other than slight adjustments of the choke, in order to secure a fair amount of agreement with the closeness of shooting required by the customer. When the amount of constriction at the choke agrees with what is generally found to be sufficient to produce the expected result, it is undesirable to attempt alterations having for object very slight modifications of the gun's behaviour, sufficiently small in themselves as to fall within the divergence caused by unpreventable variations in the behaviour of the cartridge. The firm of Eley some years ago announced the introduction of a "Lab" cartridge, the same to be made up from selected components and to give standard ballistics. This scheme received so little support from the trade that it may be regarded as having been virtually abandoned. It is, we believe, still possible to purchase from this firm hand-loaded cartridges, made up from selected components and containing weighed powder charges, in combination with a counted measure of shot true in weight and number of pellets to a very small margin. It may thus be assumed that the matter of guaranteed ballistics has been abandoned in view of the restricted demand, rendering the cost of the selection of a nitro powder, giving absolutely standard results, prohibitive. Even so, a cartridge loaded in the careful manner above described will fully serve the gunmaker's object if he adopts the very wise precaution of keeping by him a sample of each boring of barrel to be shot side by side with new work, in order to show how the cartridges are behaving at the moment. This is done in all velocity testing at Woolwich Arsenal, and a result is accepted as standard, if previously approved materials behave in a like fashion.

In some experiments recently conducted in our presence, on behalf of a gunmaker who has suffered a good deal of inconvenience from the apparent inability of his guns to shoot on a standard basis, it was very clearly demonstrated that the cartridges in use contained a slight overcharge, an unduly thick felt wad and an apparently over-powerful sample of powder, all of these elements combining to lower the percentage of pattern by an amount which made all the difference in the report given concerning the gun. The source of trouble having thus been localised there is every prospect of reorganising the supply of cartridges for pattern tests, so as to diminish for the future the liability for barrels to be returned for further alteration and adjustment when there nothing really wrong with them.

One cannot very well dismiss this most important subject without mentioning in parenthesis the apparent tendency of recent issues of certain of the better known nitro powders to give a higher range of pressure and velocity than has ever been countenanced in print or by experts of recognised standing. It was certainly a move in the right direction to point out that the labouring of past years towards a low pressure and standard velocity combination was conceived on unsound lines. Since then the three-ton standard has been generally adopted, and a little lattitude, even beyond this limit, has been allowed in the light of further careful tests and experiments. Now, however, there is reason for believing that too many samples unduly approach an average pressure of 3·5 tons to leave the gunmaker a fair chance of showing first-rate pattern results.

The gradual changing over from lead to copper crushers has doubtless enhanced somewhat the difficulty of ensuring continuity of product; but there can be little doubt that in a short time from now the Holden system of conical copper will be so generally adopted, and the new scale of readings sufficiently standardised, to enable the manufacturer to keep his powder on a dead level of behaviour which will supplement the efforts of the gunmaker in his constant attempts to improve the already high standard of boring which modern good-quality guns display in so many instances. The powder maker has so many difficulties to contend with in the regulation of his product as to render it exceedingly difficult to relate the laboratory behaviour of a cartridge to the scale of action it may display when loaded on a commercial basis. The sportsman is so particular about the appearance and finish of his cartridge that the gunmaker is forced to insert what amounts almost to an excess of wadding in order that the turnover may be perfect in shape and the shot charge free from any tendency to rattle after the shaking up it may receive on a long railway journey. The commercial cartridge is, therefore, liable to bring rather more work out of the powder than occurs with the recognised output of the laboratory. This circumstance does not imply any need for changing the specification of a laboratory loaded cartridge, so much as the necessity for arriving at a knowledge of the distinction which exists between it and ordinary cartridges. In this way the proof results which imply a high grade of efficiency under practical conditions of use will be defined. The modern cartridge is constructed to a much closer specication than was considered necessary years ago, but there is still a tendency to endeavour a still closer approach to the absolute.

THE LATE Mr. R. W. S. GRIFFITH.

The shock of losing so prominent a personality as Mr. R. W. S. Griffith is not diminished by the circumstance that no one who knew him expected that he would live to an advanced age. The extraordinary vitality with which he has risen superior to the most terrible fits of depression following from periodic nerve disturbance has been the marvel of all who have known him intimately during the past quarter century. He was a man whose motive force was mainly derived from strength of will. No illness was enervating enough to destroy the alertness of his interest and his energy in the prosecution of schemes for scientific research and the improvement of the manufacturing methods under his control. He possessed in the most notable degree the essential qualities of mind which make a successful manufacturer. Always alive to the necessity for advance there was still no detail too minute and no routine too exacting which he did not cheerfully undertake in order to maintain the high reputation of Schultze powder. His checks and counter-checks were remarkable, not only for their ingenuity, but more particularly for the thoroughness with which they were carried out week by week and year by year. Mr. Griffith was a past master in the art of arriving at a standard specification, and his skill in this respect was only equalled by the power he possessed of seeing that every tin of Schultze which left the factory was in accordance with the specification.

His connection with smokeless powder dates from the time when pin-fire cartridges were going out of use. This was in the early seventies. The later samples of sawdust Schultze loaded into central-fire cases, specimens of which we stil possess, date from the year 1877. The powder made at Eyeworth in 1869 was cut from blocks of wood in the form of square cubes. This proved a dangerous product. During the years 1870, 1871 and 1872 the square cube form was adhered to, the wood used being alder. In 1873 pine sawdust was used, and was continued during 1874 and part of 1875. In all cases the wood was treated chemically to remove the resins before nitrating. Sawdust Schultze was faulty by reason of its lack of strength. During 1875 and through 1876 and 1877 the cube form was reverted to, the wood used being English abele, viz., the white poplar. In 1878 the first granular powder was introduced and established its superiority at the gun trials at Wimbledon. This was continued through 1879, 1880, 1881 and 1882, the wood being, as previously, English abele. In 1883 wood pulp was introduced as the basis for the powder, and from that time to this there has been no variation in base and but little in composition. In 1885 the waterproofing system was introduced, and our own issue of May 1894 contained the announcement that a process for hardening the grain had been adopted.

Notwithstanding the immense amount of chemical research and practical detail involved in the above developments and changes, Mr. Griffith's name will go down to posterity mainly by reason of the ingenuity and completeness of the many incidental experiments and investigations which are associated with his name. The chronograph enabled him to unearth the secrets of velocity, muzzle, mean and striking, which have so greatly added to our knowledge of sporting nitro powders. The pressure gun again did good service in making it possible to define the strength of the powder and to standardise each season's output. Of the vast array of experiments which Mr. Griffith communicated to the *Field*, and in due course reprinted in *Sporting Guns and Gunpowders*, there is probably none which appeals more to the reader's mind than his researches concerning the stringing properties of shot charges. He fitted up a special engine for driving a rotating target of considerable area. By its aid he was enabled to register the delay which separates the arrival at the plate of the various component pellets of the charge. The results obtained were most instructive, and the sole regret is that difficulties of manipulation and upkeep prevented the permanent retention of this apparatus.

Some of his best work has been done in connection with the examination of shot gun patterns from the point of view of the influence exerted by the nature of the powder and the method of its loading. This line of labour has not only produced much statistical information of a permanently valuable nature, but it has also been the means of pointing out the most desirable methods of cartridge loading, with a view to safeguarding pattern whilst giving a proper place to other equally essential properties. Recoil is another subject which has been made the clearer for Mr. Griffith's treatment of it. He set up the first instrument for recording recoil on the Journée method of a freely suspended gun. The results he obtained provided valuable *data* for the complete examination of the subject on a theoretical basis, and the laws and principles now fully established have swept away the doubts which previously existed Scientific laws can only be found out once, and it is astonishing to note how much of the present science of the shot gun owes its origin to Mr. Griffith's experiments. His work will certainly survive him.

A REVIEW OF CORDITE EXPRESS RIFLES.

It was about the year 1893 that the modern type of military small-bore rifle was first tried on game. The cheapness of the magazine action, the wonderful flatness of trajectory, and the slight recoil all combined to make the sporting edition of the military weapon a great favourite amongst shooting men. The barrel was reduced several inches in length, so that after restocking and general trimming down of exuberances, a very efficient arm was produced at a fraction of the cost of the express rifle. These weapons were exceedingly accurate over sporting distances, in spite of the shortened barrel. Trouble was, however, experienced by reason of the small diameter and the exceptional hardness of the nickel-jacketed bullet. Its striking energy exceeded that of many express rifles, but a difficulty arose from the fact that the bullet was liable to pass through an animal's body without great loss of velocity.

This defect of the military cartridge stimulated the inventive faculties of gunmakers in the direction of producing an expanding bullet. Longitudinal slits were cut in the nose of the bullet in order to promote a mushrooming effect on impact, and a certain measure of success was attained. Rifle makers were hard pressed by the popularity of the new sporting type of magazine rifle. They maintained, with every justice on their side, that two cartridges in a double-barrel rifle were more effective for game shooting than half-a-dozen in a magazine, with a time delay between the shots for the working of the bolt. This, however, did not turn the tide which had set in in favour of the military type of rifle. Mr. Holland brought forward in June, 1898, a falling-block single-barrel rifle which had been specially manufactured to withstand the high pressure of the ·303 cartridge. This rifle gave excellent shooting results, thereby showing that private manufacture could cope with the high ballistics incidental to the use of the military type of cartridge. To Mr. Rigby seems, however, to be due the credit of introducing a double-barrel express calibre of rifle firing a cordite charge and a nickel-covered bullet analogous to the ·303. The *Field* of July 30, 1898, contained a notice of this rifle, which stated that it was the outcome of experiments with a view to apply to ·450, ·500, and ·577 rifles the proportion of charge that had in ·303 and smaller calibres proved so deadly.

The rifle which formed the subject of this notice carried a cartridge with a 480-grain bullet. The propellant used was cordite, and we may accordingly accept this rifle as the progenitor of the weapons which have subsequently been distinguished as of the high-power cordite type. The muzzle velocity was stated at 2,059 f.-s.

While the ·450, ·500, and ·577 cartridges were based upon the black powder express cases, it soon became apparent that the ·450 cartridge with a heavy nickel-jacketed bullet working on the military level of ballistics possessed more power than was necessary for ordinary soft-skinned game. The Jeffery special ·400 cordite cartridge having slight differences of dimension as compared with the black powder, ·450-·400 was accordingly introduced in December, 1898.

We then find that in November, 1899, Mr. Rigby submitted a double rifle, this time of ·350 calibre, and therefore an entirely new bore for express rifles. While this was not reported upon in the *Field*, contemporary records go to show that it was brought out as nearly as possible at the same time as Mr. Holland's ·375 rifle, which was also made for a special cartridge. The Holland rifle was reported on in the *Field* of December 2, 1899. At about this time Mr. Purdey introduced his ·360 special cordite rifle and cartridge. Messrs. Kynoch's enterprise at this time caused cartridge to follow cartridge so quickly that it is difficult now to lay down their precise order of introduction.

As soon as high-power express rifles of a calibre greater than the military became an accomplished fact we ceased to hear so much about the ·256 and ·303 as sporting cartridges. Up to the year 1897 the efficiency of the ·303 cartridge for sporting purposes was ever under discussion. Mr. Selous for instance gave it as his opinion in December, 1896, that the ·303 with an expanding bullet was powerful enough to be used with effect on all game, except such ponderous beasts as elephants, rhinoceroses, buffaloes or bisons. He further stated that he would not object to use the rifle on lion. Had Mr. Selous' sporting experiences covered a later period of rifle development, there can be little doubt that he would have preferred the more powerful cartridges that were subsequently introduced.

The ·303 and ·256 rifle are still much used for deer stalking and other similar shooting at soft-skinned game that does not charge, but there is always an element of luck in shots taken with these rifles. Better for this purpose are undoubtedly those rifles which fire bullets from ·350 to ·400 calibre.

For the benefit of those sportsmen who desire very high ballistics combined with a low chamber pressure in the rifle, the firm of Eley Bros. brought out two cartridges which they term No. 2 nitro. They are of ·450 and ·360-bore respectively, being characterised by a very large space for the accommodation of the powder charge, whereby a large amount of propellant can be used, while attaining but a low pressure.

Having thus attained great energy and striking power for the sporting cartridge, the swing of the pendulum brings us back to the use of lighter ammunition for certain kinds of sport. Mr. Purdey is a pioneer in this direction. At the beginning of 1905 he produced his ·400-bore cartridge, which contains a 230-grain lead bullet with a nickel base. This cartridge is in point of fact the absolute ballistic equivalent of the ·400-bore black powder magnum, but materially smaller in general dimensions. It gives approximately the same recoil and the same stopping power as the ·303 cartridge at ordinary sporting distances, and the trajectory is also very nearly the same. But it is a more reliable sporting bullet because of its larger diameter. This cartridge may, therefore, be likened for all practical purposes to a ·303 expanded out to ·400 bore.

Turning to another development there was from the first a great demand for a serviceable magazine rifle firing a bullet of larger diameter than the military. Messrs. Cogswell & Harrison's Certus rifle was probably the first special magazine weapon which was made to take a cartridge larger than the military, this rifle having been constructed for the ·450-·400 cartridge. Other firms made use of an ingenious adaptation of the ordinary Mannlicher action. Without changing the bolt and magazine the use of a special barrel enabled the ·375 cartridge to be used. This had the same size base and the same length as the Mannlicher, which accounts for its satisfactory working in the ordinary Mannlicher action.

ROUND THE TRADE.

The directors of the British South African Explosives Co., Ld., recommend a 5 per cent. dividend, free of Income Tax, for the year ended October 31st last.

Mr. Thos. Hill-Jones, charcoal manufacturer, asks us to mention that his business, hitherto carried on at Eagle Wharf Road, has been removed to the "Invicta" Mills, Bow Common Lane, London, E.

It seems to be well understood that Mr. Peddie of the Peddie Small Arms Corporation is the moving spirit in the arrangement to purchase the Sparkbrook rifle factory, with a view to running it as a private works.

The annual meeting of the Webley & Scott Revolver and Arms Co., Ld., was followed by a special meeting which duly agreed to the scheme for capital re-arrangement, the details of which were given in our last issue. It was mentioned at the chief meeting that the falling-off in profits was entirely attributable to the absence of revolver contracts from our own and foreign Governments, and until these were forthcoming there could be no hope of a substantial improvement in the company's profit-earning capacity.

Though the honour of supplying the powder used by the winner of the Grand Prix de Monte Carlo has again fallen to a Continental firm, Scott guns won both the first and second places. The Webley and Scott Revolver and Arms Co. are accordingly jubilant over the fact that for two years in succession (1905 and 1906), three times in five years, and on six occasions in all, the celebrated pigeon guns of W. & C. Scott & Son (now Webley & Scott Revolver and Arms Co., Ld.) have carried off the Grand Prix de Monte Carlo.

The *Times* of the 5th ult. contains mention of the circumstance that Mr. Playford, Minister for Defence, is asking the Admiralty to obtain in Australia the cordite required for the China and Australian squadrons. He has also approached the New Zealand Government with a similar request. He states that, if the Admiralty and New Zealand comply, Messrs. Nobel, having the machinery here, are willing to erect a factory.

An action has been started by Mr. John Robertson, trading as Boss & Company, gunmakers of 73, S. James's Street, S.W., against Messrs. Purdey for alleged infringement of the plaintiff's single-trigger patent No. 22,894 of November 26, 1894. It seems to be understood that the last page of the complete specification defines the points upon which a monopoly is claimed, the same being regarded as covering certain essential particulars in the mechanism which is fitted to Purdey single-trigger guns.

Mr. T. R. Bayliss presided at the annual general meeting of the firm of Eley Bros., Ld., on the 16th ult. He justified the large depreciation of £24,856 written off the plant item by the fact that practically no writing off of this character had occurred during the first twenty-eight years of the company's existence. Mr. John Balfour, the chairman of the committee of shareholders, congratulated the board on the improved position of affairs. On behalf of the committee, whose functions have now come to an end, he supported the adoption of the report.

We have received from the Ross Rifle Company a gorgeously produced descriptive pamphlet which contains not only complete views of the factory within and without, but a number of shaded drawings which emphasise the essential aspects of the mechanism of the Ross rifle. The pamphlet is without question the finest sample of modern up-to-date illustration and letterpress we have ever seen. The photographic engravings are marvellously perfect in their graduations of light and shade. No praise can, in fact, be considered as overestimating the merits of this publication, commencing with the wonderfully embossed front cover and continuing right along to the modest imprint at the end of the letterpress which informs us that this beautiful creation has emanated from the printing works of Messrs. Bartlett & Company of New York.

At the military polygon, near Ochta, says the *Novoe Vremya* during trials of shells for fortress artillery, on the 17th February, a ten-inch gun burst. It caused no loss of life. It was a steel gun, cast at the Obuchovsk factory. It weighed over 40 tons and cost £8,000. It had already fired as many as 300 charges of smokeless powder of 130 pounds each; but it burst in the firing of a charge of but 90 pounds of that powder. Only the breech and chamber remained intact, but the mouth of the gun was broken into pieces of from 36 pounds to about 5 cwts. Some of the parts were blown as far as 1,400 feet. The cause of the explosion has not been made clear. The Obuchovsk steel has enjoyed a world-wide reputation since the year 1867 when a gun was sent from Perm to the Paris Universal Exhibition. After the gun had received a considerable amount of use a careful inspection failed to reveal either scratch or blister.

According to the report of Messrs. Walkers, Parker & Co., Ld., the prices of pig lead, in common with that of other metals, have advanced considerably, in spite of an acknowledged falling-off in home consumption, and although there was no great variation during the first nine months, the market rose rapidly from October onwards until £17 17s. 6d. was reached on the 27th December. This represents an increase of £5 per ton since the previous stocktaking, the lowest quotation being £11 17s. 6d. early in March, and the average price for the year being £13 14s. 3d. The basis on which stock has been taken is the same as the previous four years. The accounts show a net trading profit of £29,033, which becomes £6,644 after paying debenture interest and head office expenses. With £9,673 brought forward, the available surplus becomes £16,317. The preference shares are to receive 3 per cent., which will absorb £6,000, and £10,318 will be carried forward.

The annual report and accounts of Messrs. Curtis's & Harvey, Ld., show a net profit of £19,310, after payment of debenture interest and other charges. This, added to the amount brought forward from the previous year, gives a distributable surplus of £24,954. This sum it is proposed to appropriate as follows:—To set aside to reserve, £2,000; to accident reserve, £1,000; to write off War and Sporting Powder Company's purchase account, £500; to declare a dividend of 2½ per cent., free of Income Tax, on the £458,000 of ordinary shares, £11,450; to carry forward £10,004. This result has been arrived at after fully maintaining all plant and machinery out of revenue, and making due depreciation for leasehold properties. The Company has to be congratulated on having produced so satisfactory a result during a time of severe competition, especially bearing in mind the fact that the above profit has been made after paying 4½ per cent. interest on debenture stock, equal in amount to the ordinary share capital of the company.

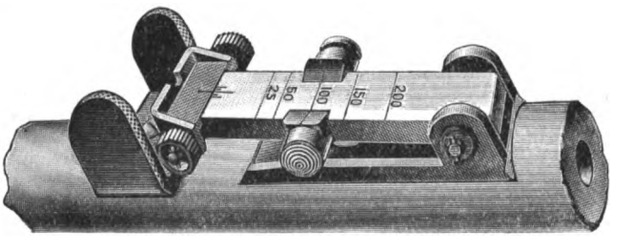
There are probably few tasks requiring more discrimination than the preparation of pamphlet matter dealing with highly scientific manufactured goods. To write for the expert is simple enough; but when custom is influenced by persons without the special knowledge which enables them to appreciate the merit of the goods or materials offered for sale a judicious combination of the technical and the general must perforce be made. These considerations doubtless appealed strongly to the New Explosives Company when engaged in the preparation of the interesting pamphlet on guncotton which has been sent to this office. Its technical matter is instructive to the beginner, and yet may still contain points worthy of note by the expert. The illustrations lighten the text, give a very fair idea of the scope of the Company's operations and at the same time emphasise the descriptions of processes. The commercial aspects of such a book must not be neglected, hence we find frequent references to the special uses and advantages of different types of guncotton, and we are reminded from time to time of the Company's desire to do business. Altogether this interesting pamphlet reflects great credit not only on the chemist who is responsible for its literary preparation, but also on the office staff who have so ably edited the production, and presented it in a suitable printed form.

(Concluded on page 53.)

THE NEW CADET RIFLE.

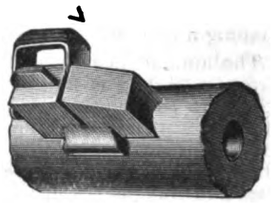
THE programme of events which culminated in the publication by the *Field* on the 10th ult. of a full description of the new cadet rifle constitutes a record of promptness and enterprise on the part of the War Office. By the courtesy of the proprietors of that journal we are enabled to reproduce the four accompanying drawings showing the general principle and details of the new rifle. We can fully endorse the wisdom of the policy which has produced a rifle with a bolt action. However friendly our disposition may be towards competing miniature arms, such as the Martini with its hinged block, and various alternative types of falling-block mechanism, it cannot be gainsaid that they are all lacking in efficiency of ejection. The Martini contains the additional disadvantage of being impossible to clean from the breech without first dismantling the barrel. Range work under severe conditions of competition has shown that frequent wiping out with a rod or pull-through is necessary, in order to clear away the fouling which accumulates in objectionable quantities if more than ten shots are fired in a series. The cause of inefficient ejection in the types of rifles mentioned arises from the fact that ·22 calibre rim-fire cartridge cases weigh less than ten grains. The grip established between cartridge case and chamber makes it impossible in an eighth of an inch of primary extraction so to free the case as to enable the impetus given to so light a weight to produce reliable ejection.

The bolt action, working on the principle of entirely removing the cartridge case from the chamber before the ejecting action comes into play, overcomes this difficulty in the most practical fashion. The bolt mechanism similarly facilitates the inspection of the barrel from the rear, also permitting the easy cleaning of the bore during and after use. Under these circumstances it is regrettable that the system of extracting and ejecting mechanism adopted in the new cadet rifle has been badly thought out and designed on a radically deficient basis. There is further evidence that the conditions of a ·22 rim-fire cartridge with reference to burst



cases have not been properly provided for. The trigger mechanism is also faulty in design and in need of alteration, particularly with reference to the nature of the spring. Altogether there is evidence that the rifle has been approved in far too much of a hurry to justify manufacturers in regarding it as a finished model. A rifle which gives 10 per cent. of miss-fires, as the new cadet arm does, cannot by any means be regarded as the last word in miniature rifles.

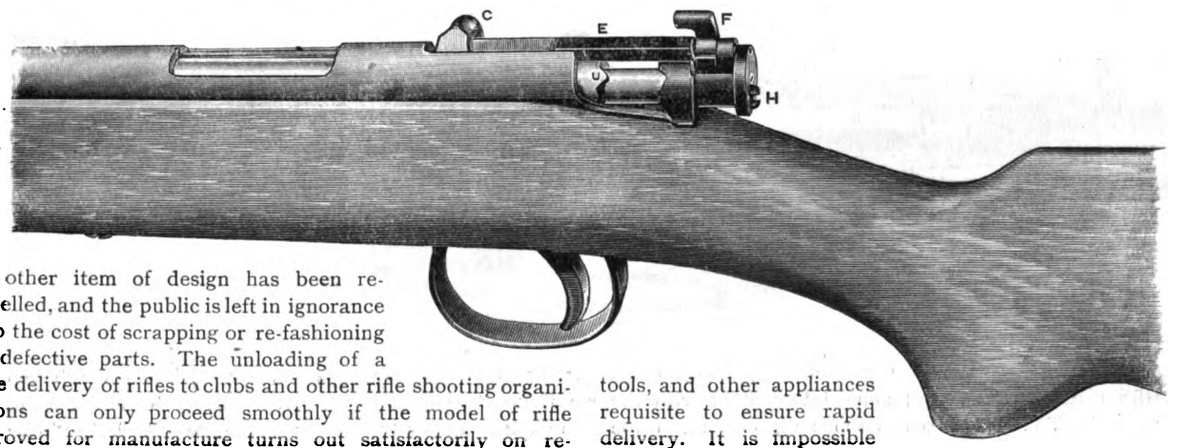
Another question, upon which opinion is divided, concerns the propriety of War Office experts having stepped in and patented details of the mechanism. Five private firms submitted by invitation of the War Office the product of their special knowledge, brains, and experience. The War Office especially asked each firm to state the particular points of the rifles submitted which were covered by patent rights. They then rejected all the privately submitted models of cadet rifle, and set to work to compile a model of their own, mainly no doubt on the basis of the unpatented portions of the various rifles submitted. If one firm patented their backsight the War Office had, we may say, several alternative unpatented devices to choose from. The same no doubt holds good for the manner of getting out the action and all other parts of the rifle. This we should not regard as a grievance if we had not been told that the War Office experts at Enfield had themselves patented portions of the new cadet rifle which they consider original. It will be the trade's own fault if the patent in question is allowed to pass through without being loaded with disclaimers and admissions of prior use, which will leave but little of the original structure intact. Even now it is not too late for the War Office to insist on the abandonment of the patent, or the announcement of its free use, so applying to the War Office cadet weapon the principle of avoiding patented devices which was adopted when dealing with the manufacturers' models.



The great advantage to the patentee of a patented contrivance in a sealed service pattern of rifle is that however trumpery may be the precise slot, curve, pivot-pin or other immaterial item dignified by the description of mechanical device, that device is used in the service pattern of arm; and if there are ten million ways of arriving at the same result, nine hundred and ninety-nine thousand of which are better than that adopted in the Government design, no service arm is a service arm which does not contain the infringing device, thereby mulcting the manufacturer in respect to what is legally termed royalty. No language admissible in these columns is too strong to use in condemnation of the principle of reserving in private ownership portions of the cadet rifle; and our attitude will continue as at present until the patent is either abandoned or assigned over for free public use, or else manufacturers are allowed to vary the scope of the specification so as to substitute their own ideas for those controlled by Government employees, who rank in the matter of patents used in rifles sold to the public as private individuals.

Continuing to deal with the commercial aspect of the question, the War Office has now entirely washed its hands of the new cadet rifle. It has been handed over to the National Rifle Association as the model of arm which should be used for miniature rifle club practice of the kind which prepares the shooter to shoot a service rifle. The N.R.A. have apparently accepted the position, in that they have addressed enquiries to manufacturers, asking whether they would like their names to be included in the list of firms to be invited to tender for the manufacture of the cadet rifle. This assumes that the National Rifle Association will give orders for the new rifle. Assuming 10,000 as the smallest

number which can be privately made at a reasonable price, and taking the price at £2 per rifle, the National Rifle Association will stand committed to an expenditure of £20,000. The Association is of course wisely directed in the management of its finances; but we cannot ignore the fact that the total cash assets of the Association, as shown on the last balance sheet, amount to but a few thousand pounds—in fact, sufficient working capital for a rifle association, but hardly sufficient for the carrying on of a gun-jobbing business. The great danger is not the lack of demand for as many cadet rifles as firms can turn out, but rather the possibility that rifles accepted and paid for as in accordance with the specification will be found defective on trial, and be thrown back on the jobber's hands. When a Government is issuing a new model of a service arm one hears that this, that, or the other item of design has been remodelled, and the public is left in ignorance as to the cost of scrapping or re-fashioning the defective parts. The unloading of a large delivery of rifles to clubs and other rifle shooting organisations can only proceed smoothly if the model of rifle approved for manufacture turns out satisfactorily on receiving an extended test; but if it is unsatisfactory, and some rival manufacturer is actively pushing an alternative model, satisfying the same general specification as the original arm, then the problem of unrealisable stock is likely to take an unpleasant form.

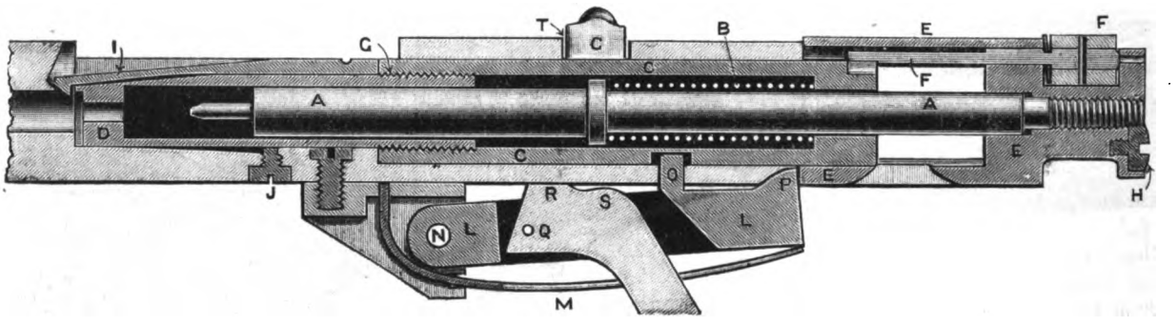


Failing a positive order from the Government, and, therefore, Government responsibility for defects of design, the manufacturer is the only person who commands the capital and the special knowledge enabling him to take the risk of turning out a large quantity of rifles, including all the usual commercial risks incidental to their sale or non-sale. In the hope of obtaining some definite statistics on this subject we addressed a circular letter to the following firms, asking what line of policy they proposed to adopt:— Birmingham Small-Arms Co., Ld., Cogswell & Harrison, Ld., W. W. Greener, Peddie Small-Arms Corporation, Ld., and the Webley & Scott Revolver and Arms Co., Ld. The whole of these firms except the B. S. A. Company seemed unable to make a definite announcement at the present moment. Three of them expressed the utmost surprise at our question, which asked whether they had concluded arrangements with the patentees of the Government rifle for manufacturing the same under royalty terms. It was in fact only from the B. S. A. Company that anything in the nature of a detailed statement of policy was supplied, together with permission to publish the same. In answering our first question they expressed doubt as to what might be the real intentions of the authorities on the subject of the new cadet rifle. At first it was given to them to understand that the War Office would issue orders for the new arm, but since then the matter has been placed in the hands of the N. R. A. It is implied, but not stated explicitly, that the latter body will take the responsibility of placing certain orders. Whether this is done or not the Small Heath company feel clear that there must be a demand to be satisfied, and being particularly laid out for such work they have decided to take up the manufacture of the cadet rifle. Experience with air-guns has shown that although their plant was designed primarily for the production of expensive arms it is capable of producing inexpensive weapons of high quality. In their opinion the cadet rifle model will be an important piece of work, comparable in style and finish with the best types of military arm. It can only be produced at the price which has been mentioned, by the aid of a very special plant of tools and machinery. The Company state that they have already in hand the manufacture of the necessary gauges, tools, and other appliances requisite to ensure rapid delivery. It is impossible to say anything definite regarding price until the official model and specification are forthcoming, but the price spoken of by the Government when they introduced the subject was a very low one, viz., something in the region of 30s. to 35s. per unit. On the subject of the patents the Company give no information, and express no opinion, this on the grounds that the specification has not yet been made public. The Company hope that the first samples will be available in time for Bisley next July. Shortly afterwards they hope to be able to deal rapidly with orders in the rotation with which they are received.

From the above letter it is apparent that the Birmingham Small-Arms Company have decided to proceed on their own course, relying on a good general demand for the rifle, and unfettered by the delays incidental to waiting upon the convenience of the National Rifle Association. This really sums up all we have to say on the commercial aspect of the new rifle. The War Office has performed excellent service in recognising the utility of such a weapon. It has widely advertised its instructional value; and the ground has been prepared for a rich harvest, provided the manufacturer is enterprising enough to sow his own crop and supervise its growth. On the subject of contracts, which the manufacturer dearly loves when invited to lock up a considerable amount of capital in special tools and appliances, we cannot help thinking that the radical difficulties of the situation will make the N. R. A. a slender reed to lean upon.

The following appended particulars of the cadet rifle are taken from the article of our contemporary the *Field*:—

Bolt Mechanism.—Excluding the trigger and its parts, the breech mechanism consists of six main portions, viz., the firing pin A, the firing pin spring B, the bolt C (which carries the bolt handle), the bolt head D, the firing pin nut E, and the safety bolt F. The bolt proper is fastened to the bolt head by the screw G, shown in the illustration. The screw serves both as a means of fastening and as a rotation bearing, the same as in the Service rifle. The bolt mechanism is assembled by inserting the firing pin and firing pin spring into the bolt, and then screwing the bolt head into place. The firing pin nut is then screwed to the rear end of the firing pin, and when it is home the keeper screw H is tightened by using a bronze coin as a turnscrew. The extracting mechanism consists of the ordinary hook-shaped extractor I, which lies within a slot cut in the bolt head. The breech face is recessed to take the projecting hook. Upon opening the bolt the extractor I draws out the fired case until the head comes into contact with the ejector stop J. The latter projects above a groove cut in the floor of the receiver. The safety bolt F, by means of its eccentric end, locks the firing pin in the cocked position and prevents the bolt from turning.



Trigger Mechanism.—The trigger mechanism consists of three main parts, and it combines with its ordinary functions that of a bolt stop. The parts in question are the trigger itself, the trigger lever L, and the trigger spring M. The trigger having a drag pull, otherwise known as a double pull, means exist for the application of two successive values of leverage. The trigger lever is pivoted at N, and it carries two projections, O and P. The projection O engages in a groove cut in the bolt, and acts as the bolt stop, while the projection P engages with a forward extension of the firing pin nut, and thus becomes the sear or retaining catch which holds the firing pin in the cocked position.

The trigger K is pivoted on the trigger lever L at Q, and it also carries the two fulcrums R and S. The first part of the trigger pull acts with the leverage resulting from the fulcrum action of R with reference to the under portion of the body of the action. This lowers the trigger lever, and draws the sear a certain distance downwards. After the trigger release has proceeded a certain distance, the second fulcrum S comes into action. The bearing surface of the second fulcrum being a greater distance from the pivoting centre of the trigger, the strength of the pull needed to complete the release of the firing mechanism is materially increased.

The working of the bolt is substantially the same as that of the ordinary Service rifle. The bolt unlocks with a quarter turn and the sear P arrests the forward movement of the firing pin on the return journey, the bolt handle being thereafter forced home against the resistance of the firing pin spring. The bolt handle locks into the recess T formed on the body of the action. The stock is detached from the barrel and action by undoing the screw carrying the front swivel, and by using a bronze coin to take out a screw beneath the rear end of the barrel.

A detail of the mechanism which cannot be shown in the sectional drawing, but which is made quite clear in the general view, Fig. 1, relates to the function of the projection U on the bolt and the corresponding recess in the firing pin nut. When the bolt is closed and the firing pin is cocked, these two parts are in line with one another, and the firing pin can drive forward to the full extent necessary for discharging the cartridge. If the bolt is not properly home, the notch and the projection are not in true alignment, and the firing pin either fails to strike the cartridge rim or else completes the closing of the bolt before doing so. After firing, the action of turning the bolt to unlock the breech withdraws the firing pin by the cam action of the projection U, this representing a partial cocking of the firing pin. The firing pin being thus held back during all loading processes, the point of the striker is prevented from projecting in such a way as to risk causing premature discharges. The Mannlicher and other military rifles contain an analogous movement, except that the firing pin is wholly cocked by the cam in the act of opening the bolt. An additional function of the part U is to resist the accidental opening of the bolt when carried in the uncocked position.

The following are additional statistics :—

Weight of rifle...	5 lb. 5 oz.
Length over all	41½ in.
Length of stock	13½ in.
Distance of bolt retraction	1¼ in.
Distance from butt to backsight ...	23 in.
Distance from backsight to foresight	18 in.
External diameter of barrel at muzzle	·55 in.
External diameter of barrel at breech	·80 in.
Diameter of bore from land to land ...	·214 in.
Depth of rifling	·005 in.

Rifling. Eight grooves of rounded shape making one turn in 16 in., the lands being about three-quarters of the width of the grooves.

The fore-end comes to within 8 in. of the muzzle.

Sight elevations marked for 25, 50, 100, 150, and 200 yards.

Wind-gauge on backsight operated by screw having 50 turns to the inch.

Foresight. Knife-blade, ·05 in. thick, ⅛ in. high.

Backsight notch. Semi-circular groove ·085 in. wide.

Sling swivels on butt and fore-end.

ROUND THE TRADE.

(Continued from page 49.)

It is reported that a well-known firm of Bristol gunmakers will shortly open premises in London.

The Normal Powder and Ammunition Co., Ld., have promoted at Hendon a new rifle club which was inaugurated under the distinguished patronage of Lord Roberts.

The minature rifle meeting which the National Rifle Association contemplated holding in Newcastle-on-Tyne during the present spring has been postponed till the month of October.

H. M. Inspectors of Explosives have issued an erratum note concerning the heat test memorandum dated January 1st, 1906, page 2, Paragraph *b*, line 4, to the effect that "0·00075 grm." should read "0·000075 grm."

Mr. W. D. Borland recently delivered a lecture before the Society of Chemical Industry, in which he dealt with the ignition of smokeless powders, the same containing particulars of his latest researches and conclusions on the subject.

The financial papers have given a certain amount of attention lately to the financial arrangements of the company which is exploiting Herculite and Yonckite, the latter being "as much superior to dynamite as is Herculite to black powder."

The directors of the Birmingham Small Arms Co., Ld., have declared interim dividend at the rate of 5 per cent. per annum, less Income Tax, on the preference shares, and at the rate of 10 per cent., free of Income Tax, on the ordinary shares, for the half-year ended on the 31st of January last.

Major John Barlow, member of the N.R.A. Council, has contributed the sum of £250, supplemented by a sum of like amount from the Association's coffers, with which it has been decided to establish a competition open to contestants in the "King's" Prize, which is limited to those who, during the last five meetings, have failed to win an individual prize of £5 in any service rifle competition. The first prize will be £50, and the remainder of the money will be divided into 151 prizes of smaller amount. The conditions will be seven shots at 200, 500 and 600 yards with an entrance fee of five shillings, and the object of the new competition is to provide additional inducements to second-class shots.

At the twentieth annual meeting of the New Explosives Company, held under the chairmanship of Mr. E. H. Hindley, reference was made to the company's intention to take up the manufacture of sporting and other smokeless powders, with a view to developing the company's business on lines independent of Government contracts. Mr. Hindley referred to the favourable position occupied by the company by reason of the fact that they were already manufacturers of guncotton, the basis of smokeless powders. He also incidentally mentioned that it would be necessary at some future time to provide extra capital, not so much in connection with the manufacturing problem as to provide the capital requisite for opening the necessary new accounts.

With reference to the accident of a gun burst at Monte Carlo, one who was present on the occasion explains that the shooter first of all experienced a miss-fire and was required in the usual course to fire another shot, the right barrel being snapped on a blank-fire cartridge in accordance with the usual practice. When the right barrel came to be used on the next occasion it burst at the muzzle. The obvious explanation is that the blank cartridge which was improvised by cutting away the shot charge from an ordinary cartridge was so deficient in confining power that the powder failed to explode properly, and so left the wads in the muzzle, where they formed a sufficient obstruction to cause the burst on the firing of the next round. This accident suggests the desirability of carefully inspecting all guns which have been used to fire blank cartridges. It further suggests the advisability of cutting away the forward end of the cartridge so as to leave a sufficient length of case to make a turnover which will add the necessary additional amount of confinement to secure a reasonably sufficient combustion of the powder charge.

The annual report of the Roburite Explosives Co., Ld., states that the severity of the competition among leading manufacturers of explosives during the past twelve months has led to an unprecedented fall in prices, resulting in a considerable reduction in the Company's trading profits. The outlook for the current year is even less favourable. Notwithstanding these unfavourable conditions the accounts show a net profit of £7,150 which, with the amount brought forward from the previous account gives £8,493 for appropriation. Ten per cent. is set aside for reserve, the full ten per cent. dividend is provided for the preference shares, and two-and-a-half per cent. dividend is recommended on the ordinary shares. This allows for £1,380 to be carried forward. Mr. H. A. Krohn presided at the general meeting held on the 15th ult. and, in speaking of the unprecedented state of affairs in the high explosives trade, he affirmed confidence in the financial strength of the company being sufficient to survive the inconvenience caused by the restriction of prices.

The Vickers Maxim report states that after providing the usual depreciations, etc., the profits of the year amount to £787,778. From this sum the amount of £137,457 has been written off the item of goodwill and patent rights, bringing the sum down to £500,000. Add the sum of £191,074, and there is an available surplus of £841,396. Taking into account the interim dividend paid in August last, the final distribution now recommended makes up a total of five per cent. on the preference shares and 3s. per share on the ordinary shares, leaving a balance of £215,146 mentioned above. The above item of half a million for goodwill and patent rights bears a favourable relation to the total of £8,733,748, shown on the assets side of the balance sheet. The bulk of the improvements visible in the company's accounts is stated to be largely due to the increase in business done with foreign countries, both in goods manufactured at home and in those made to the company's systems abroad. The directors have entered into a combination with three of the largest manufacturing firms in Italy, the Terni Steel Works, the Shipbuilding Yards of Orlando of Leghorn, and Odero in Genoa, to erect Gun Works at Spezia in that country. Following the general meeting which was held in Sheffield under the chairmanship of Mr. T E. Vickers on the 14th ult. an extraordinary meeting was held at which it was resolved to give the directors certain special powers in regard to the guaranteeing of dividends or interest in concerns in which the company might be interested or with which it might sub-contract.

Mr. Frank Huxham, Secretary of the Kynoch Company, recently attended a dinner of the Birmingham and Midland Ironmongers' Associations, and in proposing one of the toasts he referred at length to the arrangements for price maintenance in cartridges which his firm had endeavoured to carry through in conjunction with Messrs. Eley and Joyce. *The Ironmonger* of the 17th ult. contains a full report of the speech, from which it appears that Messrs. Kynoch's customers voted in overwhelming majority for price maintenance, the figures being fourteen to one. It was obvious that whilst the subject was under consideration it was necessary that in the meantime no cartridges should be sold by any manufacturer without a stipulation that the goods were supplied subject to any price-maintenance condition that might be imposed later on, and an agreement was made between the three ammunition manufacturers concerned—namely, Eley Brothers, Joyce & Co. and Kynoch. That agreement was made in January last. He exceedingly regretted to say, however, that it was broken in February by Eley Brothers accepting from Mr. W. J. Jeffrey —probably the largest retailer in the country, and one opposed to price-maintenance—his order for next season without any price-maintenance condition. In the opinion of Kynoch and Joyce that action on the part of Eley Brothers made general price-maintenance for the year impossible, and those two firms, therefore, asked to be excused from attending any further meetings on the subject this year. His objects in placing those facts before them was to show how nearly price-maintenance was carried, and the reason why, having gone so far, it had fallen through.

TRADE MARKS.

ADVERTISED. JANUARY 31,—MARCH 28, 1906.

277,029. The word "RADIO." To apply to gun carriages and accoutrements of steel. The Carbonite Syndicate, Ld., London. November 4, 1905.

279,147. } A device representing a crocodile with the word
279,148. } "CROCODILE" beneath. To apply to arms, ammunition and explosive substances. The Chillingham Tool Co., Ld., Wolverhampton. January 26, 1906.

279,642. The word "BULFIN." To apply to arms. B. R. Banks & Co., Ld., London. February 7, 1906.

279,466. The word "TROTYL." To apply to explosive substances. Sprengstoff Ag., Carbonit, Germany. January 31, 1906.

279,147. A device representing a crocodile with the word "CROCODILE" beneath. To apply to goods in class 19 with the exception of arms and cartridge cases. The Chillingham Tool Co., Ld., Wolverhampton. January 22, 1906.

REGISTERED. JANUARY 18,—MARCH 21, 1906.

275,916. Fried. Krupp, A. G., Grusonwerk.
277,293. } Cogswell & Harrison, Ld.
277,294. }
274,799. The E. C. Powder Co., Ld.
276,591. Westley Richards & Co., Ld.
277,295. } Cogswell & Harrison, Ld.
277,296. }
277,427. Curtis's & Harvey, Ld.
277,411. The Peddie Small Arms Corporation, Ld.
277,438. }
277,439 } Cogswell & Harrison, Ld.
277,440. }
277,030. The Carbonite Syndicate, Ld.
277,292. Cogswell & Harrison, Ld.
277,029. The Carbonite Syndicate, Ld.
277,291. Cogswell & Harrison, Ld.
277,990. The E. C. Powder Co., Ld.
277,780. W. S. Greaves, Ld.
274,113. A. Hollis & Son.

APPLICATIONS FOR PATENTS.

FEBRUARY 19, 1906—MARCH 17, 1906.

4,053.* Ordnance. Fried. Krupp, Akt.-Ges. (Date of application in Germany, April 11, 1905.)
4,069.* Ammunition. G. Luger.
4,108.* Gun Mountings. R A. Hadfield.
4,114.* Explosives. E. Steele.
4,115.* Explosives. E. Steele.
4,126.* Small Arms. G. Luger.
4,181. Small Arms. H. Martschen.
4,249. Ordnance. L. K. Scott.
4,308. Gun Mountings. Vickers, Sons & Maxim, Ld., and C. L. Sumpter.
4,389. Machine Guns. Baron A. O. von Augezd.
4,404 Ordnance A. T. Dawson and G. T. Buckham.
4,577. Nitrocellulose. R. H. Annison and G. T. Oliver.
4,587.* Torpedoes. A. E. Jones.
4,622. Small Arms. A. H. Butler and F. G. Clark.
4,685.* Small Arms. J. Tambour.
4,686.* Small Arms. J. Tambour.
4,776. Small Arms. H. T. Ashton and J. J. Speed.
4,937. Ordnance. A. T. Dawson and G. E. Watt.
4,959. Gun Mountings. W. Beardmore & Co., Ld., and A. Bremberg.
4,988. Fire Arms. T. G. Russell.
5,098. Small Arms. L. B. Taylor.
5,259.* Explosives. C. E. Bichel.
5,313. Ammunition. E. Baker.
5,315. Military Equipments. W. P. Wise and W. T. Twigg.
5,495. Air Guns. E. H. Parsons and L. B. Taylor.
5,554. Small Arms. J. Rigby & Co., Ld., and E. J. Rigby.
5,616.* Time Fuses. Fried. Krupp, Akt.-Ges. (Date of application in Germany, April 14, 1905).
5,617.* Time Fuses. Fried. Krupp, Akt.-Ges. (Date of application in Germany, April 18, 1905).
23,601A/05. Ordnance. C. P. E. Schneider. (Date applied for under Rule 5, November 16, 1905).
5,919. Target. C. Vesty.
5,957. Ordnance. A. T. Dawson and G. T. Buckham.
5,960. Ordnance. Fried. Krupp, Akt.-Ges. (Date of application in Germany, April 17, 1905).
6,067. Targets. A. H. MacKenzie.
6,070.* Automatic Guns W. Trabue, D. Moxley and C. C. McClarty.
6,071. Chronograph. G. Klumak.
6,093. Small Arms. W. F. Cole.
6,314.* Explosives. H. W. Lake.
6,355. Gun Sights. B. T. Hamilton and L. Stroud.
6,381.* Dynamometers. F. Sellers.
6,469.* Small Arms W. M. Scott.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MARCH 1—22, 1906.

COMPILED BY HENRY TARRANT.

25,241 (1904). **Range Finder.** C. & H. C. Beck, London. A range finder, of the type in which two telescopes one fixed and one movable upon a graduated base, is so constructed that inaccuracies due to rocking of the movable telescope are obviated. An isoflexial prism or set of mirrors is caused for this purpose to be mounted upon a sliding carriage, and is adapted to be moved towards or away from two telescopes fixed close together. Accepted February 21, 1906.

2,776 (1905). **Manufacture of Nitroglycerine.** Centralstelle für Wissenchaftlich-technische Untersuchungen G.m.b H., Germany. A process by which glycerine is nitrated not by fresh nitrating acids, but by waste acids from a previous nitrating operation which have been revived. Higher amounts of nitroglycerine are obtained than when fresh acids are used. Accepted February 8, 1906.

3,725 (1905). **Forming Guncotton Blocks.** A. Musker, Bootle. To expedite the production of guncotton blocks the guncotton is introduced into the container in which it is pressed in a semi-fluid condition. A press of the type described in Patent No. 108 (1905) is used, and the guncotton when introduced is in such a condition as to be capable of being mechanically mixed by a rotary device which is raised and lowered out of and into the container. Accepted February 22, 1906.

4,036 (1905). **Ejector for Automatic Small-Arms.** J. T. S. Schouboe, Denmark. Mechanism combining two main elements, an extractor and an ejector rod. These parts are connected with a recoiling part of the automatic small-arm, and are actuated to expel the spent cartridge partly by sliding stationary surfaces on the recoil and partly by abutting against other stationary parts of the arm. Accepted February 22, 1906.

4,057* (1905). **Manufacture of Nitroglycerine.** J. Wetter, London (Agent for *The Westfälisch-Anhaltische Sprengstoff, Ag., Germany*).

4,372 (1905). **Explosive Storage.** E. Louis, France. In order to enable chlorate and nitrate explosives to be handled and stored with safety, fat and one or more fusible combustibles with one or more oxygen-supplying substances are incorporated with them at a temperature sufficient to allow all the combustibles to melt. Accepted March 1, 1906.

7,772 (1905). **Rifle Range Marker.** F. J. Brown, Newark-on-Trent. A marker for rifle ranges designed to be worked from the butts to indicate to the shooter the value of his shot. It consists of a number of compartments horizontally arranged with a roller at each end of each compartment. A numbered piece of linen is so arranged that the number may be turned to the front by twisting the rollers. Attention is directed as a result of a provisional report under Rule 7 of the Patents Rules (1905) to Patents Nos. 3,779 (1895), 9,536 (1885), and 15,247 (1891). Accepted February 8, 1906.

10,207 (1905). **Miniature Targets.** C. J. McCoan, Guildford. Targets for use with rifles shooting small ammunition are mounted upon a reciprocating carriage and a revolving shaft. The targets may be moved from side to side or may be caused to disappear by operating wheels at the firing point. The target and supports are constructed so that they may easily be transported. Accepted February 22, 1906.

11,102 (1905). **Small-Arm Sight Elevator.** H. McKenzie, Radnor Park, and W. Tivendale, Clydebank. Between the barrel and the underside of a leaf-sight is arranged a threaded tube containing a graduated slot. In the tube a screw works. This part is adapted quickly to raise the sight to accord with any range indicated on the slot. The screw is held in position by a pinched screw or a lock nut. Accepted February 15, 1906.

11,094 (1905). **A Clinometer for Use in Gunnery.** A. W. Ryland, Preston. A clinometer is described in this specification, and this instrument is designed to give quadrant elevation to a gun and to indicate the inclination of the trunnions to the horizontal. Accepted February 8, 1906.

12,892 (1905). **Formation of Smokeless Powder.** A. T. Cocking, Four Oaks, and Kynoch, Ld., Witton. The strip or ribbon form of smokeless powder is so shaped that it takes the form of an elongated double-headed rail. The strips may be cut up into flakes. The ribs at either side of the strips prevent the strips lying too closely together, and so provide a free passage for the gases. Accepted March 1, 1906.

13,987 (1905). **Caps for Projectile Fuses.** W. Beardmore & Co., Ld., and A. Bremberg, Glasgow. A cap is provided for time or percussion fuses to protect the fuse from exposure to air and moisture. The cap can be placed in position only when the fuse is in the "safe" position. Accepted March 1, 1906.

13,988 (1905). **Percussion Fuses.** W. Beardmore & Co., Ld., and A. Bremberg, Glasgow. The percussion device of "graze fuses" is made even more sensitive than before, but to provide for absolute safety in handling the fuse mechanism is so arranged that the percussion device is released only when the projectile is in the air, by a timing device somewhat similar to that used in time fuses. Accepted March 1, 1906.

14,558* (1905). **Sight for Miniature and Air Rifles.** The Birmingham Small-Arms Co., Ld., and G. Norman, Birmingham.

15,222 (1905), **Fuse Head for Electric Blasting.** F. Render, Manchester. The wire ends in a fuse are secured in the proper position by forming pin heads upon their extremities after they have been passed through a washer. The washer is drawn into the fuse head by the wires so secured, and washer and wires are held therein by cement. The powder charge is pressed over the wire ends in such a fashion as to ensure centre firing of the cartridge more certain. Accepted February 8, 1906.

15,911 (1905). **Rifle Breech Mechanism.** P. T. Godsall, Isroyd Park, Flintshire. In Patents Nos. 22,003 (1902) and 18,824 (1904) the above patentee described the mechanism of a bolt rifle of special design. In the present specification he deals with a method of obtaining a more rapid camming back of the striker, and with other structural improvements. Accepted February 15, 1906.

16,062 (1905). **Lubricating Wad.** W. M. Cohen, U.S.A. A wad designed to lubricate the barrel during its passage through the bore consists of a number of layers of wood having their faces cemented together and arranged so that the grain of each is at right angles to the grain of that next to it. A cross-cut edge must by this arrangement exist all round the periphery of the wad, and the plumbago with which the wad is coated is held and is not exhausted until the wad has passed through the barrel. Accepted February 22, 1906.

16,558 (1905). **Range Finder.** Lieut.-Col. R. H. Owen, New Zealand. Angle-measuring apparatus of the sextant type is applied to the discovery of ranges and altitudes. The principle of calculation upon which the instrument is constructed consists in the fixed proportions which exist between the sides of triangles having the same angles. Accepted March 1, 1906.

19,513 (1905). **Automatic Pistol.** E. H. Searle, U.S.A. Automatic pistol mechanism designed especially to hold the parts in the locked position until the projectile leaves the barrel. The resistance of the bullet to rotation as it takes the rifling is used to carry the barrel forward against the action of a spring and to remove a part which releases the locked breech. Accepted March 1, 1906.

21,636 (1905). **Rifle Mechanism.** J. M. Demay, B. Ferreol, and J. M. Murigneux, France. Rifle mechanism of the bolt type is set out in this specification. The parts are adapted to be easily taken apart for cleaning, and it is claimed are cheap to manufacture They are applicable especially to weapons of the miniature type. Accepted February 22, 1906.

22,923 (1905). **Recoil Absorber for Small-Arms.** B. Behr, Hamburg. The stock of a small-arm is so arranged that the interior forms a piston and the outside a shell or cylinder in which it works. The air brake so formed works in conjunction with a liquid brake, so that the pressure faces may be kept within small limits. The fluid brake is regulated by a screw in the butt. Accepted February 8, 1906.

24,501 (1905). **Driving Band of Projectiles.** E. M Johnson, U.S.A. In order to prevent the copper driving band of a projectile from turning when passing through the bore of the gun, a number of spikes, turned in the direction that the rifling tends to rotate the projectile, are formed upon the bed in which the band is seated. These spikes are driven into the band, and hold it against rotary movement with relation to the projectile. Accepted March 1, 1906.

24,588 (1905). **Ordnance Barrel Construction.** J. H. Brown, U.S.A. To prevent one section slipping with respect to another when wire is wound on the barrel core under tension and to prevent creeping of the segments when the gun is fired under very high pressures, overlapping sheets are arranged with their inner edges engaging with steps or shoulders cut longitudinally along the core tube of the barrel. Accepted February 8, 1906.

24,869 (1905). **Automatic Discharge of Small-Arms.** T. Manciu, Austria. A device for small-arms which is adapted to discharge the shot the moment the weapon has reached a certain elevation. A compressed spring is caused to actuate the trigger when a pendulum forming part of the device is dipped by the movement of the rifle into a liquid. Accepted February 8, 1906.

25,507 (1905). **Torpedo Steering.** A. Racic, Austria. This torpedo mechanism is an improved form of that described in Patent No. 26,503 (1903). It is designed by means of an oscillating beam acting in conjunction with two cups of mercury covered with a flexible diaphragm to maintain the rudder in a horizontal position. Accepted February 22, 1906.

26,033 (1905). **Leaf-Sights for Rifles** M. Klingler, Germany. A leaf-sight of the type which is elevated by means of a slide working between the underside of the leaf and the tops of curved extensions from the bed, is constructed so that the curved extensions are not needed. The sight leaf is itself curved. Accepted February 15, 1906.

26,252 (1905). **Recoil Brakes for Ordnance.** Fried. Krupp, Ag., Germany. The fluid pressure brake described in Patent No. 19,434 (1905) is so modified that the length of the recoil of the gun may be finely adjusted. The brake apparatus is also more simply and compactly constructed. Accepted February 15, 1906.

14,627 (1905). **Automatic Sighting Apparatus for Guns.** F. T. Fisher and W. J. Griffiths. This specification is a Secret Document.

26,434 (1905). **Fuse Head for Electric Blasting.** F. Render, Manchester. A method of preventing short-circuiting of the wires of an electric fuse is described in this patent, and consists of setting the wire ends in two passages formed for them in the plug. The extreme ends are pin-headed as is described in Patent No. 15,222 (1905), dealt with above, so as to prevent the wires being pulled through the passages. Accepted February, 8, 1906.

27,257 (1905). **Automatic Rifle Mechanism.** P. Mauser, Germany. The striker and spring mechanism of the automatic rifle described in patent No. 25,518 (1902), is modified to effect improvements in the working of the weapon. Accepted February 22, 1906.

51 (1906). **Brush Mechanism of Ordnance.** Fried. Krupp, Ag., Germany. Ordnance having a recoiling barrel of the type dealt with in patent No. 13,738 (1904), is provided with a device set out in the present specification by means of which the breech wedge when in its open position is prevented from accidental closing. Accepted February 22, 1906.

1,071 (1906). **Adjustable Brake Mechanism of Ordnance.** Rheinische Metallwaaren, und Mf. The arrangement of the mechanism of recoil brakes of the type which diminish in

movement as the gun is elevated is modified so that should the front plate of the brake be removed for cleaning or oiling it cannot be replaced except in proper position relative to the transmission gear. Accepted February 22, 1906.

1,179 (1906). **Fluid Recoil Brakes for Ordnance**. H. Motz, Germany. The brake of the type in which the piston is gradually rotated during recoil and return to uncover passages for the fluid is rotated in the method described in this patent by a groove and feather engagement between the piston and a rod extending through its centre and fixed to the cylinder. The tightness of the piston is not impaired as it is said to be by other methods. Accepted February 15, 1906.

2,513 (1906). **Time Fuse for Projectiles**. Fried. Krupp, Ag., Germany. The easily rotatable cap which covers the time-fuse mechanism set out in Patent No. 28,702 (1902) is so constructed that it is automatically fixed when the shell is fired. The cap is weakened at a certain point, and is upset at that point by the shock of discharge. Accepted February 22, 1906.

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

SELECTED PATENTS.

MANUFACTURE OF NITROGLYCERINE

4057. (1905). J. Wetter, London. (Agents for *the Westfälisch-Anhaltische Sprengstoff Ag., Germany*. The manufacture of explosives containing nitroglycerine is dealt with in this specification, and the patentees, design is to add a substance which will prevent congealing or freezing at low temperatures. For this purpose dinitro-monochlorhydrin is added to the explosive compound, the amount nsed being from 15 to 25 per cent of the weight of the nitroglycerine contained in the compound. Either pure dinitro-chlorhydrin or nitroglycerine containing dinitro-chlorhydrin may be used in the manufacture of such explosives.

Compared with the addition of dinitro-glycerine to explosive compounds, the use of dinitro-chlorhydrin is claimed to offer the following advantages. Dinitro-chlorhydrin may be produced easily and without danger, the practical yield being very near the theoretical yield. It does not lower the temperature at which the explosion takes place and it is not liable to decompose. It prevents freezing of dynamite better than any other known substance (dinitro-glycerine for instance), and it accelerates the gelatinizing of the explosive. Accepted February 22, 1906.

REAR SIGHT FOR MINIATURE AND AIR RIFLES.

14,588 (1905). The Birmingham Small Arms Co., Ld., and G. Norman, Birmingham. The sight described in this patent specification has been constructed especially for use with air rifles or with rifles shooting small ammunition. The sight is capable of being finely adjusted both to correspond with different ranges and to counteract side divergence of the projectile caused for instance by wind. The sight is illustrated by the drawings which are reproduced upon this page.

The sight leaf stem *a* is pivoted between two lugs *b* (Fig. 1) which stand up from the sight bed *c*. At its other end the stem *a* carries the laterally-adjustable sight-bar *d*. The stem *a* is screw-threaded and has working upon it the milled nut *e*. The sight-bar is elevated by means of this nut. When the nut is turned upon the stem towards the sight bar, the conoidal collar *f* is caused to ride up the inclined ramps *g* which rise from the sight bed and are situated upon either side of the stem.

The ramps terminate in the flat-faced guide pieces *h* which rise from the rearward end of the sight bed. The stem *a* is guided and steadied in its movement in a vertical plane by these pieces *h* between which the flat part *i* of the stem works (see section view Fig. 3). The depressing movement of the sight bar is brought about by the spring *j* when the adjusting nut *e* is run back. This spring is adapted always to press the collar *f* of the nut *e* against the edges of the ramps *g* and so to hold the sight firmly at any elevation. The spring is secured between the ramps and its free end exerts an upward pressure against the extension *k* of the stem *a* beyond its pivot.

The sight-bar *d* is secured to the head of the stem *a* by a sliding dove-tail connection. Lateral movement is imparted to the bar by the screw *l*. The front of the stem head is formed with a groove or channel *n*, circular in section, and an open front slot *o* of less width than the channel *n*. The back edge of the sight-bar is formed to correspond with these cuttings, the barrel part *p* of the bar forming a sliding fit with the channel *n* and the flat shank part *q* with the open front slot *o*. The barrel part *p* is screwed internally to accommodate the adjusting screw *l*. This screw *l* is held against lateral displacement when it is in position by the collar *r*. This collar enters the recess *s* cut in the front of the stem as is illustrated in Fig. 2. The sight-bar is assembled (Fig. 4) by first passing the

Fig. 1

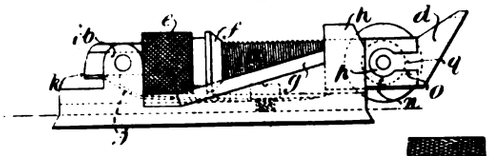


Fig. 2

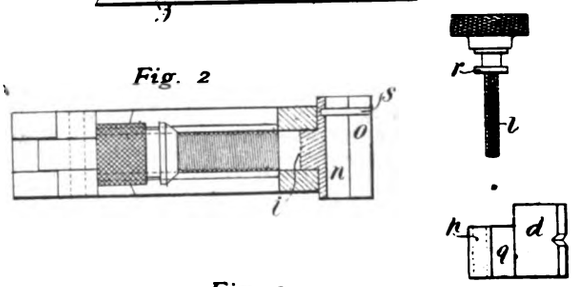


Fig. 3

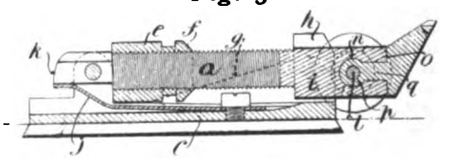
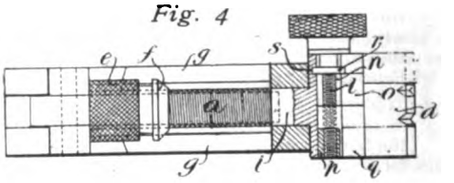


Fig. 4



screw *l* into its position. The sight-bar is then slipped into the grooves provided in the stem head for its reception and the threads of the screw and barrel are engaged to draw the bar into its proper position. The connection thus established prevents the bar or the screw being lifted lengthwise through the open end of the stem. The movable parts of the sight are provided with a system of vernier scales to allow of exact adjustment of the sight. The edges of the ramps *g* may be graduated whilst the collar *f* may also be marked. Very fine adjustments of elevation could, by this method, be obtained. The sliding bar is marked with a scale which is used in conjunction with a single mark on the centre of the stem head. The head of the screw *l* might also be marked to allow of micrometer-like lateral adjustments. Accepted February 8th, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Windgauge Slides.—To observe the simple mechanical attachment which the War Office has approved for use on the long L.-E. rifle is to wonder why the simple and obvious principle of a windgauge has been so strenuously opposed in the past. A scandal of the first order was created at the time of the South African war when it was discovered that all rifles were issued with a serious and irremediable lateral error in the sighting. The resulting changes of personnel brought Colonel Hopton to the front; and we must attribute to his influence the many notable changes which have been incorporated into our service rifle with a view to making it pre-eminently the marksman's weapon. Errors of design and general clumsiness of structure are well-nigh forgiven in the face of a rifle which shoots a consistent diagram and which is capable of adjustment so that the grouping of the shots will follow the line of sighting. The importance which is attached to the extension of rifle practice amongst soldiers and civilians has hitherto been stultified by the implied teaching that errors in the shooting of a rifle must be corrected by aiming in one direction in order that the bullet may shoot in another. Just as Mahomet found it more practical to go to the mountain than to expect the mountain to come to him, so our experts have at last recognised that the sights must be adjusted to the shooting of the rifle, rather than alter the point of alignment to suit the idiosyncrasies of the arm. It is in reality a great triumph that common-sense should have prevailed against the tradition that the soldier must be taught to shoot without any of the aids which the humblest sparrow-potter freely applies to his air-gun. The Palma match was the deciding element in the battle of principle which has now been decided. The sight of the short L.-E. rifle was hurriedly and imperfectly re-designed to cope with the new idea. The volunteers' rifle now follows suit; and we have thus seen the last of the historical individual who was found in a retired corner at Bisley painting six feet of wind on to his sight.

The New Miniature Target.—It is interesting to note that at a recent county miniature meeting carried out under the auspices of the National Rifle Association a new target was used which represents an important alteration on previous designs. The new Bisley 200-yards target consists of a 12 in. diameter area of black, with an inner ring marking out a five-inch centre. It is the latter which counts as the bull, while the remaining area of black counts as the inner. The magpie and outer rings lie outside the black and represent the usual conditions. One of the greatest difficulties connected with shooting in indoor ranges is that a bull, having a size proportional to the old 200 yards target, is unduly difficult to see. Extra good illumination only palliates the evil, and in fact produces a glare which is painful to the eye by reason of the absence of general diffusion of light. The point of principle which is involved is that the size to which the Bisley bull was progressively diminished, to limit the number of possibles made in competitions with large entries, went beyond the possibilities of human vision. The N.R.A. is nothing if not thorough, and it has passed with a jump from seven to 12 inches of black, the latter having the above inner circle which counts as bull for scoring purposes. The proportional target at 25 yards has 1½ in. diameter of black, with a ⅛ in. centre which the shooter must strike to score a bull. The actual targets printed on this system are extremely pleasant to use, and the additional comfort for the eyesight is fully compensated in the scores made by the extra smallness of the area counting as bull. Highest possibles will be somewhat more difficult of attainment, and the possibility of ties will be proportionately

reduced. The new target thus gives the standard four values of sub-division to each target. If the size of the circles outside the bull are suitably proportioned to the conditions of miniature markmanship, so disregarding the inapplicable 200-yards conditions, a very practical target will result. Such a possibility enables us to foretell the gradual disuse of the so-called decimal target, which carries an immense number of rings, sufficient in fact to divide the target into ten scoring areas. The decimal principle does not enter into the use of such a target. If ten shots are fired the highest possible becomes 100. The shooter who drops five points scores 95. If the decimal theory were really applicable, such a score would represent 95 per cent of perfection. As no such meaning can be attached to this or any other score value obtained on such a target, the theoretical justification supposed to underlie the system falls to the ground, and practical men will accordingly fall back on the four-section target, the size of whose rings is empirically proportioned to the quality of shooting experienced in practice. Gunmakers and others who lay themselves out to supply rifle club sundries should lose no time in possessing themselves of a supply of the new targets. As soon as their merits are widely known it seems certain that all targets proportioned on alternative systems will become unsaleable.

Trade in Birmingham.—There is a very strong feeling in Birmingham that something must be done to remedy the unfavourable conditions which are yearly emphasised in the Proof House returns. In speaking on this subject a year ago we took the opportunity of pointing out that the manufacture of rifles and other proprietary articles on the interchangeable basis represented a legitimate section of gunmaking readily susceptible to early development. Since that time the growing demand of the young men of the country for a cadet rifle with which to learn shooting has inaugurated a trade which is in active course of organisation. The wonderful success which has followed the introduction of Birmingham-made air-guns represents adequate proof that the manufacturers in this line of work are fully alive to the possibilities of business, and quite capable of looking after themselves. Our attention is accordingly now especially directed to a consideration of the trade in double-barrel sporting guns of the kind which are still turned out on the well-established basis of extreme personal skill on the part of the workers and relatively small dependence on exactitude of machine processes. The difficulty resolves itself into a question of considering whether the decline of trade which everyone admits, is due to a lack of demand, or to the fact that our rivals are better equipped for satisfying the needs of the market. Whatever may be the precise internal conditions of the business it must be recognised that every source of supply has its special meritorious features, and these may be summarised in the case of Birmingham as extreme soundness of construction and a thorough understanding of the design which is most appreciated by the user. Demand has certainly been reduced by the great lasting qualities of the weapons which have been sold in the past. New sources of consumption must certainly exist in an age when the unoccupied tracts of the world are being actively civilised. Important markets have been closed by tariff barriers and extended facilities of supply in America and on the Continent. The English gun still enjoys a great reputation; and it must, therefore, be recognised that the failure to replace lost markets with new ones is partly attributable to lack of enterprise in sending representatives further afield than ever before. This in fact seems to be the only possible remedy for the existing stagnation in the home demand. The systematisation of designs, and the making of them well known to possible trade customers might do something towards tapping new sources of demand. One cannot, in fact, get away from the belief that the manufacturing side of gunmaking is better organised than the sales department. The latter comprises the preparation of attractive printed matter, its translation into foreign languages and its systematic distribution, supplemented wherever possible by the personal endeavours of representatives on the spot. It needs more acquaintance with the practical conditions of the business than we can claim to possess to make recommendations in more detailed form; but one cannot go far wrong in the face of such evidence as is afforded by the interesting publications issued by the pushing American manufacturers, and the less convincing documents which emanate from the manufacturing, as distinguished from the retail, houses of this country.

Barrel Steel.—Rather more than passing interest is merited by our article in the current number on rifle and gun barrel steel. Amongst practical gunmakers the firm of Webley were the first to appreciate the importance of knowing something more about a brand of steel than the fact that its makers consider it suitable for rifle manufacture. The scientific examination of test samples of steel was doubtless conducted for many years previously by the leading manufacturers of military rifles. In a similar fashion the Whitworth Company paid great attention to the behaviour under test of their well-known brand of fluid compressed steel, which has maintained the highest reputation during a large number of years. The introduction of cordite express rifles, and the vigorous efforts which are now being made to recapture for this country the manufacture of shot-gun tubes, combine to bring the question of the steel used to the forefront of practical politics. Two equally good qualities of metal, the one an advertised brand, the other without mark or indication of origin, would be unlikely to profit equally by satisfactory behaviour in use. It is accordingly important that the present marks of origin on a gun should be supplemented by the registration on each finished firearm of the brand of metal from which the barrels are formed. The firm of Webley have fought many battles in their endeavour to secure recognition for this principle. The firm of Jessop, believing they have something extra good in the way of steel, are anxious that their name shall appear on gun barrels as a guarantee of quality of material. This is a laudable ambition, and one which fits in with the best interests of the gunmaker himself. The immense influence, mostly of an unfavourable character, which has been exercised by the marking of Continental brands of steel on gun barrels finished in this country has clearly emphasised the need for an English brand of metal which will satisfy the wish of the user for something good at a reasonably moderate price. It is, therefore, with every desire to forward a good policy that we have taken considerable pains to bring to the notice of our readers the special efforts which are being made by the firm above-mentioned to produce an ideal gun barrel steel which the gunmaker may with confidence recommend to his customers.

THE GOVERNMENT AS INVENTORS.

Just at the present time the question of War Office inventions is very much to the fore. We have the short Lee-Enfield rifle which represented at the time of its adoption a sufficient change of pattern to involve practically the same cost as the manufacture of a new model of rifle. Nevertheless the old defects of the Lee model of breech have been retained. The rifle has had less than a year's clear run, and yet it has been found to contain so many defects as to necessitate the preparation of a Mark II model. The backsight which was supposed to be the greatest achievement in the whole rifle is being entirely remodelled. We have it on the authority of Major Wallace that the stock was honeycombed with holes to throw the weight forward, and thus improve the balance; this notwithstanding the fact that the rifle is seriously top heavy and assumes a method of handling by the marksman which is certainly not conducive to the development of efficiency in snap shooting. The backsight with its complicated and unwieldy gear is the product of Enfield brain power, and at the same time a source of revenue to the patent-holding officials in respect to any private trade that may be done. The cadet rifle is similarly an example of Enfield inventive enterprise. The rejection of private inventions has been justified on the grounds that no single rifle fulfilled all the requirements of the miscellaneous committee who unexpectedly found themselves judicators on a subject they could not claim to understand. When the millennium is with us we may possibly find a manufacturer who can give a rifle committee something which they will accept as above improvement. But things being as they are, it betrays a lack of sincere intention if a proportion at least of the firms submitting models are not granted the opportunity of amending their designs to meet the criticisms of a committee. A committee in fact occupies a very strong and unchallengeable position if it confines its functions to criticism, and leaves the manufacturer to devise means for satisfying specified requirements. War Office procedure differs materially from this course. Roughly speaking the attitude may be defined in the following words:— "We have given you a chance to submit a rifle for our approval; we have carefully examined the various models submitted; we think some of them decidedly ingenious in detail; we now intend to do the job ourselves, and our decision is final." This procedure may produce a rifle; but it ignores the question whether the resulting weapon would have received the approval of the committee had it been submitted as a manufacturer's model. The reply would generally be in the negative in respect to all recent inventions which can be called to mind.

The private manufacturer is constantly required to originate new devices to meet new conditions. Years of experience give him an insight into the business which cannot possibly exist in any single Government department or collection of departments. There is, moreover, no cohesion between related branches; and the scriptural injunction to prevent the right hand from knowing what the left hand is doing is literally carried out. The cartridge and its components are essentially a part of the gun: yet the explosives knowledge is ringed in by one fence, and the science of the cap is certainly not generally understood. The form of the cartridge case, the shape of the bullet, and the thousand-and-one constructional details of the rifle are covered by an assortment of miscellaneous knowledge which is nowhere co-ordinated for use by a research department. The private manufacturer must cultivate a general knowledge of the related industries. His mind is not stagnated by infinitely duplicating a single model. As the stranger notices just those evidences of neglect which have ceased to impress the mind of the person responsible for them, so the private manufacturer is constantly surveying new territory, and maintaining the freshness and comprehensiveness of mind which are essential to the man who seeks to do original work. The most successful inventions are those which are based upon the most extensive knowledge of what has gone before. Every kind of mechanical movement, and every method of employing it, should be known beforehand to ensure that new designs shall as far as possible follow previously approved practice. The less originality there is in a new design the greater the guarantee that past experience has been utilised, and that expensive mistakes have been avoided. This principle of invention can be better applied by the private manufacturer of large experience than by the official whose early training has probably covered ground far removed from the area of his present activity.

The Spitzer cartridge affords a very interesting illustration of the disabilities which now exist. Roughly speaking we wish to retain the present calibre, reduce the weight of the bullet, and thereby increase velocity without need for materially strengthening the rifle mechanism. To arrive at the best means of fulfilling the new conditions it is necessary that the entire question of the rifle, the cartridge, the size of cap, the character of its composition, and the design of bullet shall be studied on first principles. It is difficult to see how a disjointed organization, which treats the gun apart from the cartridge, and the cartridge as distinct from the powder, the cap and the general formation of the shell, can harmonise elements which are as rigorously isolated from one another as witnesses in a law case, who are suspected of conniving to uphold false evidence. Those who, by their training and associations, have been obliged to cultivate all-round experience must necessarily regret that the many highly-trained officers who occupy important administrative positions under the War Office, are prevented from employing their undoubted knowledge on the lines most conducive to success. Each department, as represented by its expert chief, can criticise the things which fall within the purview of constant experience. No individual can successfully originate new designs if he lacks general experience and is out of touch with relevant details. Mistakes are accordingly made, progress is limited, and the country suffers from the losses occasioned by the incessant need to remedy defects which the experienced could foresee, but which in the ordinary course are only made manifest on practical use. Taking it all round the Govern- is badly served by its official inventors-in-chief, and things will not improve unless a new order of things can be initiated by which inventing becomes the recognised function of the outsider, whilst those in authority confine their attention to the simpler functions of criticism. The begrudging of a few thousands to the inventor is false economy, if considered side by side with the full cost of making at home those things which are best bought over the counter.

THE LONDON SMALL ARMS COMPANY.

FOLLOWING our article of last month we received a very courteous letter from the above Company, in which they called our attention to the fact that we had inadvertently omitted their name from the list of firms who had submitted models of a cadet rifle to the War Office in December last, in accordance with the general invitation that was sent out. It was apparent at the time of making out the list of firms, from whom particulars were invited, that there was one firm less than the number of rifles submitted. The blank has now been filled in, and the information available with reference to this Company's arrangements for entering the new line of business have been deemed worthy of treatment in a special article.

The particulars now to be given have been obtained at first hand as the result of a visit to the Company's works, Victoria Park Mills, in East London. These works have a very ancient origin, and the name of Barnett, which has been known in the gun trade for over 200 years, has been connected with the Company throughout, the present chairman being Mr. Herbert Barnett. The Company has been established in its present premises since 1866 and employs about 750 hands when working full strength.

The shops were all actively engaged in manufacturing the various parts of the new short Lee-Enfield rifle. The latest appliances and methods seemed to be in regular use in every portion of the factory. A number of the Archdale end-to-end drilling machines, an improved model of the Pratt & Witney and Loewe, were in full use. In fact the Company has recently re-organised the manufacture of the service rifle bolt, so that the drilling is now conducted by the barrel plant of machinery.

Reverting more particularly to the precise object of the visit it was interesting to note that the London Small Arms Company has made wonderful progress in the manufacture of six hand-made models of the new cadet rifle. They represent a necessary preliminary to manufacture on the inter-changeable basis of the same thing in large quantities. So advanced in fact are the preparations for making the various tools, fixtures and gauges that the Company hopes to be ready with the first samples at or about the end of June. Such a record in manufacturing enterprise is to be highly commended, and the fact that such things can be done shows that the English gun trade can rise to the same level which we have hitherto credited as the sole perquisite of the large American and Continental factories. The Company's ordinary output of service rifles when the factory is fully employed extends to the very substantial total of 800 rifles per week, together with private work representing say an additional 10 per cent. The arrangements for turning out the cadet rifle are based on the anticipation of keeping pace with a large demand for this pattern, and the buildings and plant are capable of considerable extensions should occasion demand it. If we add to this the known intention of the Birmingham Small Arms Company to be at least proportionately active it will be seen that the present famine of cadet rifles complying with the official stated requirements will soon be met, contract or no contract. Other firms will doubtless enter the same line of trade. The only remedy against production outstripping demand will be an active canvas for orders in the Colonies and abroad, and there seems to be every reason for supposing that the enterprise of our manufacturers, amongst whom the hitherto modest and retiring London Small Arms Company must take a foremost position, will be equal to the task. It is, therefore, with more than ordinary pleasure that we extend the right hand of fellowship to a firm whom there is good reason to believe will successfully achieve the important task which has been undertaken.

THE PROOF HOUSE RETURNS.

THE annual report of the Birmingham Proof House Guardians contains the usual statistics, which are here tabulated in digest form for comparison with previous years.

	1903.	1904.	1905.
Provisional Proofs	**96,674**	**63,549**	**55,380**
Definitive Proofs—			
Muzzle Loaders	24,112	34,122	31,181
African Barrels	109,158	69,661	110,615
Breech Loading Arms	100,416	71,347	57,658
Nitro Proof of Rifle Barrels ..	2,435	2,270	1,492
Express Rifle Barrels	619	557	637
Military Rifle Barrels	4,157	8,177	7,094
Chambers of Revolvers ..	64,507	31,794	48,200
Pistols	597	160	530
Sundries	412	824	448
Supplementary Proofs—			
Nitro Proof	23,492	21,819	23,803
Proved with Nitros	895	689	419
	330,800	**304,969**	**337,457**

The total number of proofs shows a material increase, but an examination of items indicates that the upward tendency is due to expanded business in the commonest class of work, viz., African barrels. The classification which reflects the general condition of the gun trade is Breech Loading Arms, and here we find a total of 57,658 proofs, as against 71,347 for the previous year, and 100,416 for the year 1903. This represents a very serious falling off, and one which is in no way compensated by the arithmetical increase of total proofs. Military rifle barrels have very nearly retained the high level of 1904. Revolvers show a figure midway between the records for 1903 and 1904. The other items remaining on the list are unimportant or else afford no special indication of the state of trade. A knowledge of conditions unfortunately removes the small comfort which is to be found in the apparent increase of prosperity in the revolver trade. This has in reality been very stagnant during the period under review, and if the proofs have increased it is because of foreign importations and not home production.

A supplementary report relates to the working of the technical instruction classes, the total number of pupils being 58 as compared with an apparent total of 43 for the previous year. The classes comprise action filing, barrel filing, stocking, screwing and finishing, and theory. The first four represent a very practical programme; but it is not clear from the report whether the teaching of machine drawing and the elements of geometry is specially directed towards making the pupils better acquainted with the theoretical principles of gun construction.

ROUND THE TRADE.

The Webley Factory is busy with a large contract for an ingenious type of pocket automatic pistol of ·32 calibre.

Capt. J. H. Thomson, as H.M. Chief Inspector of Explosives has issued a notice stating that the offices of the department have been moved from the Home Office to 54, Victoria Street, London, S.W.

The South British Trading Company have called our attention to the fact that at the recent Easter Monday competitions of the Hendon and Cricklewood Rifle Club seven out of ten prizes were won with the Stevens No. 44½ ·22 "Ideal" rifle, thus again demonstrating the popularity of this rifle for miniature club practice.

The King's Norton Metal Company have conducted some very important experiments with light weight bullets for ·303 ammunition. The special construction of the bullet forms the subject of Letters Patent, the device consisting in means for preserving the shape which gives accuracy of shooting whilst retaining a low sectional density.

At the recent Sussex Rifle Association's miniature meeting held under N.R.A. auspices, a proportional reduction of the new 200 yards bull was used, which has substantial merits for indoor and other ranges of only moderate illumination. The black area for the 25 yards distance is 1½ in. diameter, with a central area marked by a white circle just ⅛ in. diameter. The latter counts for scoring purposes as the bull, the rest of the black is the inner, the "mag" circle is rather large at 3 in. diameter, and the rest of the 6 in. square counts as an "outer."

Capt. Lloyd's report on the circumstances attending an explosion which occurred at Nether Walsted, near Haywards Heath, Sussex, on October 26 last contains a very useful warning to contractors carrying on blasting operations to the effect that a proper thawing apparatus must be supplied for softening explosives liable to harden and so become unfit for use in cold weather. The workman who was killed through employing a dangerous method of warming the explosive required for use is held guilty of a serious error of judgment. The New Explosives Company is quoted as being in the habit of issuing a most desirable form of printed notice for the use of persons employing their explosives.

A new Malin catalogue has just been issued. It is a substantial compilation, and gives the usual full particulars of all guns and their interchangeable component parts. The Company's products include a wide range of repeating rifles and shot guns, but so far as can be seen this firm is alone in not having satisfied the demand for a simple single-shot rifle for the use of the ever-increasing public who hold that many of the uses to which a rifle is put make a magazine action cumbersome, unnecessarily complicated, and in the close proximity of other shooters a source of danger. The catalogue is supplemented by a separate publication embodying testimonials and other matter of a eulogistic nature.

Jos. Lang & Son's new catalogue gives deserving prominence to the singularly well-conceived and efficiently-maintained appliances at the West London Shooting School for gun fitting, shooting instruction and general practice purposes. The well-considered enterprise of the firm's Mr. Herbert White, and the true understanding of the sportsman's mind which must be credited to Mr. Richmond Watson, the chief of the shooting establishment as above, make a combination which brings the name of Lang very much to the front amongst the tip-top firms in the trade. The descriptive matter relating to sporting guns, which appears in the list is followed by numerous highly interesting pages devoted to express rifles, these showing that the firm of Lang possesses that essential attribute to a gunmaker who would occupy the very highest positions, viz., a reputation for expert knowledge in rifles.

An explosion took place at the Blackbeck Gunpowder Mills in Lancashire, at which two men were killed.

Mr. Justice Warrington, in the Chancery Division, on the 9th ult., granted an order for the reduction of the capital of Webley and Scott Revolver and Arms Company on the basis of an arrangement between the preference and ordinary shareholders.

Some commotion was lately caused in London and Liverpool shipping circles by the finding concealed amongst the baggage of a party of Russians, en route from Canada to Russia, of a large quantity of rifles of Canadian manufacture, whose presence it had been sought to conceal.

A further erratum note concerning the "Heat Test" memorandum, dated January 1, 1906, states that the sentence beginning on line 7, page 2, should read :—"Strips, or sheets, of best white English filter paper, weighing, air dry, from 4·1 to 4·6 grams per 100 square inches, previously washed with water and re-dried, are dipped into the solution thus prepared," etc., etc.

Cogswell & Harrison's 1906 list shows by means of a map the location of the new shooting ground and testing ranges at Colnbrook, the facilities for reaching the spot from the adjoining stations are also explained. The remainder of the pamphlet is devoted to excellent illustrations, accompanied by particulars of the firm's specialities in guns, rifles and clay pigeon appliances.

Messrs. Tunstall & Brant write:— "We shall feel much obliged if you will kindly inform your readers that as the wind-gauge slide lately adopted by the War Office comprises our patent tightening action for retaining the slide in the desired position on the leaf, it cannot be manufactured except under our licence." The patent tightening action consists of a piece analogous to the one used on the Brown and Sharp vernier calliper for giving the sliding piece a frictional grip on the stem.

A somewhat unexpected pleasure awaited us when opening a packet, which proved to contain a copy of No. 1 of *Explosives, Arms and Ammunition*, a German paper which is printed in English for the purpose of the English dealer showing that the only way to keep his end up is to patronise the explosives, arms and ammunition of German makers. Sound and excellent reasons are advanced for resisting the pernicious principles of protection. A lesson in patriotism is suitably conveyed by a stirring account of the death of Nelson. All communications should be addressed to Verlagsanstalt Europa, G. m. b. H., Newendorf bei Potsdam, Germany.

On Friday afternoon, the 20th ult, an accident occurred at the fuse factory of Messrs. Bickford, Smith & Co., Ld., Tuckingmill, Cornwall, a fire suddenly breaking out in the room known as No. 18, fuse spinning room, in which five girls were working. The reels of fuse soon took fire, followed by an explosion of gunpowder; but the girls, owing to the excellent means of exit, were able to make good their escape, one of them entirely unhurt, the other four more or less burnt. The drenching apparatus having been turned on within a few minutes of the alarm, the damage to the room is quite trifling. It is just 33 years since the only other mishap at the factory took place.

The report of the Hotchkiss Ordnance Company, Limited, shows that the profit of last year, after meeting all working and establishment charges, amounts to £8,075, to which has to be added £4,887 brought forward from the previous year, making in all £12,962. After providing £5,670 for interest upon debentures and debenture stock, and £1,500 for the service of the sinking fund, there is an available balance of £5,792, which it is proposed to carry forward to next year. Ordnance trade since the turn of the year has been brisker than for many years past. The French Company has made large demands for fresh capital to deal with this demand, and further to keep pace with the developing business in automobiles.

Under the title of Henrite Explosives Ld., a company has been registered with £30,000 capital to adopt an agreement with Luck's Explosives Ld., and carry on the business of manufacturers of and dealers in explosives, etc.

Mr. Haldane, replying to a question put in the House, stated that this year short L.-E. rifles will be made in the proportion of about two at Enfield to three in the trade factories, these including the London Small Arms Company and Sparkbrook. It is not anticipated that this year's accounts will show any material difference between ordnance factory and trade prices.

The report and balance sheet of the British and South African Explosives Co., Ld., for year ended 31st October last shows, after sundry writings off a profit of £84,398 which added to £16,079 brought forward gives an available total of £100,477. It is proposed that £60,500 be appropriated for a 5½ per cent. dividend leaving £39,977 to be carried forward. The assets side of the balance sheet shows £381,001 of outside investments as part of total assets £1,373,630.

It is reported from Ottawa that Sir Charles Ross, Bart, has conducted some important experiments with a new cartridge adapted for use in the Ross rifle. A muzzle velocity of 2,735 feet per second has been obtained. This implies the use of a fixed sighting for all distances up to 700 yards, which is to say that a prone rifleman can fire at an object on the ground at this distance, and that his bullet will not attain a greater elevation than the height of a man.

The Rifleman is the name of a 3d. monthly magazine which is issued as the official organ of the Society of Miniature Rifle Clubs. The editor is Mr. Harry Marks, secretary of the above organisation. Some rather fuzzy illustrations of the new cadet rifle duly appear. The second article is a reprint from *Fry's Magazine*. Editorial notes, club reports, news of new ranges, particulars of infant prodigies and other miscellaneous matters make up an interesting budget for the keen rifleman.

At the Birmingham Miniature Rifle Meeting the Duke of Norfolk congratulated the assembled competitors on the great success which had attended the function. The noble President of the Society of Miniature Rifle Clubs, under whose auspices the meeting was held, went on to express regret that there was insufficient evidence that the rising generation of marksmen had been studied as much as they should be. He recommended the establishment of more cadet corps in the district.

The accounts of the Schultze Gunpowder Company, Limited, have been drawn up on the basis of the reduction of capital sanctioned by the shareholders last year. The past shooting season has been above the natural level, and the profits have increased by £765. The preference dividend absorbs £7,307 as before, and after writing off £770 under the scheme of capital reduction, there remains to be carried forward £1,975, a sum representing a considerable increase on last year's figure. The report pays a warm tribute to the memory of the late Mr. R. W. S. Griffith.

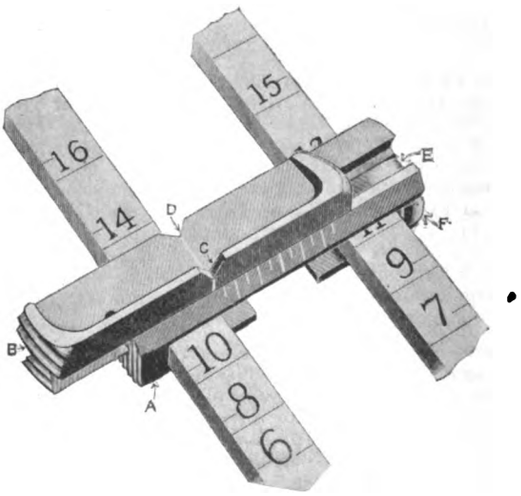
Two very interesting letters which have been sent to this office by Mr. Walter Winans contain a variety of up-to-date information of the latest developments at Gastinne-Renette's Gallery in Paris. Not only has Mr. Winans made some excellent shooting with the new wax-bulletted cartridge, having hit his human opponent every time, but he has taken part in some very practical tests of a duellist's power to get in the first shot. The time is registered by a metronome, which marks the interval between the "one-two-three." The beats of the metronome are gradually hastened until the shooter's limit of pace has been reached. The score is considered in relation to the time taken to get off the shots, hence the importance of getting in the first shot is duly taken into account. Mr. Winans concludes one of his letters by pointing out the great saving of time which can be registered by taking aim at the region of the pit of the stomach rather than raising the elevation to the level of the chest.

A question in the House of Commons elicited the fact that the last year's fees to the civilian members of the Explosives Committee, Lord Rayleigh, Sir Andrew Noble, and Sir William Crookes, amounted to £1,450, and the President of the Committee, Lord Rayleigh, has resigned his position.

Much inconvenience and trouble has been caused by the recent extraordinary action of the proof authorities in Austria, who have refused recognition in that country of the English proof marks, guns so proved being refused admission unless re-proved in accordance with the Austrian regulations and scales.

The directors of the Nobel-Dynamite Trust Company, Limited, having received the particulars of the earnings of the subsidiary companies, recommend the payment of a dividend for the year to April 30th on the ordinary shares at the rate of 8 per cent., and a bonus at the rate of 2 per cent., both free of income tax, placing to reserve account the sum of about £74,000, and carrying forward about the same as last year.

The accompanying illustration gives particulars of the new match slide which has been designed and adopted by the War Office, and sanctioned by the National Rifle Association for use at the coming Bisley Meeting. The Enfield factory has undertaken its manufacture, and it has been decided that the issue price shall stand at 1s. 6d. The slide itself is of a type well known to gunmakers and rifle shots, and although the actual combination has been specially devised by the experts at Enfield, the principles embodied in its design seem to be mostly covered by a host of anticipations. The two



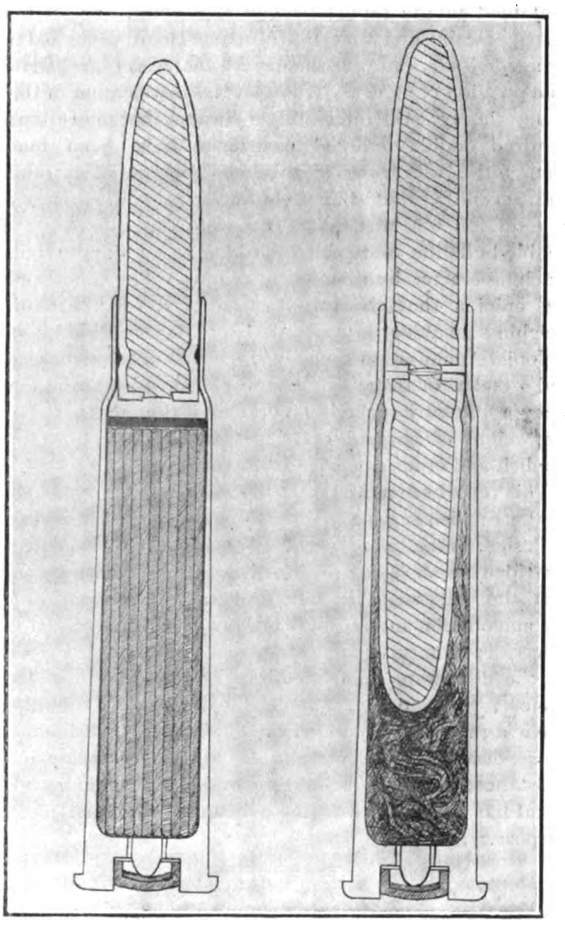
main parts consist of the slide *A* and the traversing piece *B*, which carries two notches *C* and *D*, so arranged at right angles to one another that the one may be used in the "flap-down" position of the leaf, and the other when the flap is up. *E* and *F* are tightening springs for taking up any loose play which may exist between the leaf and the slide on the one hand and the parts *A* and *B* on the other. Tunstall and Brant claim exclusive property in the spring *F*, but as it is unlikely that any private firm will desire to compete with Enfield on the above basis of selling price, the War Office are the only people who are concerned with the rights and wrongs of the question. The slide will undoubtedly prove a great boon to riflemen. Its chief recommendation is that in providing a wind-gauge for the long Lee-Enfield rifle its sighting disadvantages as compared with the short Lee-Enfield rifle have been removed. The two rifles may thus compete together in a number of events set down for the coming Bisley Meeting, and the results of the shooting obtained will be settled by the relative merits of the two arms.

THE BURST RIFLE EPIDEMIC IN AUSTRALIA.

THE science of firearms owes a debt of gratitude to Mr. C. Napier Hake and his colleague, Dr. T. R. Lyle, Professor of Natural Philosophy at the University of Melbourne. The justification for this somewhat sweeping statement is to be found in a report on the bursting of M.L.E. rifles which has been presented to the Honourable Minister of Defence. It seems that the first accident occurred at the Port Melbourne rifle range in August, 1904, and that in the following year five similar accidents occurred in New South Wales, and were followed by others of a like nature in Victoria. The first series of accidents in Victoria were referred to a State Military Board of Enquiry, presided over by Major Monash, two other officers sitting with him. Three rifles which had apparently been burst in identical fashion and from the same cause were examined and considered by the Monash Board. The members insisted in each case that the injury was due to the bursting of a defective cartridge case manufactured by the Colonial Ammunition Company, the defect in question consisting of a flaw in the metal. The members were also of opinion that the recess cut in the face of the barrel for the accommodation of the extractor represented a source of weakness, in so far that a portion of the cartridge case was left entirely unsupported.

The Board does not appear to have attached any special importance to the evidence provided by the burst cartridge case that a chamber pressure had been attained far in excess of service limits. The members similarly failed to note the possible deductions that might be drawn from the presence in one of the burst rifles of a bullet lodged in the barrel, and in another instance one remaining in the burst cartridge case. A bull was actually scored in the case of the gun which burst and which was afterwards found to contain a bullet. The Monash Board evidently fell into the error usual amongst persons who first come into contact with accidents of this nature, viz., to endeavour to find a defect in the fractured metal, rather than consider the general question as to whether conditions may not have been present which might bring about an excessive strain. Notwithstanding that Mr. Hake reported to this Board that in his opinion the rifle burst by reason of the excessive pressure put upon it by an abnormal cartridge, they pinned their faith to the coincidence of a supposed flaw in the cartridge with the unsupported portion of the chamber wall. Mr. Hake gave good reasons for his verdict by means of an explanation which is described as the two-bullet theory. In other words he regarded it as clear from the evidence that the cartridges which had caused the accidents contained, besides the ordinary bullet, an additional bullet squeezed into the powder chamber of the cartridge in the manner depicted in the accompanying illustration.

One of the reasons for which Mr. Hake's two-bullet theory was not accepted by the Monash Board shows that its members, although doubtless well versed in the ordinary duties of their profession, had not sufficient scientific training to adjudicate on a scientific problem involving technicalities capable of understanding only by trained experts. In Mr. Hake's words "they (the officers comprising the Board) also cannot believe that a force necessary to burst the rifle would fail to eject a bullet." The ejection or otherwise of a bullet lodged amidst a mass of powder necessarily depends upon the position of the bullet in the case in relation to the distribution of the charge. However, the report now before us is not that of the Monash Board, but of Mr. Hake and Dr. Lyle, who were employed to review the proceedings of this Board, to consider all available evidence and present the resulting conclusions on a scientific basis. After fully reviewing, and illustrating by means of diagrams the extraordinary deformation sustained by the cartridge cases found in the rifles after the accidents the experts purposely cut deep grooves, both externally and internally, into cartridge cases taken at random



from stock. Notwithstanding the resulting weakening of the metal these cartridges behaved perfectly in every instance, and there was no evidence of a tendency to give way. Further experiments included the firing of cartridges, into which an additional bullet had been purposely forced amongst the charge in the manner illustrated. In every such case the rifles burst, and the cartridge shells were deformed all in a manner strictly analogous to what had happened in the accidents previously investigated.

In theoretical justification of the abnormal rise of pressure, which must follow from the reduction of chamber space in a

cartridge by the introduction of a foreign body the size of a ·303 bullet, the report refers to a well-known empirical formula which suggests that the closed chamber pressure of the cartridge would be increased from the normal of 63 tons to 147 tons per square inch. These values assume that the whole of the cordite is resolved into gas before the bullet commences to move. In practice the chamber pressure under normal conditions of loading is 16 to 18 tons. Apart from the extra pressure due to reduced air spacing of the charge, the explosive itself would develop gas with greatly increased rapidity. The rise of the chamber pressure under such abnormal conditions might, therefore, represent a greater proportional increase on the 17 tons service pressure than is represented by the ratio of 63 and 147. It really seems almost unnecessary to pursue the closely reasoned arguments contained in the report beyond this point, since it is quite clearly established that the Monash Board were led astray by a side issue, and that the expert analysis of facts shows the true position of affairs. However in justification of the two-bullet theory it is interesting to know that more than one hundred double-bulleted cartridges have been found in ammunition withdrawn by the department for re-examination, and secondly, that the Company, in whose factory the ammunition was made, have reported that the origin of the double-bulleting is to be found in an automatic bulleting machine erected by them early in 1904. The experts express the opinion that the introduction of a reliable automatic weighing machine, as proposed by Major Whitney of the Colonial Ammunition Company, is a step in the right direction and a means of instantly detecting such mistakes in loading. They apparently spoke in ignorance of the fact that checking the weight of finished cartridges is a routine procedure in English and other cartridge factories.

This report seems to upset the very serious condemnation of the English service rifle on the grounds that it is defective in design, in that it does not allow for a possible defect in a cartridge case. This criticism is, of course, upset by the fact that the very slight removal of metal necessary for the accommodation of the extractor makes no difference to the behaviour of a cartridge which has been materially weakened by the deliberate removal of a large proportion of its substance. It is, moreover, not to the discredit of the rifle that, when a range of pressure is reached which must inevitably cause disaster, the explosion should follow the line of least resistance, and that the line of disruption should go where metal has been removed for a definite and quite justifiable purpose.

SALE OF SPARKBROOK FACTORY.—Information of a definite character concerning this very burning question is difficult to obtain from the mass of hearsay evidence and local reports, to which our present knowledge is limited. The delayed announcement of a definite arrangement has generally been attributed to a difficulty in completing the underwriting contracts which in the present instance constitute an essential preliminary to laying the prospectus of the proposed new company before the public. One may assume from the manner in which the Government has notified the impending sale of this important factory that the initial financial arrangements are well nigh certain to go through. The company will come before the world as a definite manufacturing enterprise with a three years guarantee of Government orders. The demand for a cadet rifle will doubtless form a prominent argument to be used in the prospectus for the purpose of encouraging public subscriptions. The workmen who have been engaged in the Government factory have been given to understand that their situation will be improved rather than prejudiced by the changed order of things. Against this promise is the fact that many dismissals have taken place, so that the number of hands at present in active employment has been seriously curtailed. A little patience must of course be exercised during so radical a transformation. Consequently the workmen have been informed that the immediate results of the decision to alter the status of the Sparkbrook Factory must be regarded rather as a temporary dislocation than as an indication of how things will be in the future.

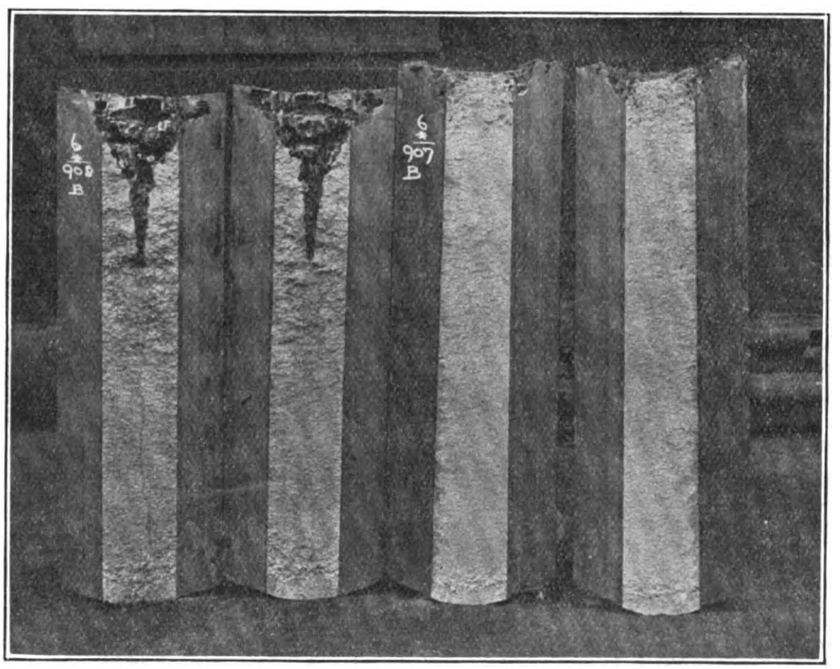
STEEL FOR GUN AND RIFLE BARRELS.

In our issue of October last year an article appeared under the signature of Mr. F. W. Jones, which contained some very interesting theoretical matter concerning the relation of gas pressure to the stresses set up in the gun or rifle barrel. The further relation of such values to the characteristic test results of steel were also explained. The article in fact placed the scientific aspects of the strength of rifle barrels with reference to the work they are called upon to perform on a sound footing. In the latter portion of the article reference was made to a special gun barrel steel which had just been prepared by Messrs. William Jessop & Sons, probably the largest manufacturers of crucible steel in the country. The steel had an elastic limit of over 30 tons, an ultimate strength of about 50 tons with a 30 per cent elongation on an eight-inch piece. This specification of steel aroused very great interest among some of our leading rifle manufacturers, because it represented an ideal combination they had for many years sought, without finding it easy to obtain in the routine of commercial purchasing.

The evident importance of the subject led to our accepting an invitation from Messrs. Jessop's to visit their works in Sheffield, with a view to examining and reporting upon the precautions which are taken to impart to their metal special physical characteristics. That is to say the steel is claimed by them, not only to satisfy the most rigorous tests by the machine ordinarily used for such purposes, but to contain exceptional freedom from the kind of defect which tests do not show, but which are the bugbear of the rifle manufacturer. A perfect specimen of steel, as judged by all ordinary methods of examination, is liable in the course of manufacture to show the presence of greys and other faults which lead to the scrapping of a certain proportion of the output, and in special cases to dangerous bursts, notwithstanding the precautionary proof test to which every rifle is subjected. To explain the grounds upon which claims for exceptional freedom from defects have been put forward, it is necessary to refer, first, to the treatment which a bar of steel receives during the forging process, and secondly to the actual processes by which the bar of steel is produced.

The bar from which a barrel is made consists of a piece of

steel some 14 inches long and of suitable diameter. This is forged by a steam hammer fitted with the usual dies and shaping pieces so that the bar of steel takes the form of a barrel blank. It is in fact elongated in the process of forging to something approaching twice its original length, the bar of iron itself being similarly brought into shape by an analogous process of diminishing width and increasing length. Thus it happens that any defect in the original ingot is so spread in a longitudinal direction that it may represent a very serious reduction in the strength of the walls of a finished barrel. Nearly all experiments in the bursting of thin barrels such as are used in shot guns, display a tendency on the part of the metal to break in a longitudinal direction. Steel, strictly speaking, is a perfectly homogeneous material, so falsifying the rough and ready explanation that the grain is of longitudinal formation. The obvious analogy provided by a wood plank is thus inapplicable, the structure of metal is very minute and does not consist of long cells having a considerable tenacity in one direction, and a very loose amalgamation transversely. The only possible explanation of the tendency to longitudinal fracture is that such metal must contain defects which, though small in themselves, are very serious when lengthened out by the many processes which convert the ingot of steel into a much greater length of bar metal.



The obvious requirement of a sound rifle barrel, when finished, is that it shall be of metal which has been freed by exceptional means from defects which would be unimportant in almost every other class of manufactured article. The firm of Jessop have spent many thousands of pounds on a new patented plant which has been specially devised with this end in view. The accompanying illustrations depict the results of the new and the old processes side by side. These wonderful photographs show ingots of steel which have been split open in the ordinary course of manufacture with a view to examining their physical condition The two halves of the left ingot represent the old process, whilst those on the right show the greatly improved results which are obtained by the special system of fluid compression which Messrs. Jessop have lately adopted. When an ingot of steel has been cast by the ordinary process very much the same kind of thing happens which every gunmaker is in a position to observe for himself when taking a sulphur cast of a gun chamber. The shrinkage of the mass of molten material causes a subsidence of the central core, which appears to extend a considerable distance into the body of the casting. Shrinkage must take place, the outside must cool before the centre, and any defects which are contained in the metal must exist to a maximum extent at the bottom of the pipe or hole. The steel manufacturer does his best to prevent defective metal getting into his output by the expensive process of planing deep notches on either side of the ingot, splitting it in half, and cutting off for remelting the objectionable upper part containing the pipe. It is in point of fact nothing more or less than a compromise at the best to endeavour to demark the boundary at which homogeneous metal begins and defects end.

The left-hand view of the old style of ingot shows a streak-like discolouration which extends throughout the whole length of the ingot. Closer examination of the actual sample shows that this is merely a weather mark caused by the water which had been used in the machining process. On the other hand there is obvious evidence that the pipe has no definite termination, the defects extending some distance into the portion of the ingot for commercial reasons which must be retained as sound. The two views of the right-hand ingot contain an obvious freedom from defects, which promises a highly satisfactory gun or rifle barrel, whatever may be the portion of the ingot from which it may be formed. The difference of result is obtained by the use of very powerful hydraulic machinery, which subjects the ingot at a certain stage of the cooling process to an immense lateral pressure, thus reducing the diameter in exact ratio to the shrinkage of the metal. The squeezing process possesses the great advantage that it drives to the top of the ingot that portion of the molten metal, which is last to solidify, and which, therefore contains the greatest proportion of impurities and defects.

Fluid compressed steel is not unknown to the gun trade but it has hitherto been supplied at prices which may be regarded as well nigh prohibitive for ordinary grades of output. Messrs. Jessop claim that by their improved process they can not only give the user the benefit of their special skill in the selection and treatment of gun barrel alloys, but they can in addition provide the advantages which accrue from fluid compression at a cost but slightly in excess of what is charged for steel cast in the usual way. Ordinary tests may not show the benefits deriveable from the new process; but gunmakers will not be long in appreciating the merit of any scientifically

devised improvement in manufacture which gives an extra measure of insurance against the danger to gun users from unexpected bursts, which under present conditions, no forethought can prevent.

APPLICATIONS FOR PATENTS.

MARCH 26—APRIL 21, 1906.

6,580. Weapons. A. Krüll.
6,581. Nitroglycerine. F. L. Nathan, J. M. Thomson, W. Rintoul and A. Scott.
6,599.* Time Fuses. R. H. Quisling.
6,804. Air Guns. G. Ramage and T. Moss.
6,824. Explosives. C. Witzmann, C. Dreyfus and The Clayton Analine Co., Ld.
6,869. Fire Arms. H. P. Oakie.
6,895. Air-Guns and Rifles. L. Jeffries.
6,925.* Ammunition. J. H. Barlow.
7,039. Ordnance. Sir W. G. Armstrong, Whitworth & Co., Ld., and A. G. Hadcock.
7,040. Ordnance. Sir W. G Armstrong, Whitworth & Co., Ld., and A. G. Hadcock.
7,041. Percussion Fuses. Sir W. G. Armstrong, Whitworth & Co., Ld., and J. S. Douglas.
7,042. Fuses. Sir W. G. Armstrong, Whitworth & Co., Ld., and J. S. Douglas.
7,070. Ordnance. G. T. Teasdale-Buckell.
7,107. Ammunition. J. Donaldson and T. Ansboro.
7,154.* Ordnance. Fried. Krupp, Akt.-Ges. (Date of application in Germany, May 2, 1905).
7,161, Machine Guns. A. T. Dawson and G. T. Buckham.
7,194. Gun Carriages. S T. Richardson and R. Price.
7,372. Range Finders. A. T. Dawson and G. T. Buckham.
7,398. Rifle Sights. T. Grace
7,415.* Small Arms. A. H. Russel.
7,571. Ammunition. King's Norton Metal Co., Ld., T. A. Bayliss and H. Melville-Smith.
7,682.* Ordnance. Fried. Krupp, Akt.-Ges. (Date of application in Germany, June 5, 1905).
7,784. Rifle Carriers for Cycles. J. Falconer.
7,921. Time Fuses. Sir W. G. Armstrong, Whitworth & Co, Ld, and W. H. Sodeau.
7,923. Plugging Shot-holes. O. Rasmussen. (Date of application in U.S.A., August 10, 1905).
7,952.* Ordnance. H. C. L. Holden.
7,954.* Ordnance. H. C. L. Holden.
7,969. Small Arms. M. G. Farquhar and A. H. Hill.
7,994.* Rifle Sights. S. S. Peacock
8,003.* Receptacles for Ammunition. Fried. Krupp, Akt.-Ges. (Date of application in Germany, June 13, 1905).
8,246. Air Guns. Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
8,280. Ordnance. A. F. Petch and R. Redpath.
8,281. Gun Mountings. A. F. Petch.
8,328.* Ordnance. A. F. Petch and R. Redpath.
8,370. Gun Mountings. A. F. Petch and A. C. Lochenies.
8,408.* Fuses. A. F. Petch.
8,416. Fuses. W. R. Comings.
8,604.* Smokeless Powder. R. F. G. Robricht.
8,630.* Ammunition. W. Urbanowyez
8,631.* Ordnance. Fried. Krupp, Akt.-Ges. (Date of application in Germany, June 30, 1905).
8,652. Ordnance. M. L. Jannitti.
8,715. Air Guns. J. B. Lane.
8,821. Targets. L. Jeffries.
8,848. Small Arms. H. W. Holland and T. Woodward.
8,923. Ordnance. A. F. Petch, A. C. Lochenies and R. Redpath.
8,928. Small Arms. The Rexer Arms Co., Ld.
9,172. Machine Guns W. H FitzGerald.
9,222. Range Finders. M. G. Farquhar.
9,234.* Ordnance. T. Bergmann.
9,262. Small Arms. The Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman.
9,267.* Gun Mountings. Fried. Krupp, Akt.-Ges. (Date of Application in Germany, July 8, 1905).

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MARCH 29—APRIL 19, 1906.

COMPILED BY HENRY TARRANT.

29,121 (1904). **Time Fuse Mechanism.** J. E. Read and G. W. F. Lester, London. The time fuse mechanism described in this patent includes improvements in connection with the air vanes, the safety devices for preventing premature discharge, and to the arrangement of the striker and other parts. Accepted March 15, 1906.

3,662 (1905). **Running Target Apparatus.** A. Winser, Southsea. Apparatus for conveying an even and steady movement to a running man or deer target, consisting of a machine at either end of the run. Each of these machines is attended by a marker, and the movement is given to the target by a weight wound up after each run. The weight is held until it is necessary to start the target by a rachet and pawl. Accepted March 22, 1906.

5,985* (1905). **A New Potassium Chlorate Explosive.** Major C. G. Demetriade and Lieut. C. Jonesen, Roumania, and H. C. Williams, London.

6,279 (1905). **Safety for Small-Arms.** C. H. Hansen, Denmark. A safety for small-arms which is designed so that it shall be released by the hand which grasps the fore-end when the weapon is at the shoulder. One end of a lever is pressed in by this hand, and the other end is removed from its locking engagement with the firing pin. Accepted March 22, 1906.

6,361 (1905). **Substitute for Nitroglycerine.** J. Wetter, London (Agent for *The Westfälisch-Anhaltische Sprengstoff, Ag., Germany*). In order to obviate certain disadvantages which are attendant upon the use of nitroglycerine in explosive compounds, this substance is substituted by mono- or di-chlorhydrin. Examples of explosives containing the last-named are as follows:—(1) Dinitro-mono-chlorhydrin 92 parts and collodion cotton 8 parts. (2) Dinitro-mono-chlorhydrin 35 parts, dinitrotoluene 5 parts, collodion 1 part, ammonium nitrate 45 parts, sodium nitrate 10 parts, and rye flour 4 parts. Accepted March 8, 1906.

8,286 (1905). **Practice Rifles for Ordnance.** A. T. Dawson and G. T. Buckham, London. In Patent No. 3,024 (1904) an aiming or practice rifle provided with its own breech mechanism of the angularly movable type was dealt with. The rifle set out in the present patent is provided with a block which is adapted to slide vertically in a series of "buttress thread" grooves. These grooves afford sufficient resistance to the gas pressure during firing. Accepted March 8, 1906.

8,552 (1905). **Ordnance Mountings.** C. Holmström and A. E. Mascall, London, and E. Middleton, Sheffield. To dispense with the varying of the orifices in recoil brakes so as to shorten the length of recoil of high-angle firing guns, the gun is mounted upon a top carriage. Both the gun and the carriage are provided with their own recoil buffers and return springs. Accepted March 8, 1906.

10,411 (1905). **Air-Gun Breech Fastening.** M. Pulvermann, London. An improved locking device for securing the breech to the barrel of an air-gun consists mainly of a spring-operated wedge-shaped nose which fits into a corresponding recess on the face of the breech end of the barrel. The barrel works on a pivot in a fork which extends forward from the breech cylinder. Accepted March 22, 1906.

11,081 (1905). **Rifle Rear Sight.** A. Tunstall, and W. F. Brant, Birmingham. A rear sight for rifles is provided with lateral and vertical adjustments of the screw type. The sight is of the leaf description. Accepted March 15, 1906.

12,400 (1905). **Fuse Mechanism.** F. Wigley, Birmingham. The body of the fuse described in this patent is formed of two separately made pieces of different metal. The base is of a soft metal such as an alloy of aluminium, and the stem of a hard metal as steel. The stem contains both the time and percussion detonators, and such a construction obviates the probability of the impact detonator being disabled upon impact by a slight closing. Accepted March 22, 1906.

12,401 (1905). **Protecting Caps of Fuses.** F. Wigley, Birmingham. A damp proof joint is made between the fuse and its protect-

ing cover by rolling the edge of the cap and allowing it to have a snap connection with a corresponding groove on the fuse. A damp proof material may be placed within the groove. The cap stands clear of the fuse except at this edge. Accepted March 8, 1906.

13,089 (1905). **Automatic Magazine Guns.** Fried Krupp, Ag., Grusonwerk, Germany. The feed mechanism of automatic machine guns is so arranged that the cartridges are placed in a box magazine side by side, and in the case of small calibres one above the other. The cartridges from one vertical row are lifted one after the other by a cartridge lifting device. As soon as one row has been emptied another row is moved forward. The supply movements are affected either by movements of the breech or barrel or by a piston actuated by gas pressure. Accepted March 29, 1906.

13,097 (1905). **Automatic Arms.** Fried Krupp, Ag., Grusonwerk, Germany. Automatic firearm mechanism operated by recoil is dealt with in this patent. A slide is connected with the casing of the weapon, and by means of a lever forming the connection it is caused to have a greater movement than the barrel or gas pressure piston. The movement of the slide actuates the various parts for ejecting the spent cartridges and reloading. Accepted March 29, 1906.

13,297* (1905). **The Removal of Metallic Fouling from Gun-Barrels.** The King's Norton Metal Co., Ld., J. W. Bayliss, and H. W. Brownsdon, London, and H. M. Smith, Abbey Wood.

14,101* (1905). **Telescopic Sight for Rifles** M. Blood, M.A., Kingston-on-Thames.

14,912 (1905). **Graze Fuse for Shell.** H. H. Mulliner, and A. C. Lochinies, Coventry. The prevention of premature explosion of graze fuses is aimed at by the improvements set out in this patent. The compressed powder pellet usually employed as a lock to hold the graze detonator out of action is displaced by a solid one, and the chamber containing the fulminate cap is provided with a number of vents to relieve the pressure of premature ignition. Accepted March 29, 1906.

15,928 (1905). **Construction of Ordnance Barrels.** A. T. Dawson and G. T. Buckham, London. To prevent partial compression of the inner tube of the barrels of ordnance and of the consequent reduction in the diameter of the bore, a ring or band is interposed between the adjacent shoulders of the inner tube and that lying next to it. This ring may be crushed by the elongation of the inner tube, and this crushing obviates deformity of the bore. Accepted March 22, 1906.

18,207 (1905). **Running-out Springs for Recoiling Guns.** F. T. Fisher and W. J. Griffiths. This patent specification is a Secret Document.

18,439 (1905). **Recoil Brake for Ordnance.** B. Behr, Germany. This "hydropneumatic" brake consists of two cylinders arranged around the barrel and their two pistons mounted on a tube. One of these cylinders acts pneumatically, and the other contains water and so forms a hydraulic brake. Accepted March 22, 1906.

20,782A (1905). **Automatic Pistol Mechanism.** O. Imray, London (Agent for *Colt's Patent Fire-Arms Mfg. Co., U.S.A.*) The improvements in automatic pistol mechanism set out in this patent are designed to transmit to the frame of the weapon the stress due to the sudden arrest of the movements of the barrel without injury resulting therefrom to either. The barrel and breech locking and unlocking during recoil is also modified. Accepted March 22, 1906.

22,135 (1905). **Hammer Lock for Small-Arms.** M. V. B. Allen, U.S.A. The hammer safety described is intended for double-acting revolver or pistol mechanism. The safety consists of a rod which in the locking position abuts against the underside of the hammer heel. The safety is operated by the thumb, and projects through a slot in the top of the butt. Accepted March 22, 1906.

22,136 (1905). **Hammer Lock for Small-Arms.** M. V. B. Allen, U.S.A. A safety arrangement for locking the hammer of a revolver similar in principle but different in construction to that set out in the foregoing patent No. 22,135 is dealt with in this specification. The safety engages the hammer in the same way, but it is conveniently arranged to be released by means of the thumb-nail. Accepted March 22, 1906.

22,161 (1905). **Torpedo Ignition Device.** E. Nilhoff, U.S.A. Instead of a time or percussion fuse the ignition device consists of a water primer such as a mass of sodium. The primer is covered by a hinged shield which admits the water to the primer only when the projectile or torpedo has lost the greater part of its velocity. Accepted March 8, 1906.

22,162 (1905). **Ignition Device for Projectiles.** E. Nilhoff, U.S.A. The charge of a torpedo is ignited by the discharge of a percussion cap which is struck by a pin. The pin is released by a certain pressure of water. The depth of the projectile thus governs the time of explosion. Accepted March 8, 1906.

22,934 (1905). **Prevention of "Flare-Back."** W. D. Smith, U.S.A. In order to prevent flare-back when the breech of ordnance is opened after firing the breech is designed to carry a fluid injector. The fluid, preferably water, is injected into the bore by pressure. The firing pin is operated by fluid pressure, and the lubrication of the bore after swilling is provided for. Accepted March 8, 1906.

23,244 (1905). **Service Rifle Adaptor.** Capt. A. N. Tucker, R.E., London. By this invention for adapting service rifles to reduced ranges and ammunition, the length and rifling of the barrel, the position of cartridge and projectile and the charge are arranged in exactly the same proportions as in the case of the rifle when in use at full ranges. The miniature cartridge is shot from the front end of a dummy ·303 cartridge and the bullet passes through a rifled sleeve reduced in length in proportion to its reduced diameter. The sleeve fits within the ·303 barrel. Accepted March 8, 1906.

23,371 (1905). **Time Fuses.** Fried Krupp, Ag., Germany. In order to prevent premature ignition of the main charge which is due to deformation of the lower part of the fuse and the priming ring, the empty space formed by the inertia and through which the flame jumps to the main charge is prevented by the provision of a loose ring or annular plate. Accepted March 15, 1906.

25,579 (1905). **Construction of Air-Guns.** A. L. Blomén and P. S. Ewerlöf, Sweden. This patent deals with the construction of air-guns having an air reservoir and an air pump lying beneath the barrel, and particular attention is paid to the valve and trigger arrangements. Accepted March 8, 1906.

1,630 (1906). **Cartridge Clip.** O. M. Lissak, U.S.A. The cartridge clip described in this patent is roughly of the usual construction. The novel features are its rounded ends and two small tongues at either end which are turned up so as to hold the cartridge securely within the clip. The tongues lightly grip the rims of the two outside cartridges. Accepted March 15, 1906.

2,895 (1906). **A Harmless Bullet.** P. Devillers, Paris. A bullet designed for saloon shooting or for practising duelling, consists of a mixture of beeswax, mutton fat, and sulphate of baryta. These bullets are completely harmless at 25 metres. Accepted March 15, 1906.

3183 (1906). **Percussion Cap Remover.** D. Larrson, Sweden. A machine for removing percussion caps from spent cartridge cases is dealt with in this patent. The piston possesses a lever which is designed to grip the cap when it is expelled from the case. During the upward movement of the piston the lever is locked so that it cannot drop the cap. Accepted March 15, 1906.

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

SELECTED PATENTS.

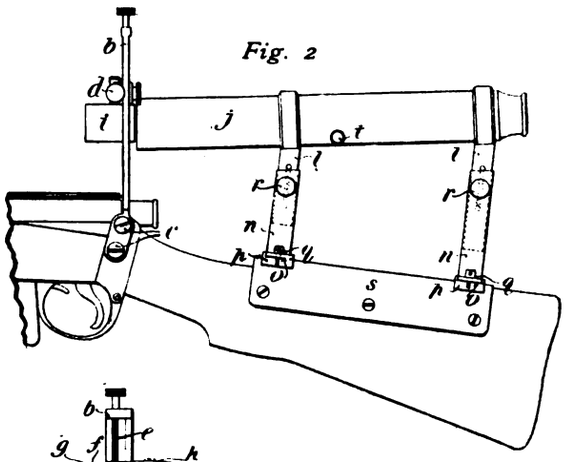
TELESCOPIC SIGHT FOR RIFLES.

14,101 (1905). M. Blood, M.A., Kingston-on-Thames. The sight described in this patent is of the telescopic order, is of simple construction, and has had special attention devoted to its mounting. Mounted as it is shewn in the illustration appended it is designed for use when firing in the back position, but it may be shifted forward to accommodate it to other positions of the shooter.

The tube *a* (Fig. 1) is clamped to the muzzle of the barrel as is illustrated just to the rear of the foresight. It possesses an object glass which is secured inside at about the centre of the tube. The

rear sight (Fig. 2) consists of the vertically mounted bar *b* (see detailed drawing) which has a divided scale upon its edge. It is secured by the screws *c* to the rear end of the breech casing. It may of course be clamped to any other fixed part further forward. The sliding block *d* is capable of a vertical movement which is imparted to it by the screw *e*. The block possesses a vernier scale which works in conjunction with the scale on the edge of the upright bar *b*. The horizontal bar *f* may be shifted laterally in relation with the bar *b* on the block *d* by the screw *g*. This horizontal bar is also scaled on its rear face. The plate *h* which forms a fixed extention of the block *d* has a vernier cut upon it which works with the scale on the bar *f*. The tube *i* containing the cross

Fig. 2



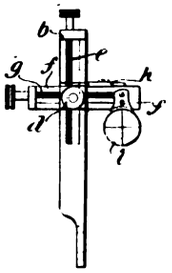
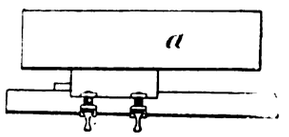


Fig. 1



wires or similar sighting appliance is secured to the bar *f*. This tube partakes of the vertical or horizontal movements of the bar *f* or block *d*. The cross wires are carried exactly at the focus of the object glass.

The tube *j*, which contains an erecting eye piece of low power and large field, is supported by the legs *l* extending downwards in the tubular uprights *n*. These uprights stand up from the horizontal slides *o* which slide in their beds *p*. The distance of the sight from the shooter's eye is regulated by sliding these supports either backwards or forwards. The screw pins *q* are designed to hold the sight in any position. The height of the sight is regulated by the screw pins *r* working through the tubular uprights and one of a number of holes bored in the legs *g*. The beds *p* are made fast to a saddle part *s* which is secured upon the top of the stock. The spirit level *t* may be embodied in the tube *g* so that the shooter may be sure of the sights being upright. When used in any other but the back position the tubes *i* and *j* may be mounted further forward and the focal length altered accordingly. Accepted March 22, 1906.

A NEW POTASSIUM CHLORATE EXPLOSIVE.

5,985 (1905). Major C. G. Demetriade, and Lieut. C. Jonesen, Roumania, and H. C. Williams, London. A new explosive compound containing potassium chlorate as its principal ingredient is set out in this specification. The explosive is claimed to be stable and safe in transport.

The explosive consists of potassium chlorate mono-nitrobenzine, picric acid and a finely divided cellulose (hygroscopic cotton). About 650 grammes of finely pulverised pure potassium chlorate is mixed with 60 grammes of finely divided cellulose. This mixture is filled into small hygroscopic cotton containers or sacks, and the sacks are soaked for half an hour in a solution containing 104 grammes of picric acid dissolved in 260 grammes of mono-nitrobenzine. The sacks are removed after this time and are hung upon tinned hooks to drain excess liquid. The cartridges are then ready but they should be wrapped in parchment paper or tin foil. They can be detonated with one to two grammes of fulminate of mercury. The cellulose employed in the compound tends to absorb and hinder the evaporation of nitrobenzine in the cartridge and a certain proportion of it is in course of time converted into nitro-cellulose.

The new explosive is a doughy mass of reddish yellow colour, and it has a better taste. Its density is about 2·5. It freezes only at 6° C., and subsequent thawing does not injure it If after a very protracted period a little deterioration has taken place the explosive may readily be restored by freshly impregnating it with picric acid and nitrobenzine. Accepted March 15, 1906.

THE REMOVAL OF METALLIC FOULING FROM GUN BARRELS.

13,297 (1905). The King's Norton Metal Co., Ld., T. W. Bayliss, H. W. Brownsdon, London, and H. M. Smith, Abbey Wood. The treatment of fouled rifle and gun barrels and the removal of the cupro-metallic fouling is dealt with in this patent specification. The treatment extends to the removal of copper or alloys of copper from fouled surfaces generally.

The metallic fouling is removed from gun or rifle barrels by treating them with a solvent consisting of a solution of ammonium hydrate to which has been added an oxidising agent—preferably ammonium persulphate. This latter substance is preferred on account of its great solubility. A stronger solution of the persulphate may be used than would be possible were potassium persulphate or other persulphate employed. Other ingredients might be added to the solution if it were necessary. The ammonium persulphate, to which is added a little ammonium carbonate, is dissolved in ammonium hydrate having a specific gravity of about 0·935. About a 5 per cent. solution of ammonium persulphate is obtained. The following example is quoted. To one volume of ammonia of specific gravity 0·880 is added an equal volume of water. In 100 cubic centimetres of this diluted ammonia is dissolved five grammes of ammonium persulphate, and about one gramme of ammonium carbonate This solution will completely dissolve copper or copper alloy when applied to a fouled surface. The solution, however, will not keep for any length of time, and the ammonium persulphate and ammonium carbonate are therefore made up into tablets. Five, ten or 20 per cent. of ammonium carbonate is ground up intimately with ammonium persulphate, and the mixture is moulded so as to produce tablets each containing any desired number of grammes of ammonium persulphate. A five gramme tablet is, when the solvent is required for use, added to 100 cubic centimetres of ammonia diluted so that its specific gravity is about 0·935.

The solution before use is colourless, but when the fouling is dissolved the latter imparts a blue colour to the solution. This colouring of the solution forms a guide as to absence or presence of fouling in the barrel. After each treatment of the barrel with the solvent the barrel is washed out with water and is then dried and lubricated as usual. The acid decomposition products resulting from the explosion of the charge and the cap are also it is claimed rendered inert by the solvent. Rusting and corrosion of the barrel are thus prevented. Accepted March 15, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Explosives Committee.—Replying to a question in the House of Commons the Secretary of War stated that the Explosives Committee had been reconstituted as a Board of Ordnance Research, the Board to consist of Major General O'Callaghan, president, Rear-Admiral Foote, Sir William Crookes, Sir A. Noble, Mr. Ewing, and two members of the Ordnance Committee. Provided the policy embodied in the above decision does not imply the kind of economy which is represented by abandoning something good because it is expensive, the new committee can be congratulated upon having attained a wider scope and a greater opportunity of doing useful work. The explosive is part of the general system represented by the gun. The gun is constructed with reference to the explosive charge. The projectile represents an intermediate item, which is closely related to the propelling charge on the one hand, and on the other the gun which gives it a purpose and direction. To be logical the Small Arms Committee must be brought into the same group, so that all departments of ordnance research may be directed on the same general plan. No departure from existing precedent would be involved in such a course, for the simple reason that small arms manufacture and design is already administered as a sub-section of ordnance. More than this the highest qualification which can be earned by an officer concerned in the manufacture and testing of small arms and small arm components is represented by the abbreviation *p.a.c.*, which implies that the holder of this degree has passed the advanced course of the Ordnance College. There is practically no problem in small arms which is not duly reproduced, studied and systematised on the more substantial basis of the behaviour of ordnance. To think in smaller quantities and to appreciate the enhanced influence which is exercised by mechanism and construction in the smaller weapon is merely to carry ordnance studies into a closely related sub-department. Centralisation is regarded as the bugbear of War Office administration; but research cannot be too much centralised, because the common knowledge of one department may represent the very information without which the attainment of success is impossible in another.

The Sparkbrook Factory.—War Office efforts at collaboration in company promotion have resulted in a failure so far as Sparkbrook is concerned. Wishing to get rid of an important factory, and so doubtless be free from the importunity for orders of influential Birmingham politicians, encouragement of a very special nature was offered to a group of individuals who were willing to float a private company. A guarantee of Government orders, the entrancing prospect of making cadet rifles for 30s. a piece, and sundry outside manufacturing possibilities failed to convince City underwriters that here was a scheme which the British public would take off their hands. The unfortunate investor in industrials has been many times bitten by the mania to take over a business, previously administered on sound lines, but which has been re-organised for his benefit on radically unsound principles. In due course the promotors retire in favour of the official staff, whose duty it is to satisfy shareholders that their investment in a manufacturing enterprise, with a large goodwill and an insignificant capital has proved a proper repository for their savings. The Sparkbrook Factory failed even to reach the prospectus stage; and it is, therefore, a matter for congratulation that the Birmingham Small Arms Company, manufacturers and not financiers, have taken over this embarassing

national asset. The guarantee of Government orders still remains. The phenomenal development of the motor car industry affords a tempting opportunity to manufacture components on the principle which has proved so satisfactory in the case of the bicycle. Here then is a means of absorbing the Sparkbrook Factory without the trade dislocation which usually accompanies the introduction of new people into an established business, where the existing trade is already appropriated.

Taking his name in vain.—A brilliant example of patriotism is to be found in the whole hearted devotion of Lord Roberts to the promotion of rifle shooting amongst the general population of this country. After a life of more than ordinary care and hardship he has devoted his remaining years to what must be a deadly monotonous routine of exacting formality. To travel miles for the purpose of opening a miniature rifle range amidst uninteresting surroundings, and to take part in a ceremonial where speeches are often long and tedious is to sacrifice himself for the benefit of a cause. In the spirit of self-sacrifice which has animated his whole connection with rifle shooting, Lord Roberts has given the sanction of his personal support to the smallest and humblest of clubs. Though the reputation he has gained can never be cheapened, the object of this short note is to suggest that the patriotic side of rifle shooting should be less emphasised by those having an axe to grind. A publican who hopes to sell more beer by setting up a rifle range in the inn garden may be excused if he claims to inspired by patriotic motives. But amongst those who have something to sell, and hope to make a profit out of selling it, it would be far better if the trading motive remained unadorned. A catalogue of rifle shooting sundries strikes a jarring note when the cover contains some clap-trap about England's might. The manufacturer is a very imporiant item in the carrying out of the scheme which we all have at heart. Being reputed a nation rather of deeds than of words let us at least avoid all talk of patriotism in circumstances where interested motives clearly exist. Rifles will sell just as well on their merits as because Lord Roberts tells us to use them; and if we advertise something about buy Mr. Somebody's guns for the nation's welfare it will not be surprising if foreign goods are offered by Mr. Zummerzeim on the same recommendation. Business and sentiment never mix well; and the least we can do to show our appreciation of Lord Roberts' efforts to promote rifle shooting is to respect the single-mindedness of his motives, and avoid treating him as a business asset.

Property in Names.—The English language, although standing very much where Shakespeare left it, is still subject to a yearly increase of proper nouns which represent the ingenuity of manufacturers and other introducers of proprietary articles. This kind of terminology forms the subject of deep thought and discussion by those who desire to give their offspring that cheapest of good starts in the world, a good name. The fashion in explosives is to take some common name or jumble of initials and add the letters "ite." This lacks ingenuity, but has at least produced a large number of useful names which are regarded as good or ordinary according to the commercial success of the substances concerned. One of the most brilliant invented names connected with gunnery is Cunicide, which to the ordinary person suggests death in some form. The chemical abbreviations "cu" and "ni" show that it is the cupro-nickel deposit in a rifle barrel upon which this material exercises its deadly effects. Rifle cleaning oils have many names, but none predominate, apparently because their is no individual member of the class which is in sufficiently general use to take possession of the mind. Among all the "ites" and the "ides" and other manufactured word abortions, no name really seems good until the public have been forced to remember it. Pegamoid strikes one as an excellent symbol for the waterproof preparation in question now that many thousands of pounds have been spent in engraving that name on the tablets of the mind. The termination "oid" at once becomes essential to goods of the same class. Hence Kynoid, which is phonetically and in other respects an excellent descriptive term for a brand of goods. In divising a new word to be used in a new connection it is impossible to foretell how the name will appear after years of familiarity have softened its obviousness or its apparent crudity. We have Shakespeare's authority for the view that a rose does not derive its sweetness from the pleasant name it bears. In a like manner one may well argue that the chief essential for a good name is to issue it to the world under the ægis of large advertisement contracts. Whatever the name it will in due course gain lustre if large sales ensue. A lad, however christened, is told to make for himself a name in the world. This suggests that success is the chief element in making a name.

Explosives in Congress.—According to the reports of the proceedings at the Chemical Congress in Rome, several questions of importance to the explosives industry were referred to at length. Amongst these, was the injurious action of explosive propellants on the bore of guns. If one is to judge from the summaries which have reached this country nothing of any great originality was brought forward in this connection. Here we have at least got so far as to distinguish between erosion and corrosion, the former being due to the mechanical action of the gases, and the latter to the rusting action which proceeds afterwards by the chemical action of the residues. Capt. Hardcastle has shown that metallic fouling is intimately concerned with these actions, in that the bore of the gun becomes plated with material abbraized from the driving bands on the projectile. This plating forms a cover which deprives the bore of the gun of the benefit that would otherwise accrue from the cleaning process. It is on this footing and when considering the relation of temperature of combustion to erosion that the subject must be approached. To be less precise is to rely on generalities having no special practical application. Proposals for modifying the composition of nitroglycerine to raise its freezing temperature were put forward and considered on an academical basis. More practical than this was the debate which arose on the subject of devising a system of transporting explosives to be universally sanctioned, so obviating the complications which ensue when goods packed in accordance with one country's regulations are refused passage through another country. The difficulties of securing anything in the way of coded regulations as between one country and another are very great; but it is possible that having regard to the importance of the question at issue, something practical may be accomplished. Our own authorities are so well versed in the technicalities involved, and our shipping trade is of such wide extent as to make it appear that British influence should be an important factor in securing a settlement.

SHOT GUN BARRELS.

Amongst the many questions which intimately concern the future prosperity of the gun trade that of shot gun barrels must always occupy a foremost position. In our last issue some interesting developments were discussed concerning the quality of metal from which shot gun tubes are made. The question of workmanship occupies a different position, but is still nevertheless closely related to the quality of the finished product. Just as foreign countries have shown themselves masters of the art of cheaply manufacturing somewhat rough and clumsy single barrel and other replicas of the English shot gun, so our own country is known to excel in the art of imparting to all weapons a carefully considered distribution of metal which is generally spoken of as balance. The strength of the barrel tubes, and their efficiency from a shooting standpoint, form part of the general problem of disposing the metal in the most favourable manner. Now that competition has become increasingly acute it is desirable to consider what steps can be taken to lower cost by way of giving enhanced value, rather than supply the old standard of work for a reduced price.

The barrel affords the right kind of opportunity for carrying out the policy here to be outlined. Recent notable improvements in barrel manufacture have resulted from the experience which has been gained in the use of modern boring and shaping machines. The rough tube can be fashioned by machinery nearer to the finished size than at any previous period in the history of gun-making. It is not so much a question of getting the inside of the correct diameter; but rather of reducing the outside to somewhere near an ideal finished form. A case which recently happened illustrates this point in a remarkable fashion. A demand had arisen for barrels of first-class workmanship at a reduced price. In previous years it would have been impossible to accept the tempting order which was offered. But when it was found that barrel tubes could be purchased of such weight and trueness as to diminish the expensive hand processes involved in the finishing processes the order was accepted, and a quality of barrel was produced at a price which would have been impossible under other circumstances. Supposing that the principle here involved could be widely adopted, and the same raising of quality could be introduced into all the processes of barrel manufacture, it would be possible in time to raise the proportionate quality of the barrels in all our guns to the standard observed in weapons of a higher grade of quality. The stimulation of a supply of cheap and accurate barrel tubes of a weight representing substantial readiness for putting together would give the barrel as distinguished from the tube maker an opportunity for devoting his available funds on the later processes, such as the more careful fitting of the ribs, the jointing of the lumps and the general assembling of the tubes in double-barrel form. To make such a policy effective in the widest sense, the gun trade must be prepared to sacrifice at least one of the processes which by tradition is regarded as essential to the making of a first-class gun. One would not dare to suggest the abandonment of the process of regulating for shooting were there not already evidence that this expensive and undesirable procedure has in some places been recognised as superfluous, in that guns whose shooting is known to be of the best are regulated by mechanical means alone.

By reviewing the new and the old methods of adjusting a gun to behave as intended, it will be possible to systematise the arguments in favour of the change which is progressing by slow developments. At the present time it is the custom to bore and choke a gun, purposely leaving surplus metal for removal as subsequent experiments may dictate. A prolonged course of shooting at the plate shows that the gun does or does not behave as required. If it behaves all right it is regarded as having passed the shooting test, and a gun is issued to the public which is known to differ in boring from the average of other guns constructed to perform the same functions. If on the other hand the firing tests are not satisfactory various changes are made, fresh tests are conducted, and in due course the gun attains something approaching average dimensions. From a scientific point of view this is not a satisfactory formula to adopt. Practice equally substantiates this same view. It frequently happens that a gun, which has passed the test once, fails to do so on a subsequent occasion. In a similar way a set of tests may indicate that the gun is shooting too wide or too close; the barrel borer makes the change which experience tells him will correct the alleged abnormality, yet it often happens that the report from the shooting ground is to the effect that the property originally complained of is more accentuated than ever. A final case may be quoted in which the gun is returned from the barrel shop, being supposed to have been altered in consequence of a previous report. Though identically the same as before it will at the second test be passed with flying colours.

All this means that the shooting staff assumes a uniformity about the behaviour of cartridges which can never exist. It is, therefore, bad in theory as well as in practice to adjust guns with extraordinary exactitude by means of a testing instrument, viz. the cartridge, which itself varies within disproportionately wide limits. Modern mechanical science tell us that far the best estimate of a gun's behaviour can be gained from gauging the interior with a view to ensuring its agreement in every detail with a general specification of dimensions which has been shown to give reliable all-round results. A gun so treated may behave more or less well according to the behaviour of the cartridge which is employed in the tests. Slight variations should be disregarded in the case of all guns which have passed the far more exact test of mechanical examination. Guns should accordingly be manufactured to an approved specification for the interior of the barrels; and the shooting should be confined to a final passing test to examine for fair average of general behaviour. The results of such tests must of course be judged in a spirit of far greater leniency than has hitherto been regarded as essential for a high grade of output. In most doubtful cases the problem can be finally settled by shooting a standard gun, kept for that purpose, against specimens of new manufacture. If the shooting ground expenses, a heavy item in all first-class factories, can be curtailed in the way indicated a valuable extra margin is afforded, whereby quality can be improved without additional cost to the purchaser. In favour of the policy recommended is the circumstance that there is ample reason for the belief that better shooting guns would result by discountenancing the haphazard check afforded by firing with cartridges about which very little is known.

ARRANGEMENTS FOR BISLEY.

THIS year's Bisley programme contains a number of novelties which demand careful study by those who cater for trade in miniature rifles and ammunition for the same. At the risk of repetition the new definitions under this heading are here given in full :—

MINIATURE RIFLES. CLASS A.—ANY. Any breech-loading rifle, complying with the following conditions :—*Weight.*—Maximum, 8 lbs., complete as used when firing. *Calibre.*—Maximum, ·325. *Pull of Trigger.*—Minimum, 4 lbs. *Sights.*—Of any description other than magnifying or telescopic.

MINIATURE RIFLES. CLASS B.—MILITARY. Miniature Rifles (Class B) are of four descriptions, viz. :—

1. Any Service Rifle with a calibre not exceeding ·310, or Miniature Rifle of War Office pattern, firing miniature ammunition as defined in these regulations under heading "Ammunition."
2. Any Service Rifle fitted with the Morris or other Tube.
3. Any Rifle of Service Pattern, but provided with a barrel bored, chambered and rifled for the ·22 short, long, or long rifle rim-fire cartridge, the ·230 long or short Morris Tube, or any other miniature ammunition which has received the approval of the Council or Bisley Committee. The bolt may be modified to fire and extract the cartridge, and the magazine may be omitted.
4. Any "Class A" rifle with a calibre not exceeding ·310, provided that the general shape of the foresight and the notch in the backsight are the same as those of a Government pattern rifle, and that the notch of the backsight when in position for aiming is not less than 23 inches from the heel of the butt. The backsight notch may be mounted so as to be capable of lateral adjustment in addition to the usual vertical adjustment. The foresight may only be made adjustable to the extent of the usual driving fit into a dove-tail slot.

Pull of Trigger for all Miniature Rifles included in Class B.—Minimum, 4 lbs. *Sights* for all Miniature Rifles included in description 1, 2, and 3 of Class B must be the same as for the same pattern of rifle as issued for service, except—(*a*) that the foresight may be made a driving fit into a dove-tail slot, and that the backsight notch may be so mounted as to be capable of lateral adjustment; and (*b*) that the height and width of the foresight block may be of any dimensions.

MINIATURE AMMUNITION. *Indoor.*—With a bullet not exceeding 80 grains in weight the observed velocity must not exceed 1,200 ft. per second over 20 yards (energy equivalent 222 ft.-lbs.). With a bullet exceeding 80 grains but not exceeding 100 grains the observed velocity must not exceed 1,000 ft. per second over 20 yards (energy equivalent 256 ft. lbs.). *Outdoors.*—The weight of the bullet must not exceed 140 grains, and the observed velocity must not exceed 1,450 ft. per second over 20 yards (energy equivalent 653 ft.-lbs.).

The following competitions are influenced by the above definitions :—

The *Greener*, which consists of ten shots at 100 yards with Greener rifles and sights, is subject only to one proviso that the sights used must comply with the regulations for miniature rifles, Class A. This proviso does not prevent the term "Greener sights" from being applied to a match backsight fitted on the butt.

The *Savage* competition consists of seven shots at 100 yards with a Savage 1903 magazine rifle. Though not specifically stated it may be assumed that ·22 L.R. ammunition will be used.

The *Stevens* competition will also consist of seven shots at 100 yards with Stevens rifles and ·22 calibre ammunition. The sighting and other fittings are to be in accordance with the rifles as supplied by the Stevens Company at the firing point. It is understood that these rifles will be fitted with slings to promote steady holding.

The *Clubs Riflemen* is open to holders of "riflemen's" certificates, who have never obtained a "skilled shot's" certificate, and have not won a Bisley prize of £2 or upwards. The contest consists of seven shots at 100 yards with miniature rifles Class A, outdoor ammunition. The best rifle for such a competition would obviously be one with all the refinements common to the best types of aperture sight, firing a cartridge having a bullet near the maximum weight of 140 grains and a 20-yards velocity of 1,450 f.-s. The Sherwood cartridge falls within this limit as the bullet weight is correct, and the muzzle velocity is given at 1,450 f.-s., viz., the value which is permissible for the mean velocity over 20 yards. Less powerful cartridges would of course compete at a slight disadvantage.

The *Exeter* is a competition limited to non-prize winners at previous meetings, as per a specified list. It comprises seven shots at 25 yards with a miniature rifle, Class B and indoor ammunition. This competition will provide an interesting trial of strength between service rifles firing indoor ammunition, whether from tubes, adapters or special barrels, and miniature rifles fitted with open sights, subject to the proviso that the backsight be not less than 23 inches from the heel of the butt. The trigger pull for such rifles must not be less than 4 lbs. The specification of indoor ammunition allows a 1,200 f.-s. observed velocity for bullets not exceeding 80 grains in weight, and 1,000 f.-s. velocity for bullets not exceeding 100 grains in weight. The difficulty of obtaining Stevens and other rifles of sufficient length for use with open sights will probably favour the use of ·22 Lee-Enfields, fitted with special barrels to fire the ·22 L.R. cartridge. Adapters as used in full calibre service rifles will have a show, provided they are fitted with bullets not exceeding 100 grains in weight and propelled at a velocity not exceeding 1,000 f.-s. The Mullineux bullet weighs 90 grains, but the Trask is nearer 120 grains, and would be excluded in its present form.

The *Miniature* consists of seven shots at 100 yards with miniature rifles Class B and outdoor ammunition. The objectionable conditions of previous years, viz., debarring rifles above a certain cost, are now omitted, and open sights must be used. The present regulations seemed destined to bring to the front a class of rifle which can hardly be considered to exist in the best available form at the present moment. The service rifle possesses the general dimensions which display open sights at their best, and a reduced charge cartridge could doubtless be used therefrom with great success. Miniature rifles of ordinary dimensions would be at a disadvantage against such a combination.

The *Olympia* is again restricted to non-prize winners, and it consists of seven shots at 50 yards with miniature rifles Class B and indoor ammunition. Here again some very interesting conditions have been introduced by reason of the use of open sights, but the ammunition is such as to make the ·22 long rifle cartridge the one likely to be most used.

The *Sporting Telescope* competition consists of seven shots at 100 yards, and it will be interesting to observe whether this valuable addition to the programme will bring West End gunmakers into the running. If they consider previous experience they will bear in mind the fact that Kynoch's ·32-·40 cartridge has hitherto proved the most accurate grouper at 100 yards. Some of the lighter express rifles would, however, doubtless prove very efficient.

The *Martin Smith* competition remains the same old out-of-date contest, consisting of seven shots at 100 yards with any single or double sporting rifle.

TRAJECTORIES— UP-HILL AND DOWN-DALE.

BY CAPTAIN J. H. HARDCASTLE, R.G.A.

In the course of last month thousands of shots were fired at young rooks in the tops of high trees, and a good percentage of the bullets duly hit the mark. The average angle from the gun to the rook is as a rule well over 45°. Often the bird is nearly overhead, and in any case presents a target not greatly exceeding two inches by three inches. Swaying about in the wind, partly concealed by the leaves and seen against a brilliant sky which seriously distresses the eye, the mark in spite of its size cannot be regarded as an easy one to hit. Nevertheless the contest of rifle *versus* rook is a foregone conclusion for the rifle when the rook is still, and an even chance when the wind is fresh. For this work rifles are as a rule sighted on the level for a range of about 40 yards. The shooter walks to the rookery and aims at a steep angle, without seriously asking himself whether the adjustment of his sights, as found on the level, is correct for the novel conditions of an up-hill aim. Experience shows that the trajectory does not seem to be influenced by the angle of elevation of the target. The explanation of this apparent anomaly is very easy or very difficult, according to the degree of thoroughness with which the answer is given If the explanation is to be presented to a board of examiners in mathematics it would be very long and bristling with curious symbols; but the answer which I propose to give should present no difficulty to anyone who can work out a muzzle velocity from the results of a chronograph reading.

Before going deeply into the subject it will suffice to dismiss the rook shooting aspect of the problem by quoting the trajectory tables for various ·22 calibre cartridges which were published in the *Field* issues of April 7, April 14 and May 12. In these it was clearly laid down that when the height of foresight is included in the calculation 40 yards sighting gives exact shooting at about ten yards, and a negligible difference of elevation for all distances from the muzzle to 40 yards. With a trajectory which may be regarded as flat for all practical purposes it is sufficient to say that the sight adjustment for any given shot in the top of a tree is the one which is true for the horizontal distance separating the shooter from the butt of the trunk. If the high elevation of the mark produces a difference of flight it at least lies within the errors specified for the sight adjustment assumed in the *Field* tables of trajectory for bullets fired on the flat. When considerable distances are in question and the sights must be set to correct a substantial drop, the question of firing up-hill and down-dale must be more minutely considered.

On page 144 of the *Text Book of Small Arms* (1904 edition) there is given a table of elevations to be used with the service rifle when firing either up or down steep slopes, and this table is prefaced by a few remarks expressed in terms which lead the reader to suppose that the writer is fully acquainted with the theory of the subject, and merely gives the results to avoid a long and highly technical exposition of the matter. In point of fact the published table is very far indeed from being correct; and the range to be set on the sights when firing at an object on a different level corresponds very closely with the cosine of the angle of slope multiplied by the distance to the target measured along the slope. Put in simpler language the range to be put on the sights is almost exactly "the range on the horizontal plane of the firer, at which a perpendicular raised or let fall from the mark meets it."

This simple statement is in direct contradiction to the statement in the official text book, and is in complete agreement with the solution given by Colonel Ingalls of the U.S. Artillery in his official *Handbook of Problems in Exterior Ballistics* (Washington 1900), pages 9 and 77. The table published in the text book is as follows:—

Range.	Elevation on Sights in Degrees and Minutes.							
	Horizontal.		20 Deg. Slope.		30 Deg. Slope.		40 Deg. Slope.	
Yards.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
200	0	9·5	0	9·0	0	8·5	0	7·5
300	0	16·0	0	15·0	0	14 0	0	13·0
400	0	23·0	0	22·0	0	21·0	0	18·0
500	0	31·0	0	29·5	0	27·0	0	24·0
600	0	40·0	0	38·0	0	36·5	0	33·0
700	0	50·5	0	47·0	0	44·0	0	40·0
800	1	2·0	0	57·5	0	54·5	0	50·0
900	1	14·0	1	10·5	1	7·0	1	3·0
1000	1	28·0	1	24·5	1	21·0	1	16·0

The correct table, as worked out by Ingalls' tables, is subjoined for comparison:—

Range in Yards.	Elevation on Sights in Degrees and Minutes.							
	Horizontal.		20 Deg. Slope.		30 Deg. Slope.		40 Deg. Slope.	
	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
0	0	0·0	0	0·0	0	0·0	0	0·0
100	0	4·4	0	4·2	0	3·9	0	3·3
200	0	9·5	0	9·0	0	8·2	0	7·0
300	0	15·4	0	14·3	0	13·0	0	11·2
400	0	22·3	0	20·2	0	18·5	0	15·9
500	0	30·3	0	26·7	0	24·6	0	21·0
600	0	39·4	0	34·3	0	31·4	0	26·7
700	0	49·8	0	43·2	0	39·2	0	33·0
800	1	1·5	0	53·4	0	48·0	0	40·1
900	1	14·2	1	5·0	0	57·7	0	48·1
1000	1	28·0	1	18·0	1	8·5	0	57·0
cosine	1·0000		0·9397		0·8660		0·7660	

In working out the second table the *data* were taken to be: muzzle velocity 2,000 f.s., angle of elevation on the horizontal plane for 1,000 yards 1° 28′. Using Ingalls' tables and the formula

$$\sin 2\phi = aC$$

the value of the ballistic co-efficient is found

$$C_1 = 0{\cdot}3775$$

Taking the 40° slope up-hill as an example, the horizontal range is 2298 feet, and the height of the target 1,000 yards distant is 1929 feet. Since the barometer falls about one inch for every 900 feet rise above the surface of the earth, it must be standing about two inches lower at the target than it is at the gun, and the air is correspondingly less dense. We allow for this by the method explained in the *Text Book of Gunnery* (1902 edition), pages 207, 224 and 225, and the correct value of the ballistic co-efficient is then

$$C = 0{\cdot}3953$$

some six per cent. greater than before, because the air traversed on this upward path is some six per cent. on the average lighter than on the level of the rifle. We then proceed

to find the angle of elevation for a range of 2298 feet (which angle we will call ϕ_x) by the usual formula

$$\sin 2\phi_x = aC, \text{ where C is } 0{\cdot}3953$$

$$\text{We find } \phi_x = 0^\circ\ 56'.$$

This angle 0° 56′ was found by using Ingalls' tables. Using the tables in the *Text Book of Gunnery* we should start with $C_1 = 0{\cdot}417$ about and ϕ_x would be the same as by Ingalls, viz., 0° 56′.

The angle of elevation of the target is 40°. This angle Ingalls calls "ϵ," and he connects it with the angle ϕ_x for 2298 feet, and the whole angle of elevation ϕ, strictly called the angle of departure, by the equation

$$\sin(2\phi - \epsilon) = \sin\epsilon\,(1 + \cot\epsilon \sin 2\phi_x)$$

On the right hand side we know the size of the angle $\epsilon = 40^\circ$, and from the tables we look out the value of sin ϵ and cot ϵ, and as we have found sin $2\phi_x$ the value of sin $(2\phi - \epsilon)$ is easily computed and the value of $(2\phi - \epsilon)$ is known, and thence the value of 2ϕ and ϕ is obtained, $\phi = 40^\circ\ 57'$. This means that the rifle must be elevated 57′ above the target 1,000 yards distant and 40° above the horizontal. It will be noticed that the use of the above equation only alters the elevation from 56′ to 57′ at this range and velocity, and consequently when working out the remainder of the figures for this table the work can stop at ϕ_x.

When shooting down hill at 40° for 1,000 yards $\phi = 39^\circ\ 2'$ which means that the rifle must be pointed 58′ above the target, which is practically the same as the result for shooting up-hill, although gravity is in one case hindering and in the other case assisting the bullet. This apparent anomaly is to be explained by the counterbalancing effect of the density of the air. Shooting up the bullet goes into lighter air, and shooting down into denser air, and in the result the density and gravity just about balance one another. In no case can the figures in the corrected table be checked by actual firing beyond perhaps 200 yards, as a slope of even 20° a quarter of a mile long suitable for target practice does not exist in nature. But a check of the method can be obtained from practice with heavy ordnance, if a jest may be allowed. A balloon is 19,000 feet up and 6½ miles distant horizontally. It is desired to hit it with a heavy shell, w. = 380 lbs., d. = 9·2 in., v. = 2,360 f.-s. What angle of departure is necessary? Here the angle "ϵ" the elevation of the balloon is 29°, and working by this method we get the angle of departure as 40°. The question now arises, who would shoot at a balloon in such an absurd way? The jesting reply is that in the summer of 1888 four rounds were so fired, but there was no balloon. The rounds are commonly called "The Jubilee Rounds," and the calculated range was 20,922 yards and the mean observed range was 20,876 yards. The calculated time of flight was 64·30 seconds, and the observed time was 63·45 seconds. The calculated path would just have made it hit the balloon if it had been up.

THE DUBLIN EXPLOSION.

Major Cooper-Key's report on the explosion which occurred at Messrs. Trulock, Harriss and Richardson's premises at Dublin relieves the anxiety which was felt that this accident might represent an exception to the general immunity to storage and cartridge filling operations connected with smokeless powders. To quote from the report itself:—

"The cause of the accident is not far to seek. As already stated, FitzGerald and Myles were engaged in breaking up revolver cartridges at the time, and for this purpose they had been provided with two steel hammers, subsequently found among the débris, with which to knock out the bullets by tapping round the rims of the cartridge cases. According to a statement made by Myles he was holding a cartridge on the edge of one of the hammers and tapping the bullet with the other when the first flash occurred. The hideous recklessness of this operation would be sufficiently apparent even if a catastrophe had not been further assured by the indiscriminate medley on the bench of capped cartridge cases, bullets, gunpowder, and such small quantities of percussion cap composition which may become loosened by age and fallen from the caps. In fact, it is only the extreme care with which the tapping appears to have been done that could have prevented an accident occurring much sooner than was the case. One of the most elementary precautions adopted in connection with the manufacture, storage and conveyance of explosives is the prohibition of the use, or even presence, of any article of iron or steel in the room or carriage in which the explosive is kept or conveyed.

The cartridges were admittedly very old, and there is every probability that small portions of the cap charges may have escaped and been present in the miscellaneous hotch-potch on the bench, so that it is little short of miraculous that some 50,000 of these cartridges had been broken up without accident, as would appear to have been the case. That there was a quantity of loose explosive on the bench is evidenced by the even distribution of the cases in all directions and by the wounds on the faces of the two men. The weight of the bullets found on and near the bench was 48 lbs., which at 220 grains per bullet, gives 1,527 cartridges; the powder charge of each is 13 grains, giving roughly 2¾ lbs. of powder, and there is good reason to believe that a considerable part of this was loose on the bench at the time of the explosion.

In addition to this, however, there was a 25-lb. powder tin, standing underneath the bench. This tin according to FitzGerald was about two-thirds full of powder, and it was the explosion of this that did the damage. This powder was very old, probably caked, and possibly damp, which would account for the very small locally destructive effect combined with a considerable lifting power. Had the gunpowder been in thoroughly good condition there is no doubt whatever that the floor of the gallery would have been destroyed and one or both of the men dismembered, or otherwise severely injured.

By section 105 of the Explosive Act, 1875, it is provided that the process of breaking up an explosive shall be regarded as an operation of manufacture, and by section 4 of the same Act such manufacture may not be lawfully carried on except in a licensed factory. On consideration, therefore, of all the circumstances of the case, I felt it my duty to press on the local authority the advisability of instituting proceedings against the firm for manufacturing explosive in an unauthorised place. The offence was no doubt due to ignorance; indeed, the manager confessed as much; but in connection with a trade involving so material a risk to the neighbourhood as that of a gunsmith and ammunition dealer, the plea of ignorance should in my opinion be absolutely disregarded."

Mention is made in the Report of the circumstance that, against the strictest injunctions to the contrary, the powder safe contained a parcel of cartridges in addition to some powder.

ROUND THE TRADE.

Messrs. Rigby and Steward are jointly responsible for a new match rifle sight, arranged to give the shooter the benefit of low-power telescopic magnification.

Mr. J. C. Isaac, the respected representative in Cornwall, Devon and Somerset of Messrs. Curtis's & Harvey, died last month at the age of 45 years. Mr. Isaac was previously connected with the East Cornwall Gunpowder Co., Ld.

It is reported from Eley's laboratory that a muzzle velocity of 3,600 f.-s. has there been attained with a 95-grain bullet in a ·303 rifle. Calculations show that this combination gives an angle at 600 yards of 25 minutes, as compared with 40 minutes for the ordinary ·303.

The report of the King's Norton Metal Co., Ld., is brief and to the point, the point being that there is £32,193 available for distribution, and that the carry forward of last year is very nearly repeated, after paying 7 per cent. on the preference shares, 10 per cent. on the ordinary shares, appropriating £3,500 to depreciation and setting aside £6,300 as provision for new plant.

Mr. Charles Lancaster's new catalogue of guns and rifles contains a singularly wide selection of the various weapons and appliances which appeal to shooting men in all parts of the world. The inclusion of the automatic shot gun and the B.S.A. air-gun show a broad-minded tolerance towards new developments which are a valuable asset to the gunmaker who keeps a close watch on the buying and selling aspects of his business.

Mention is made in the daily press of a model of a new naval gun sight, the invention of Professor Forbes, which was exhibited at a recent conversazione of the Royal Society. The sight is so devised as to correct by automatic means decreased velocity due to erosion, to aim the correct amount forward of a moving object, and finally to compensate for variations in barometric pressure. Patent No. 16,924 (1905), as mentioned elsewhere, seems to refer to this sight.

The ordinary general meeting of the Colt Gun and Carriage Co., Ld., was held on the 22nd ult., at which Mr. Andrew Haes, who presided, explained the difficulties of the new directors in their efforts to sort out the affairs of the Company. The other directors are Mr. H. M. Hyndman, Mr. H. T. Brice and Captain Zigomala. It was mentioned that the efforts which were being made to push business in all possible directions were greatly hampered by want of capital.

In reply to an enquiry we addressed last month to the National Rifle Association we were informed that the Birmingham Small Arms Co., Ld., the London Small Arms Co., Ld., and the Peddie Small Arms Corporation have been granted permits to manufacture the new cadet rifle, and that applications from the firms of Webley and Greener are under consideration. Information has since reached us to the effect that the two last-named firms have duly received the permit under consideration.

The annual report of the Nobel-Dynamite Trust Co., Ld., has followed the dividend announcement which was reproduced in these columns a month ago. With £4,678 brought forward the available profit is £333,359, as compared with £308,218 in the previous year. The dividend of eight per cent. and a two per cent. bonus, as mentioned last month, are duly confirmed, but the reserve account benefits by £50,000 instead of the £74,000 mentioned in the first instance. The extensiveness of the markets covered by the subsidiary companies is evidently so great as to show an increase of earning power in what is frankly admitted to be a time of keen competition with regard to prices. At the general meeting of the Company the chairman outlined the reasons which have led to the building up of large reserves by the Trust Company as well as by the subsidiary concerns. He justified this course by the obvious need to be prepared at all times to replace old machinery with new when improvements promising economy are introduced.

The Schultze Gunpowder Co., Ld., have furnished to this office a sample of the celluloid-covered waistcoat-pocket memorandum book which they issue to their friends. As in many similar instances, what one gets for nothing is superior to what stationers charge for in their shops.

In the course of trials with the new quick-firing field gun it was found that the glints of life from the protecting shields make it unduly conspicuous, efforts are being made to find a suitable means for minimising the reflection of the sun's rays. Deep rust indentations form the best cloak for iron and steel, but service traditions demand a conspicuous array of polished parts.

The Kynoch Company have issued £100,000 of four per cent debentures at par, the same forming part of the amount authorised to the extent of one-half of the issued capital of the Company. From an announcement sent to the press to effect that letters of allotment and regret have been posted it is to be assumed that the new issue was successfully launched. The debentures now stand at £400,000, as against a total of £870,370 of issued capital, as shown in the balance sheet for the year ended March 31, 1905.

The Explosives Department of the Home Office have arranged, in consequence of many enquiries, to supply heat test papers at the price of 10s. 6d. per thousand. The notice on this subject reminds purchasers that, as the papers must be kept for one month before being issued for use, it is advisable that orders should be given one month previous to the desired date of delivery. A further warning is issued that the papers will keep for six months, or perhaps longer, if stored in a dark place, but that they should be tested from time to time in the manner described in the original memorandum.

An interesting letter which has been sent to this office by a recent visitor to Washington states that the War Department has been bullied into adopting a type of sight which gives the marksman a peep and two other selections to choose from at all ranges and three additional variations at certain distances. The bed of the new sight pivots in front, being a modification of the Buffington sight and beautifully made at that. Expert opinion in the Ordnance Department is against the use of sights, which do not increase the military effectiveness of a rifle nor its value as a means of shooting instruction.

The new edition, "the seventh and revised popular," of Lancaster's *Illustrated Treatise on the Art of Shooting* reminds the reader that this well-known gunmaker will always rank as the pioneer of illustrating shooting deportment, with a view to showing by graphical means what to do and what not to do when out with a gun. Amongst interesting fresh matter contained in the volume before us is a series of carefully selected extracts from the *Field* and other sources of information. It is interesting to notice that the author has specially honoured in this way the important tests which were conducted by that paper about a couple of years ago to determine the behaviour of a charge of shot at every stage of its progress from the muzzle to the 40 yards distance.

The accounts of the Morris Tube Co., Ld., show a reduction of profit which has necessitated a reduction of dividend from the usual 10 per cent. to 8 per cent. The chairman, in his statement at the annual meeting, attributed this serious deficiency to an unexpected increase in the price of metals shortly after the year's contracts with the Government had been made. In favour of the view that the loss is of a temporary nature it was mentioned that the gross sales for the year under review have been about £6,000 in advance of those in the previous year. An unfavourable aspect of present prospects was also mentioned, viz., the apparent economical disposition of the present Goverment. A new electrical branch of the Company's activities has absorbed the firm's available cash, and as a consequence the shareholders were asked to assist in placing the extra debentures which are required for filling the gap so occasioned. Replying to a shareholder the chairman expressed the opinion that the the Morris tube would hold its own against rival devices for miniature practice with service pattern rifles notwithstanding the greater initial cost involved in the purchase of a Morris tube.

The Webley Company have issued a notice to the effect that the name Webley and Scott Revolver and Arms Co., Ld., has been altered to Webley and Scott Limited. This is a welcome approach to the brevity of title of which Kynoch Ld. is a shining example.

The gay collection of tents which faced the running deer range at Bisley will mostly find a new location next July, following the removal of the revolver ranges, to a site near the 200 yards firing point. The loss of a delightful outlook will be keenly felt by the many visitors who enjoyed the comparative quiet at this retired quarter of the camp.

The death is announced from Brighton of Mr. Arthur Norton-Lane, better known as "20,000 Shots," who must rank for all time as one of the most ingenious and thoughtful of the amateur enthusiasts who have studied the problems of the shot gun. Mr. Lane was in his 91st year, yet letters from his pen have appeared in the sporting press during the past year.

The London management of the Savage Arms Company have issued a very telling show card, depicting Lord Roberts firing a shot with one of these rifles at the opening ceremony of a new rifle club. This card mentions that on March 17, 1906, Mr. C. W. Robins of Leicester made 94 consecutive bullseyes in 95 shots with a Savage bolt rifle at the N.R.A. 25 yards miniature standard target with one-inch bull. We doubt whether the one-inch bull can be correctly so described; but as the multiplicity of N.R.A. standard targets compares in extent with the postage stamps in a collecting album a little latitude must be allowed.

The annual report of the National Explosives Co., Ld., shows a loss on the year's trading of £6,082, which has been written off by transferring £6,000 from reserve, and appropriating a part of the carry forward from last year, so leaving a credit balance of £610 to be carried forward. Further expenditure on the new guncotton compressing plant has absorbed £4,702 during the year. At the annual meeting held on the 25th ult. Mr. Athol Thorne ascribed the loss of profit which has been so marked a feature of the past three years' balance sheets, to the bad conditions under which the explosives trade is at present labouring. He, however, held out no hope of improvement for the present.

The catalogue of Mr. Alexander Martin, of Glasgow, contains particulars of a singularly varied assortment of goods, sufficient in fact to place him in a front position amongst the most enterprising of our provincial gunmakers, that is, of course, assuming that this term can be properly applied to a great centre of population like Glasgow. Mr. Martin is one of the finest military rifle shots in the United Kingdom; and it is interesting to observe from his supplementary price list of rifle shooting goods and sundries how comprehensive is his grasp of the rival merits of competing contrivances. Not satisfied with issuing two catalogues Mr. Martin is also the author of a most interesting score book and code of instructions for rifle shooting. One of the most appreciated aspects of this book is the printing of all matter on a buff coloured paper, so diminishing the glare which the vivid sunlight occasions at a time when fatigued eyesight spells disaster.

Capt. Thomson, in reporting on the explosion at Messrs. Berk's chemical works at Stratford, last January, explains that four drums containing waste acid from nitroglycerine manufacture burst simultaneously, a hammer and chisel having been used in opening a drum which was corroded round the plug. The report contains matter of considerable technical interest, by reason of Capt. Thomson's reference to the new Waltham Abbey system of making nitroglycerine. The accident seems to have arisen from the presence of nitroglycerine which had formed in the drums notwithstanding the precautionary addition of two per cent. of water to prevent after-separation. Capt. Thomson does not appear to regard even a five per cent. addition of water as a sufficient safeguard to justify the removal of waste acids from an explosive factory. It is pleasing to note that the Chief Inspector absolves Messrs. Berk from all blame in the matter.

The London Sporting Park introduced what is known as the "Parachute clay pigeon" at an invitation shoot which was given on their grounds on the 23rd ult.

At the annual meeting of the Hotchkiss Ordnance Company on the 8th ult., the chairman announced the issue at an early date of approximately £75,000 of second debenture stock, of which probably only £50,000 would be offered in the near future. The very large contracts in course of execution coupled with a large programme of motor manufacture make extra working capital essential.

Mr. Gustaf Roos, president and founder of the Hendon and Cricklewood Rifle Club, displays fresh evidence of his unbounded energy by the announcement on a picture post card that 600 members were enrolled during the first two months of the Club's existence; that 35 prizes, including a challenge trophy, have been received; and that H.R.H. Princess Louise Augusta of Schleswig-Holstein has graciously consented to distribute the prizes on Saturday the 7th prox.

The report and balance sheet of the E. C. Powder Co., Ld., show, after deducting the Directors' fees, a profit, free of income tax, amounting to £9,137, as compared with £7,954 for the previous year. An interim dividend of two shillings per £3 share has already been paid, and the directors recommend a further dividend of four shillings per share and a bonus of one shilling per share, making in all a distribution of rather more than 11¼ per cent. The above distribution absorbs £5,775 on the paid up capital of £49,500. Of the remaining balance £1,000 is written off freehold land; the same amount off patents, reducing them to £2,000; and a third £1,000 is added to fire insurance reserve. The balance of £362 is added to the carry forward amount, which thus becomes £3,895.

CORRESPONDENCE.

THE GOVERNMENT AS INVENTORS.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—Your article in this month's issue of your journal on "The Government as Inventors" will be very widely read and appreciated. Indeed, it is a matter of such general public interest that I hope space may be found for its reproduction far beyond the prescribed limits of a trade journal. It may indeed be said of this subject that history repeats itself. I am old enough to recollect the evidence given by the late Mr. Westley Richards and his contemporaries before one, or more, of the many Royal Commissions appointed to investigate and report on War Office administration.

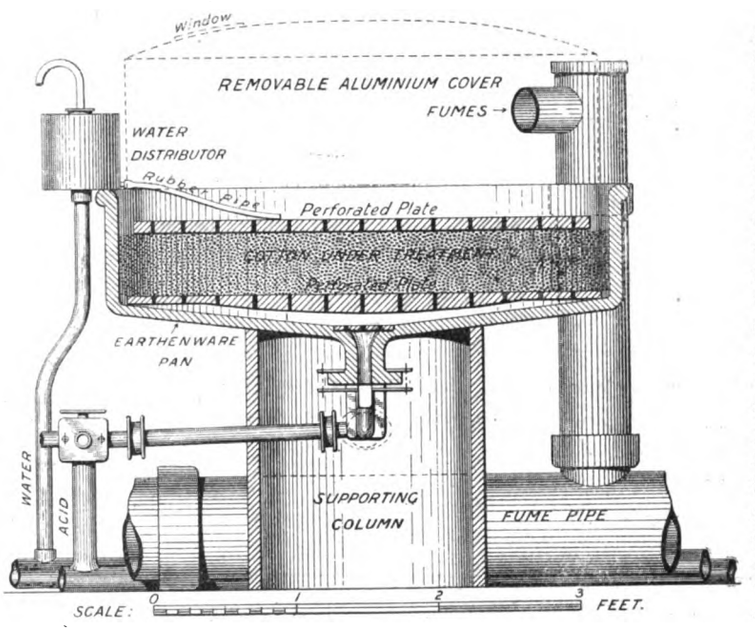
One generation succeeds another, and yet to-day the same blunders and defects of administrative incapacity in the lack of co-ordination of war material production continue. Under the system which has remained practically unaltered for the past thirty years private manufacturers get no fair play. Now, much the same as in Mr. Westley Richards' day, the Government officials keep sufficiently in touch with trade inventors to pirate and appropriate their improvements, without acknowledgment or adequate compensation.

It has of course been pointed out over and over again that any private enterprise conducted on such loose and ill-fitting departmental conditions could not long exist. The recommendations of successive Royal Commissions are hopelessly pigeon-holed, and the Government manufacturing establishments, acting almost independently of each other, maintained out of public money, muddle on. In the name of honour and commonsense, how much longer is this disastrous condition of affairs to be allowed to continue? Is it absolutely beyond the wit of man to alter?

FULMINATE.

MAKING GUNCOTTON BY THE DISPLACEMENT PROCESS.

IT seems difficult indeed to realise that after the many years during which guncotton has been manufactured it would be possible to introduce an entirely new process, destined apparently to take the place sooner or later of the method now universally in use. Notwithstanding the apparent impossibility of dealing on an original basis with a problem which has been studied for so long by so many master minds, there are good reasons for believing that the process described in Messrs. J. M. and W. T. Thomson's patent No. 8,278 (1903) fully merits the claims made on its behalf, and may, therefore, be expected to revolutionise existing practice. The new Thomson apparatus has been working at Waltham Abbey on a commercial basis for the past eighteen months, and the results have been found so satisfactory that it was decided some time back to re-equip the entire plant on the new basis. The brothers Thomson hold important positions at the Royal Gunpowder Factory, Waltham Abbey, and it is by their united efforts, and the help received from Colonel Nathan, that things have now reached a stage which justifies the belief that a new chapter in the history of guncotton must be written.



SECTION SHOWING THE NEW APPARATUS.

The Abel process, adopted about 1865, may be said to have held its own up to the introduction of the Thomson method. The Pot system, as used for special nitrations such as high and low soluble nitrocellulose, is as a matter of fact only a slight variation of Abel's; and even the centrifugal system does not differ radically from the Abel process. The Thomson method, however, introduces an entirely new feature, viz., the displacement of the heavy mixed acids by water. The actual process involved in carrying out the new idea is simplicity itself. Hitherto 1¼-lb. lots of cotton have been dipped in the acid mixture, where they have been allowed to remain for a few minutes. The surplus acid has then to be squeezed out, and the cotton, containing about ten times its weight of acid, is transferred to an earthenware pot, cooled on the outside by immersion in a stream of cold water. After 24 hours of this treatment the cotton has become thoroughly nitrated. The superfluous acid is then mechanically removed by a centrifugal machine. A series of washings then follow, and are continued until the whole of the free acid has been removed. The new process displaces most of these operations. The cotton is introduced into the nitrating vessel containing acids, where it remains until sufficiently free from acid for boiling.

DESCRIPTION OF APPARATUS.—The apparatus consists of four circular pans each, as shown in the illustration, three feet six inches inside diameter, and ten inches deep at the side of the pan. The bottom has a fall of two inches to the outlet, which is three-quarters of an inch in diameter. The pans are supported on pedestals about two feet above the floor level. The four pans are connected together by lead and aluminium pipes, and these are again connected to the nitrating acid supply pipe, and to a gauge box where the rate of flow is determined while the waste acid is being displaced by water.

DESCRIPTION OF PROCESS.—A small perforated plate is placed over the outlet of each pan, and a large perforated plate, about one inch less than the inside diameter of the pan, placed on the bottom. The stoneware cock on the pipe leading from the nitrating acid store is opened, and the acid at a temperature of from 10 deg. to 15 deg. C. is allowed to rise in the pans to the proper level. A charge of cotton waste is then immersed in the acid in each pan, and perforated plates in segments placed on the top. When all the cotton waste has been pushed under the surface of the acid, water at a temperature of from 5 deg. to 10 deg. C. is run on to the surface of the plates, which soon completely seals the acid, when the fume hoods may be removed to the next set of pans. The nitration is allowed to proceed for two and a half hours. The cock leading to the gauge box is then opened, and the waste acid is allowed to run off at the rate of about 17 lbs. per minute. Water is run on the top of the pans at about the same rate as the outflow of acid. The first portion of the waste acid is returned to the acid store tanks to be revivified with strong sulphuric and nitric acids. The second weaker portion is conducted to the acid factory for denitration and concentration, and the last portions containing very little acid are allowed to flow down the drain. Waste acid down to a gravity of 1·10 can be concentrated with economy.

CAPACITY OF PLANT.—Each pan is capable of nitrating 20 lbs. of cotton, for which 600 lbs. of nitrating acid is required above the large perforated plate at the bottom. (The acid below the plate amounts to about 100 lbs., but does not come in contact with the cotton, and is returned with the

waste acid for revivifying to the acid store tanks.) Each charge can be carried through all the processes and placed in the boiling vats in from seven to eight hours.

REVIVIFYING QUANTITIES AND CALCULATION FOR SAME.

Mixed Acid Composition.

H_2SO_4	70·5 %	= 96 % C O V		73·44 %
HNO_3	21·0 %	= 91·5 % Nitric Acid		22·95 %
H_2O	8·5 %	= Water		3·61 %

Waste Acid Composition.

H_2SO_4	72·50 %	= 96 % C O V		75·52 %
HNO_3	17·80 %	= 91·5 % Nitric Acid		19·45 %
H_2O	9·70 %	= Water		5·03 %

H_2O in Mixed Acid.	C O V in Mixed Acid.	H_2O in Waste Acid.	C O V required for H_2O in Waste Acid.
3·61	73·44	5·03	102·33

But as 100 parts waste acid contains 75·52 parts C O V the necessary addition is 102·33 − 75·52 = 26·81 parts.

Similarly for the nitric acid we have

H_2O in Mixed Acid.	Nitric Acid 91·5 % in Mixed Acid.	H_2O in Waste Acid.	Nitric Acid required.
3·61	22·95	5·03	31·98

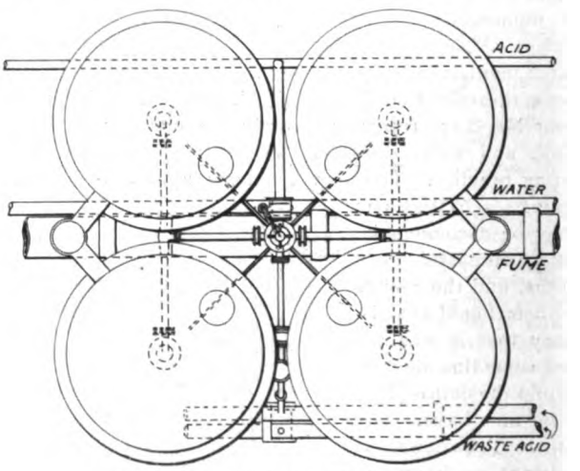
and again as the waste acid contains 19·45 commercial nitric acid the addition required is 31·98 − 19·45 = 12·53 parts.

COMPOSITION OF REVIVIFIED MIXED ACID.

Waste Acid	100·00 parts	=	71·76 %
C O V 96 % Monohydrate	26·81 ,,	=	19·24 %
Nitric acid (91·5 %) ...	12·53 ,,	=	9·00 %
	139·34 ,,		100·00 %

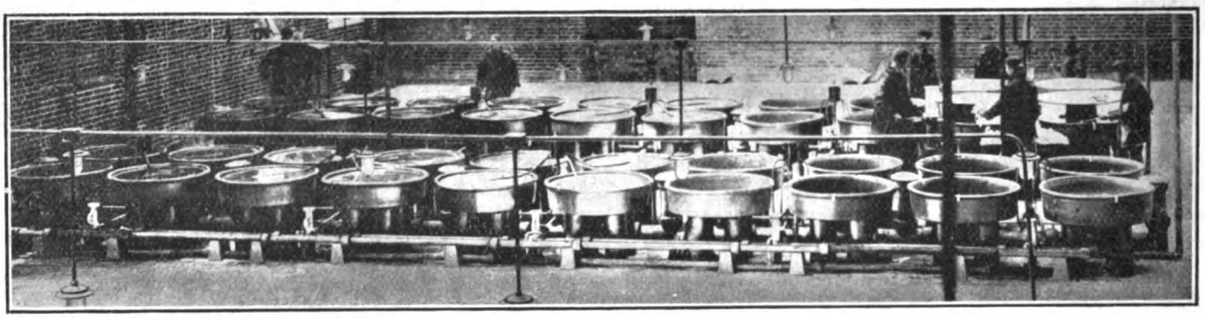
Therefore using 96 per cent monohydrate sulphuric acid and 91·5 per cent. H N O_3 nitric acid, from 100 parts of mixed acid used, about 70 parts of the waste acid can be revivified apparently *ad infinitum*. If there is any waste acid over, this is run into the nitric acid retorts along with the weaker waste acid, and the nitric distilled over at 1·5 specific gravity, which is ready for use in revivifying. The residual sulphuric acid is passed down denitrating towers if any nitric remains, and then concentrated in a Kessler plant. If the sulphuric acid is under 96 per cent., or the nitric under 91·5 per cent., less waste and more fresh acids are used, as determined by calculation on analysis of the acids.

Although the Thomson method is said to give a higher yield and more uniform nitration than the Abel, nevertheless its great recommendation is economy in labour, plant and working. The whole operation takes about seven hours, the actual filling and emptying taking two men about twenty



EACH UNIT COMPRISES FOUR PANS.

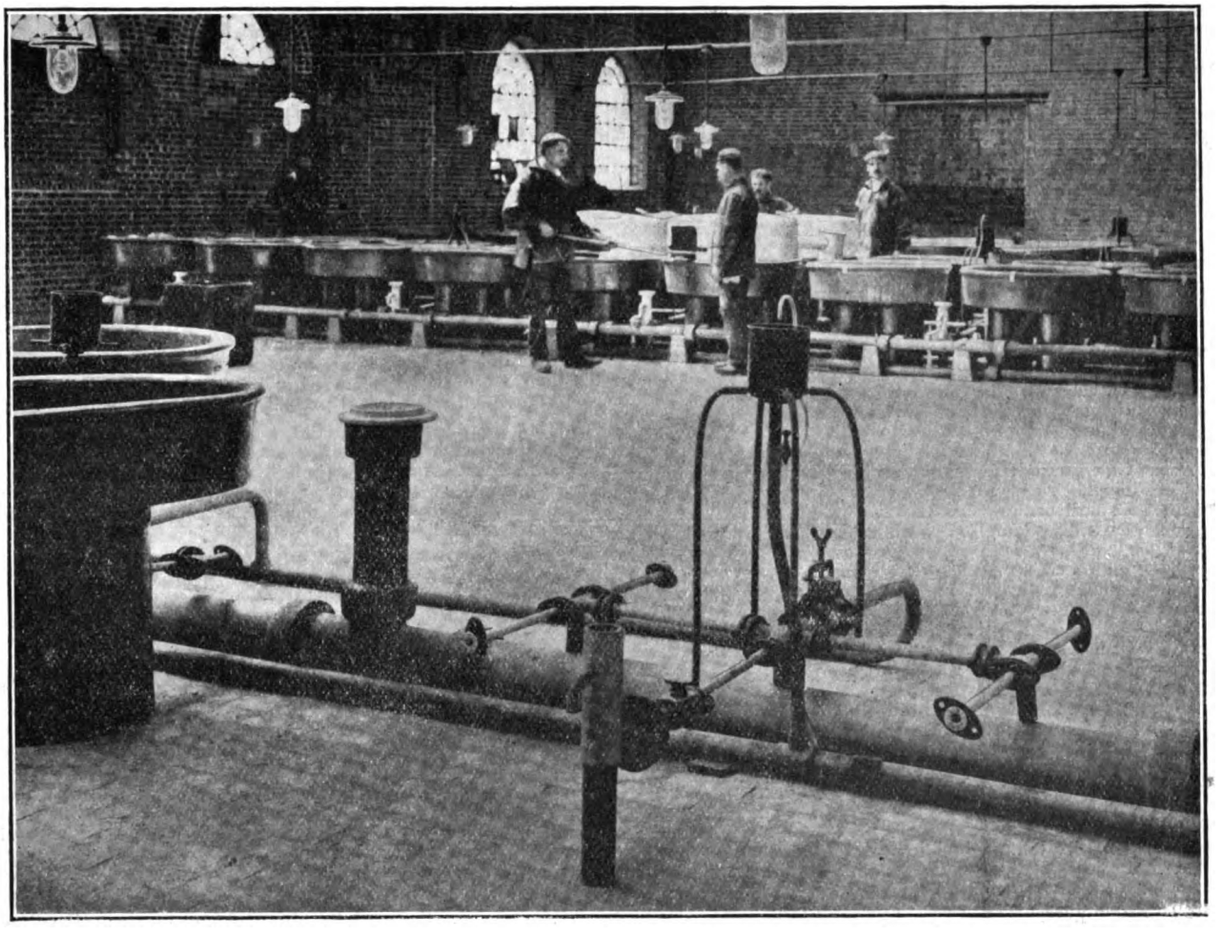
minutes per set of four pans. It would, therefore, be simple to run two nitrations per day of sixteen hours per set, and on eight sets produce one ton of guncotton per day. Excluding the attention to valves and cocks, such a plant would entail the labour of two men about six hours per day, and therefore leave them free to fetch the cotton and take away the nitrocellulose. Manufacturers will see at once a great saving in labour on the nitration pure and simple, amounting to over 50 per cent., as compared with Abel's process. In addition to this economy on labour there is also that due to steam required to drive the usual centrifugals and extracting pans not a small item in some factories. The plant, we are informed, is comparatively inexpensive and seldom requires renewal.



VIEW SHOWING THE ARRANGEMENT OF THE UNITS IN ROWS.

The first advantage claimed for the new process is that the disagreeable fuming which usually accompanies the process of nitration is practically abolished. In a house where the entire outfit of apparatus is in full operation the unaccustomed visitor, instead of catching his breath and quickly

seeking relief outdoors from the choking sensation caused by the acid fumes, can remain watching the operation as long as his curiosity may dictate. The abolition of centrifugals is an important factor in the reduced emission of fumes which accompanies the processes of loading and unloading such apparatus. More than this, the frequent discomfort, breaking of pots, loss of time, and danger to workmen caused by the decomposition of charges of guncotton in course of manufacture are entirely obviated by the new system of treatment.



IN THE FOREGROUND THE PLUMBING INSTALLATION IS SHOWN.

It seems reasonable to suppose, and practical experience very strongly confirms the view, that under the new system renewals and repairs will involve a very low yearly expenditure. The existing style of plant is subject to very rapid deterioration, whereas with the new system of treatment there is no power-driven machinery to go wrong, and such lead fittings as are in use, being always full, will enjoy a greatly prolonged period of existence.

The loss of nitrocellulose due to decomposition in the pots and centrifugals is entirely abolished. The great economy of acid is another important feature of the new method of treatment. Not only is a saving effected by the recovery of an unusual proportion of the surplus acid, but the diminution of the amount of acid thrown out in the washing process reduces the amount of pollution caused in the neighbouring waters used as a sink. The loss of acid resulting under the new conditions is estimated at about 0·14 of a pound of strong acid per pound of nitrocellulose produced, as compared with 1·5 lb. to one pound of strong acid per pound of nitrocellulose when wrung in acid centrifugals. This implies a more thorough pre-washing of the nitrocellulose, a result obtained with a very much reduced consumption of water. The fact that the whole of the operations of nitration and washing involve no handling of the explosive and no power-driven machinery, the amount of labour employed is reduced to the charging of the pans with cotton, the operation of the various taps controlling the water and acid, and the subsequent removal of the washed nitrated cotton at the end of the process. On a plant capable of dealing with twelve tons per week the staff is reduced by more than half, which obviously represents an important reduction of workers in a class of work where for health reasons labour is already reduced as far as possible. Those workmen whose services are still necessary for operating the plant enjoy materially improved conditions by reason of the absence of fumes. A more complete justification of a new process it would be difficult to imagine; and yet from personal enquiry we can safely affirm that every claim above made has been fully substantiated, and no compensating disadvantages have so far been discovered.

TRADE MARKS.

ADVERTISED MAY 2—23, 1906.

280,675. The word "ALUMEXITE." H. J., J. C., A. P., and P. Pain, London. March 12, 1906.
281,386. The word "CROCODILE" written above a picture of this reptile. To apply to explosive substances. Curtis's & Harvey, Ld., London. March 31, 1906.
281,536. } The letters B.S.A. To apply to arms and ammunition
281,537. } and explosive substances. The Birmingham Small Arms Co, Ld., Birmingham. April 2, 1906.
282,183. A device representing a crocodile. To apply to arms in the nature of weapons. R. Martindale & Co., Ld., Birmingham. April 20, 1906.
281,186 The word "FELIXITE." To apply to explosives. The New Explosives Co., Ld., London.

REGISTERED APRIL 19,—MAY 17, 1906.

279,642. R. R Banks & Co., Ld.
276,446. Sprengstoff, Ag., Carbonit.

APPLICATIONS FOR PATENTS.

APRIL 23—MAY 19, 1906.

9,437. Bolt Action Rifles. The Birmingham Small-Arms Co., Ld., A. H M. Driver, and G. Norman.
9,467. Targets. D. W. Holt
9,514. Range Finder. A. V. Alexander.
9,645. Charge Holder for Magazine Rifles. W. B. Wallace.
9,696. Targets. W. Winans.
9,722. Gun Locks. T. M. Thorsen.
9,748.* Single-Trigger Mechanism. H. Greener.
9,791. Explosives. V. Vender.
9,876.* Cartridge Cap. M. Walbinger. (Date of application in Germany, April 28, 1905).
9,957. Time Fuse for Shell. J. V. Ramsden.
10,039. Range Finder. A. Bar and W. Stroud.
10,120.* Cartridges. F. E. Clotz. (Date of application in U.S.A., April 29, 1905).
10,144. Ordnance. F. Wigley and A. F. Petch.
10,146.* Cartridges. H. F. Clark.
10,209.* Small-Arm Stand. J. Livtsohak.
10 211.* Ordnance. The Rheinische Metalwaaren und Mf. (Date of application in Germany, September 14, 1905).
10,296. Rifle Practice Apparatus. W. Winans.
10,410.* Torpedoes. T. J. Moriarty. (Date of application in U.S.A., May 5, 1905).
10,424.* Explosive Manufacture. F. Volpert.
10,477.* Projectile Fuse Setter. Fried. Krupp, Ag. (Date of application in Germany, August 10, 1905).
10,478.* Projectile Carriers. Fried. Krupp, Ag. (Date of application in Germany, July 25, 1905).
10,562.* Ammunition Vehicles Fried. Krupp, Ag. (Date of application in Germany, August 10, 1905).
10,604.* Sighting. W. J. C. Downey.
10,611.* Ordnance. K. Haussner.
10,651 Range Finders. M. G. Farquhar.
10,679.* Rifle Butt-Plates. F. T. Murray.
10,828. Ordnance Brakes. M. & J. E. Shumacher.
10,892. Telescopic Sights. W. L. Pakenham, T. H. R. Wray and Crompton & Co., Ld.
10,896.* Ordnance. H. Hellberg.
10,927.* Guncotton. T Reishoff.
10,992.* Bullet Catcher. W. R. Orde.
10,998.* Gun Barrel. C. R. Bellamy and P. J. Dennig.
11,006. Machine Gun. H. C. Heide. (Agent for *J. A. Malcolm*).
11,007.* Ordnance. A. Christophe and P. Menteyne. (Date of application in France, January 2, 1906).
11,024. Triggerless Small-Arms. W. Jerman.
11,034. Ordnance. W. Beardmore & Co., Ld., and A. Bremberg.
11,087.* Telescopic Sights J. E Evans-Jackson. (Agent for *The Warner & Swasey Co.*).
11,092.* Bolt Rifles. A. Francotte & Co. (Date of application in Belgium, August 10, 1905).
11,093.* Rifle Mechanism. C. Francotte. (Date of application in Belgium, October 21, 1905).
11,111. Ordnance. C. Holmstrom, E. Middleton and A. E. Mascall.
11,177. Projectile Fuse. A. W. Fellowes-Gordon.
11,195. Ordnance Sighting. C. Holstrom, E. Middleton and A. E. Mascall.
11,201. Discs for Trap Shooting. W. P. Jones and J. F. Wheat.
11,246. Range Finders. V. Saporetti.
11,266.* Ordnance. C. D. Abel. (Agent for the *Rheinische Metallwaaren und Mf.*).
11,340.* Shell. The Marquis Roberto Imperiali.
11,446. Combination Bicycle and Gun. H. Stracke.
11,557. Air Guns. G. Hookham
11,588. Air Guns. L Jeffries
11,653. Cartridge Loading Machine. H. W. Holland and T. Woodward.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

APRIL 26—MAY 24, 1906.

COMPILED BY HENRY TARRANT.

4,797 (1905). **Diagonal Scale for Sights.** A. Davidson, Cummersdale, nr. Carlisle. Diagonals are marked upon the leaf, of the backsight of a rifle, and these correspond with divisions representing hundreds of yards. The diagonal scale is variable and is so arranged that each degree measured on each diagonal represents one foot of wind at the particular range which the diagonal indicates. Accepted April 5, 1906.

8,115 (1905). **Projectile Fuses.** J. H. Rigby, Liverpool. The construction of time and percussion fuses is so modified as to obviate the injurious action of moisture upon the time composition. The range which may be attained is also increased by decreasing the number of rings able to be fused. Accepted April 17, 1906.

8,286A (1905). **Practice Rifles for Ordnance.** A. T. Dawson and G. T. Buckham, London. The firing mechanism for aiming or practice rifle for ordnance set out in Patent No. 8,286, 1905 is modified. The alterations are dealt with in the present specification. Accepted April 12, 1906.

8,731 (1905). **Automatic Small-Arms.** R. Frommer, Hungary. In connection with automatic small-arm mechanism a latch is provided. This latch is intended to render the breech return springs inoperative and to lock the movable barrel so that the arm may be used purely as a repeating hand operated rifle. Accepted April 25, 1906.

10,674 (1905). **Safety Device for Small-Arms.** E. Delisse, France. This safety device consists of a movable heel plate which is pressed inwards when the arm is resting against the shoulder. The movement of the plate is communicated to a trigger lock by means of a rod running through the stock. Accepted April 5, 1906.

11,605 (1905). **Correcting Ordnance Line of Fire.** Capt. A. F. Ball, Gosforth, Newcastle-on-Tyne. The field plotter used in connection with invisible targets is constructed so that it solves the triangle from which range is discovered, and gives the correct line of fire; and by using two observation towers on right and left of the gun it enables the battery captain to plot mechanically the position of each round and to read the error in range and direction. Accepted April 5, 1906.

11,741 (1905). **Magazine for Rifles.** J. H. Matthews, Melbourne. A magazine for rifles is so constructed that the cartridges may be simply dropped into it. The cartridge platform is depressed by hand and it is released only when the cut-off is manipulated. Accepted April 5, 1906.

12,635 (1905). **Prevention of Erosion.** G. C. J. Topp, Ryde, Isle of Wight. In order to prevent the gases of combustion injuring the rifling, the barrel is electro plated by a metal which is not attacked by the gases. The metal may be renewed when it is worn off without removing the gun. The patentee is aware of patent 8,614 of 1893. Accepted April 12, 1906.

12,902 (1905). **Short Base Range Finder.** H. D. Taylor, York. This patent deals with the adaptation of single or double rotating or swinging prisms to a short base range finder the

observing telescope of which is single or undivided. Accepted April 19, 1906.

14,958* (1905). **Manufacture of Nitroglycerine**. Deutsche Sprengstoff, Ag., Germany.

15,564* (1905). **A New Smokeless Powder.** A. T. Cocking and Kynoch, Ld., Birmingham.

16,387 (1905). **Automatic Sighting and Firing of Ordnance**. H. H. Lake, London. (Agent for *S. K. von Ecseghy and Handelsgesellschaft Kleinberg and Co., Austria*. The device described in this patent is an improved form of that through which a gun on a moving vessel is automatically sighted and fired at the moment when during its movement it is on the target. Accepted April 5, 1906.

16,474 (1905). **An Explosive Projectile**. P. R. J. Willis, Kingston-on-Thames. (Agent for *J. Shearman, U.S.A.*) The explosive charge of the projectile described in this patent extends backwards through the breech of the gun. It is exploded by a long rod when the projectile strikes the object. A pair of wings are arranged at the rear to guide the shell in the air. Accepted April 5, 1906.

16,483 (1905). **Surprise Targets**. W. D. Kimber, Natal. (Agent for *A. M. Ritchie and F. Margrie, Natal.*) The disappearing targets are by this invention actuated by a spring motor. The motor is enclosed in a bullet proof casing and is operated from the firing points by electrical means. Accepted May 3, 1906.

16,924 (1905) **Sighting Apparatus for Ordnance**. Professor G. Forbes, F.R.S., London. An indicator is so designed that it may be set for range so as to be truly accurate in the case of ordnance which has a horizontal deflection due to the motion of the ship. This invention also allows for correction of "drift" without inclining the elevation pivot to the horizon. Accepted May 3, 1906.

17,316 (1905) **Automatic Small-Arms**. H. Stamm, Switzerland. Automatic mechanism for small-arms was described in patent No 7497, 1902 In the present specification modifications principally of the breech mechanism are dealt with. Accepted April 26, 1906.

17,795 (1905). **Fuses for Lyddite Shells.** The King's Norton Metal Co., Ld., T. R. Bayliss and H. W. Brownsdon, London, and H. M. Smith, Abbey Wood. In order to prevent accidental explosion of lyddite shells through premature ignition of the fuse, the chamber between the detonator and the communicating fire holes in the pellet is filled with mercury. The shock of firing allows of the escape of the mercury. Accepted May 3, 1906.

18,185 (1905). **Fuse for Lyddite Shells**. The King's Norton Metal Co., Ld., T. R. Bayliss and H. W. Brownsdon, London, and H. M. Smith, Abbey Wood. By means of the mechanism described in this patent the detonator of a lyddite shell fuse is isolated from the powder magazine until after the shock of discharge. The shock of starting shears a pin and allows the pellet to advance and strike the detonator. Accepted May 3, 1906

20,305 (1905). **Revolving Gun Mountings** Sir W. G. Armstrong, Whitworth and Co., Ld. and R. Wright, Newcastle-on-Tyne. The revolving valve of the rotary hydraulic multiple-cylinder engine used to turn a heavy gun mounting is so constructed that the engine may be capable of a speed four hundred times that of the mounting. The valve is run at a slower speed than the engine to avoid wear and tear. Accepted May 3, 1906.

21,599 (1905). **Automatic Pistol Mechanism**. W. D. Condit and E. H. Searle, U S.A. The pistol mechanism described in this patent is adapted to be operated by the recoil. Certain novel features are described and the assembling of the parts in particular is dealt with. Accepted April 5, 1906.

23,371 (1905). **Fuses for Projectiles**. Fried. Krupp, Ag., Germany. The premature ignition of shell which is due to the sagging of the lower part of the fuse on discharge is obviated by providing a special loose annular ring constructed of very strong material. This ring cannot follow the buckling of the body of the fuse. Accepted March 15, 1906.

23,513 (1905). **Recoil Brake Apparatus**. F. B. Yingling, Germany. The opening of the valves in recoil brakes of the types set out in patents Nos 27,093, 1903, and 21,929, 1905, is so regulated that the pressure in the brake cylinder is decreased in a uniform manner. The throttling takes place during the latter part of the recoil. Accepted April 12, 1906.

25,976 (1905). **Material for Cleaning Gun Barrels**. J. Y. Johnson, London (Agent for *Saponia-Werke Ferdinand Boehm, Germany*). The material for cleaning and protecting gun barrels from rust is as follows:—From 10 to 20 per cent. of a saturated solution of sodium hydroxile in alcohol is stirred with from 90 to 88 per cent. of a mixture of equal parts of liquid and solid paraffin until a homogeneous unguent is produced. Accepted April 26, 1906.

26,266 (1905). **Gun Mounting**. C. P. E. Schneider, France. Ordnance is mounted upon an axle which is cranked so that the angle of inclination of the gun may speedily be altered. The cranked axle may be locked either in its highest or lowest positions. Accepted April 12, 1906.

177 (1906). **Drum Magazines for Rifles**. P. A. Philippides, Greece. The drum magazine mechanism described in this patent is so arranged that it may be removed from or introduced into its casing through the top of the breech. Accepted April 5, 1906.

178 (1906). **Rifle Breech Bolt Mechanism.** P. A. Philippides, Greece. The breech bolt mechanism dealt with in this patent is designed to allow of easy and certain assembling of the parts. Accepted April 19, 1906.

3,087 (1906) **Recoil Brake Mechanism**. Fried. Krupp, Ag., Germany. The valve opening and shutting hydraulically to brake the recoil of ordnance is arranged to suit different lengths of recoil The valve openings are modified initially and the valve and valve face are arranged not only to revolve relatively one to the other, but to slide longitudinally. Accepted April 5, 1906.

3,329 (1906). **Armour Piercing Projectiles**. E. M. Johnson, U.S.A. The point of an armour piercing projectile is of maximum strength and the body gets gradually softer towards the base. This construction is produced by blending the hard and soft metals when the mould is being filled. More soft metal is added as the mould is filled. Accepted May 3, 1906.

3,981* (1906). **Single-Trigger Mechanism**. G. B. Osterhout, U.S.A.

4,686 (1906). **Safety Device for Small-Arms**. J. Tambour, France. This locking device consists of a bolt carrying a spring operated pivoted part which projects over the sears. One of the sears may be locked whilst the other is disengaged in a double-barrelled gun. Accepted April 5, 1906.

5,616 (1906). **Mechanical Time Fuses for Projectiles**. Fried. Krupp, Ag, Germany. The clockwork time fuse of the type described in patent No. 28,708, 1902, is modified so that the transport safety device shall act more reliably and simply. Accepted April 5, 1906.

5,617 (1906). **Mechanical Fuse for Projectiles**. Fried. Krupp, Ag, Germany. The mechanical time fuse arrangement dealt with in patent No. 28,708, 1902, is provided with a device for putting the timing apparatus out of operation. This arrangement is found to be desirable when the time device is combined with a percussion fuse. Accepted April 19, 1906.

5,960 (1906). **Sighting Gear of Barrel Recoiling Ordnance.** Fried. Krupp, Ag., Germany. In patents Nos. 4,735, 1905, and 17,858, 1905, was set out ordnance equipped with an independent sighting line. This sighting gear is modified so that the sight may be roughly and finely adjusted independently of the elevating gear. Accepted April 19, 1906.

6,070 (1906). **Automatic Pistol Mechanism**. W. Trabul, D. Moxley and C. C. McClarty, U.S.A. Automatic pistol mechanism which may also be manipulated by means of the trigger is set out in this patent. The breech bolt has only a small movement so that when hand operated the trigger has not too much work. Accepted May 3, 1906.

8,408 (1906). **Graze Fuses for Projectiles**. A. F. Petch, London. The rotatable body of a graze fuse is so arranged that it must revolve to some extent relative to the casing before communication can be established between the detonator and igniting charge. The fuse is locked against this movement until the projectile is fired. This arrangement prevents premature bursting. Accepted May 3, 1906.

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

SELECTED PATENTS.

MANUFACTURE OF NITROGLYCERINE.

14,958 (1905). The Deutsche Sprengstoff, Ag., Germany. Various compounds have been proposed for preventing or reducing the congealing tendency of nitroglycerine and its explosives, but the patentees state that such preventatives have been inefficient or have deteriorated from the explosive force of the compound. They propose to use monochlordinitro-glycerine which they have discovered to be a compound suitable for reducing the congealing tendency of nitroglycerine without diminishing its power. By adding 5 per cent. to 20 per cent. of this compound to nitroglycerine or vice-versa it is said not only to prevent congealing (except at very low temperatures), but in the manufacture of gelatinised explosives it increases the gelatinizing power of the nitroglycerine. Accepted April 5, 1906.

SMOKELESS POWDER COMPOUND.

15,564 (1905). A. T. Cocking and Kynoch Ld., Birmingham. A smokeless powder for use as a propellant is set out in this specification, and the principle claim in connection therewith relates to a property of the powder which produces a solid residue on combustion adapted to act as a lubricant to neutralize acid products. Corrosion is by this method prevented and the moderate temperature of combustion is claimed to prevent erosion. Further advantages claimed are :—The reduction of the volume and of the luminous character of the flame produced by combustion; the plasticity of the explosive which allows of cutting without splintering when dry; and the diminishing of the effects of temperature on the ballistics of the explosive. These advantages accrue from the addition to the explosive compound of olive oil or some such oil of high molecular weight, and great heat of formation, and soluble in the incorporating solvent, together with a neutral salt of an alkaline metal and a neutral salt of an alkaline earth.

An example of the composition of the explosive is as follows :—Nitroglycerine 30 to 40 parts, nitrocellulose 60 to 50 parts, vaseline 2·5 parts, olive oil 2·5 parts, potassium tartrate 0·9 parts, and barium nitrate 4·0 parts. These constituents are incorporated in any suitable manner and the consequent compound is cut up into strips shaped like a double-headed rail in section as was set out in patent No. 12,892, 1905. The olive oil reduces the temperature and also gives greater chemical stability to the explosive. In combination with vaseline the desired rate of combustion is obtained The salts of alkaline metal and alkaline earths are added to produce a solid residue in the gun barrel. This residue takes the form of an alkaline carbonate and it lubricates the barrel and neutralizes any acid products of combustion which might cause erosion. Not less than 30 per cent. of nitroglycerine should be used in the compound so that it possesses the necessary plasticity to prevent splintering when it is cut. When using such a large amount of nitroglycerine it is necessary to use a salt which will lower combustion temperature, and the tartrates mentioned above are therefore used in preference to the nitrates. The combination of the salts which lower the temperature with olive oil minimises the liability of the explosive to give higher ballistics when subjected to external heat before, or at the time of, combustion. Accepted April 12, 1906.

THE "OSTERHOUT" SINGLE-TRIGGER MECHANISM.

3,981 (1906). G. B. Osterhout, U.S.A. The single-trigger mechanism described in this specification is of the selective type. The position of the safety regulates the order in which the barrels are fired. The involuntary pull is intercepted by the raising of the sear tail after the first barrel has been fired. The slight depression of the tail pushes the sear lifting devices backwards so that neither sear can be lifted by the involuntary pull.

The mechanism is illustrated by the drawings reproduced upon this page. To the post *a* which is rigidly attached to the trigger plate, is pivoted at *b* an angle plate *c*. Through the movement of this plate *c* the right-hand sear is lifted. To the bottom of the plate *c* is pivoted another "tripping member" *d* (Fig. 5) through which the left-hand hammer is released. The tails of the sears *e* and *f* enter slots as is illustrated in their respective "trippers." Upon the inside of the right-hand plate *c* is pivoted a spring operated limb *g* (Fig. 3). The inner face of the left-hand plate *d* is provided with the projection *h* (Figs. 2 & 4). The shoulder *i* upon the trigger, which is mounted much in the usual way, is adapted to engage with the part *g* when in certain positions, whilst the top of the blade engages with the projection *h* in other positions when the left-hand barrel is to be fired.

Fig. 1

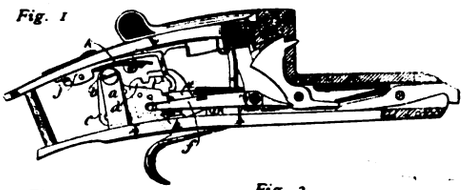


Fig. 2

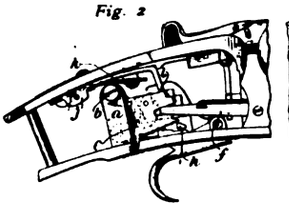


Fig. 3

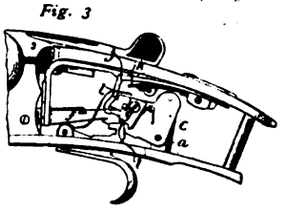


Fig. 4

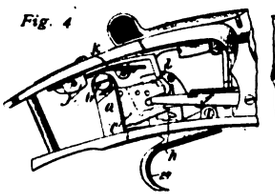
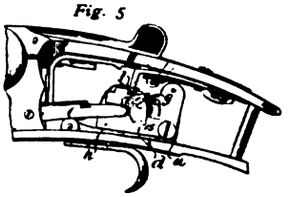


Fig. 5



The position of the "trippers" is regulated by the position of the leg depending from the safety device *j*. This leg may be, by means of the spring *k*, locked in one of the three positions. In the first, *i.e.*, its most forward (Figs. 1, 3 & 4), it locks the left-hand tripping member *d* through the shoulder *l*. In its second, or middle position (Fig. 2), both tripping members are locked, and in its third, the part *g* is pushed backwards against the action of its spring and the right-hand plate is rendered inoperative until one barrel has been discharged.

When in the position illustrated on Fig. 3 a pull of the trigger would raise the right-hand tripper *c* through the engagement of the trigger point *i* and the part *g*. The right-hand barrel would be discharged. With the release of the sear nose from bent, the sear tail is depressed and the right-hand plate *c* is swung backwards on its pivot (Fig. 1). This movement carries the left-hand tripper backwards also, thus removing the projection *h* from engagement with the top of the blade. The trigger is also depressed during this backward movement by the part *g* which slides over the part *i* of the trigger until they are out of contact one with the other. The left-hand sear *e* is raised through the "tripper" *d* by the second deliberate pull. When it is desired to fire the left-hand barrel first the safety *j* is shifted to its most rearward position as is illustrated in Fig. 8. The part *g* is forced back and the left-hand tripper will be raised by the first pull. The middle position of the safety (Fig. 5) locks both trippers through the shoulders *l*. Accepted April 26, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Powder Frauds in Belgium.—The disgraceful state of affairs revealed in the proceedings reported in another column, E. C. Powder Co., Ld., *v.* Cooppal et Cie., is only tempered by the knowledge that the Belgium Court has shown its disapprobation in a manner revealing the principles of justice in their highest form. We in England are proud of our judicial system and the fearless traditions which guide our judges in their decisions. Yet there could be no boast of fairness which is not fully reproduced in the unqualified disapproval with which the Belgium Court has condemned and punished the contemptible action of the Cooppal Company. For a firm which we have always credited with occupying a position analagous to that of the English Companies whose business integrity we cherish as a national asset, to do the things of which Messrs. Cooppal are adjudged guilty is evidence that business morality has in places sunk to a very low ebb. If the energy which has been expended in imitation and fraudulent substitution had been directed to the production of a first-class rival product, there can be little doubt that good commercial results would have been achieved. To make an imitation of the E. C. powder, to corrupt the retailer by holding forth the bait of enhanced profits on sales and to reproduce labels and other marks of origin, is to be guilty of a series of offences which must make honest men shudder. Whilst desirous of not being led away into pharisaical praise of our own methods we may at least rejoice in the knowledge that the British principle is to originate and to offer under a true description whatever we have to sell. The Belgian is far too much the parasite of commerce, and we can honestly say that great as is the rivalry which his skill in manufacture creates, that rivalry would be far more effective if it were systematically conducted above board, on honest lines and with a desire to sail under the right flag.

Breaking up Cartridges.—The constant reiteration by H.M. Inspectors of Explosives of the illegality of breaking up cartridges on registered premises is hardly consistent with their usual practical attitude. Probably the greatest reason for the successful working of the Explosives Act is due to the circumstance that but few things are forbidden which, law or no law, must be of daily occurrence. To take out one's pocket knife, to slit the side of a cartridge case and so extract the powder is a manufacturing operation and should only be carried out in a factory. Explosives not authorized in this country must not be imported in bulk except under a special permit. They are freely admitted in the form of safety cartridges. One may shoot these cartridges, but to express knowledge of the colour of the powder, its physical condition or to say how it behaves in Eley cases is to confess having manufactured an unauthorized explosive. This apparently absurd interpretation of the Act would not be put forward if chapter and verse could not be quoted in its support. The report of the recent Dublin explosion contains a passage which suggests that the breaking up of cartridges was carried out in a workshop because it was known to be forbidden in the much safer cartridge filling room. If H.M. Inspectors would carefully consider the whole question of the best means for legally disposing of unused stocks of obsolete or bad cartridges, and frame an Order in Council thereon, the present state of uncertainty would be removed. The initiative should come from them; for they must well know that people with a factory licence have enough trouble in breaking up their own

rubbish and would certainly not undertake to do similar work for outsiders. Suitable provisions should also be drafted to determine the conditions under which the purely laboratory operation of removing the contents of a cartridge to examine the charge should be conducted. The better the system of loading adopted the more frequently is this kind of check applied, and its wholesale condemnation does not increase the respect with which the Explosives Act is regarded.

Telescope Sights.—The decision to introduce a competition for telescopically-sighted rifles at the coming Bisley Meeting raises once again the question whether the shooter needs this extra assistance in his marksmanship. Practically speaking every exponent of the sporting rifle, from the shooter of horned game to the miniature marksman who takes rabbits, rooks and small birds as quarry, would have a telescope if the extra assistance it affords did not involve so heavy an outlay. Those who have used rifles so fitted combine in praise of the great value of being able to get a better view of their game when examined through the low-power glasses which experience has shown to be best for the purpose. The further encouragement afforded by magnifying lenses to obtain steadier holding and more perfect alignment is regarded on all sides as a measure of humanity which increases the success of shooting without adding to its destructiveness. Extra facility in alignment does not materially increase the range at which shots may be taken. It merely raises the percentage of success for shots taken within recognised sporting distances. To give satisfaction to the shooter a sighting telescope must contain the best lenses. Shooting conditions demand the most perfect mounting, both as regards optical construction and the gunmaker's work of fitting and adjustment. Rifle telescopes must thus remain a luxury for the wealthy, but the number used might nevertheless be materially enhanced if the mechanical fittings necessary for fixing them on an existing rifle could be systemised in much the same way that Lyman sights can be applied to any existing rifle, and be changed from one to another without much trouble. Telescopes cannot be fitted without a certain amount of expert manipulation, but as things now stand few of the best glasses can be satisfactorily and economically adapted to an existing rifle.

High Velocity in Military Bullets.—The Spitzer controversy has fallen from the position of an item for newspaper discussion, and has taken its proper place as a subject for experiment and enquiry by practical men. The cartridge factory finds no difficulty in supplying ammunition with any required weight of bullet, and a powder charge capable of imparting the velocity appropriate to any reduced weight. The mathematician spends his time in working out curves of trajectory and remaining energy, whilst here and there a few experiments have been made to determine the accuracy of the new combination at long ranges. No calculations and no accuracy tests will fully answer the ultimate query as to the exact amount of weight which can be profitably exchanged for a given increase of velocity. The war test is the only one which really counts, since there is no mathematical symbol to express the practical killing value of a rifle and cartridge. If flat trajectory is such an important matter it is entirely a practical question whether the flatness which comes with moderate increases of velocity, coupled with the old form of bullet, is or is not preferable to an exaggerated degree of flatness obtained by sacrificing weight in the projectile. In all shooting experience, under practical conditions where targets have no place, efficiency seems to be directly proportional to the amount by which error due to misestimations of range can be minimised. The old express bullet collapsed under the competition of the small-bore military rifle, notwithstanding the fact that a well-delivered blow from the large diameter lead bullet was far more effective than the less favourable combination represented by ·303 and other bullets. The modern express rifle subsequently ousted the military bullet for many classes of big game shooting, because it possessed the double advantage of flat trajectory and efficiency on impact. There are many qualifying conditions which make the sporting analogy inappropriate as a final test of military conditions. Particularly is this the case in respect to the problem of maintaining a low recoil and keeping down the weight of the cartridge. Neither of these points seriously affects sportsmen. The truth doubtless lies concealed behind the vague generality that flatness of trajectory must be enhanced with the smallest possible interference with the present weight and dimensions of bullet.

Secret Service Funds.—The strong protests against the principle which the B.S.A. Directors sought to apply to their business by building up a reserve fund independent of the assets shown in the balance sheet reads curiously beside the statement made at the general meeting that many firms exercise the same privilege. The question has been discussed from many points of view, but mostly from the standpoint of commercial morality, the idea being that secrecy necessarily covers, or may at some future time cover, something of an objectionable nature. However, the scheme, although accepted by a large majority of the shareholders, has been upset by an adverse decision in proceedings instituted by an aggrieved shareholder. From the point of view of public policy directors should in all cases be amply protected from the very natural desire of shareholders to divide profits up to the hilt, so leaving no provision for lean years, or for occasions when prompt and liberal expenditure is necessary to protect or develop a company's position. The whole question really turns on the personal integrity of the directors who ask for a special mark of confidence of this nature. If their past record shows evidence of skilful finance and sound working, and there appears to be reasonable justification for believing that sound traditions will not be abandoned, then it seems right to sanction the policy of withholding from public gaze the reserve strength of a commercial enterprise. So wide is the latitude which the directors already enjoy with regard to depreciation and valuation of assets, that any desired profit can be shown, and almost any sum which it is deemed necessary to conceal can be hidden in any of the well-known items to which no check can be applied. Undoubtedly there are dangers as well as advantages in the keeping of a private reserve. Rumour might estimate their value in various ways, and market quotations could not but be influenced by the reports current. But all things considered there seem to be sound reasons in favour of an exceptional reserve fund of this character, always provided that suitable arrangements are made for exercising the kind of control which would operate against the mal-administration of funds so created.

OUR BELGIAN RIVALS.

SIR CECIL HERSTLET'S consular report on the above subject represents a piece of work which may justly be compared with the brilliant review on the same subject which was written some ten years ago by the editor of the *American Machinist* in the course of a European tour of inspection. Several noteworthy distinctions may be drawn between the two reports. The American editor for instance approached the subject from the point of view of a highly trained mechanical engineer reared in the traditions of modern machine shop practice, and proportionately impatient of all forms of hand labour and the slavery consequently undergone by the women, children and even canine assistants of the male worker. Sir Cecil Herstlet has no engineering knowledge or prejudices to direct his comments on technical matters, or warp his judgment when viewing hand labour in a highly organised form. Sir Cecil is evidently familiar with the squalid little villages in the midland counties of England where every cottage contains its forge, and where all the inhabitants devote their time to the fashioning of hand-wrought nails. Against the British Consul's lack of engineering knowledge may certainly be placed his evident grasp of commercial affairs. In one sense his report may be read as an ordinary piece of journalism, in which description excludes comment, because his horizon is limited by absence of special knowledge and experience. The care and system with which he has laid out his report, and the facilities which his official position has doubtless given him, at any rate confer on what he has written the distinction of representing a very high-class standard of journalism, if we must still persist in regarding his work as a piece of descriptive writing. A second point of difference which distinguishes the later from the earlier report is the evidence provided in several directions of noteworthy developments by way of modernisation of method and general systematising of manufacture in accordance with modern ideas.

The first thing which strikes the reader who approaches the Foreign Office pamphlet is the thorough state of organisation which characterises the Liége firearms industry in all its branches. We have first of all the technical school for educating the gunworker, and following that a trade which is so developed in every branch that each section seems to be contributing the greatest possible turnover to the aggregate value of the trade done. It is in this respect that the position of the Birmingham gun trade till a few years ago suffered adversely by comparison. Since the organising element in the trade, as typified by the Birmingham Gunmakers' Association and the Proof House Guardians, began to take a statesmanlike view of general conditions a considerable levelling up has occurred. Several branches of the industry had been allowed to dwindle into unimportance, notwithstanding that lack of demand was not the promoting cause of the decline. In most instances the trouble arose from trusting too long in established connections and ancient methods of manufacture. Bit by bit trade grew less: the old men retired, and the younger men branched out in other directions. Trade as a whole must suffer from weakness in any individual section, and the modern watchword of enterprise, which has been so effectively preached in Birmingham during recent years, has certainly fallen on attentive ears to judge by the revivification process which has influenced some of the neglected branches of the trade. The Belgian report suggests that the enormous turnover and prosperity of the industry as a whole arise in part from the energy with which many apparently insignificant sources of trade are pushed. In England we have our specialities, and we work them for all they are worth; but their number is limited and we lack the power of averaging results which arises when the number of contributory channels is considerable.

When Mr. W. L. Powell proposed the prosperity of the Birmingham gun trade on a recent festive occasion he drew an interesting parallel between the gathering at which he presided and a similar celebration which occurred as nearly as possible 50 years ago. A report of the earlier meeting showed that the toast list numbered 22 items; and Mr. Powell was not slow in making full use of the humourous aspects of such a situation. Custom has no doubt transposed the relation which formerly existed between the number of courses served at dinner and the number of toasts celebrated afterwards, but the interesting trade aspect of the comparison was the extraordinary number of organised branches of the trade, each of which found a spokesman able to speak on its behalf. To-day there still remain to us many important sub-divisions of gunmaking about which the public hears but little. Conditions of trade demand the suppression of all names except that of the gunmaker pure and simple. But within the trade itself there should certainly be committees and gatherings for the purpose of discussing how the interests of each section can be forwarded by those versed in its details. Not only should the various classes of gun, rifle and pistol be separately considered, but the many components of the gun and rifle should be similarly studied with a view to examining possible sources of new demand. The relations of mutual confidence and good fellowship which have been cultivated amongst the master gunmakers should encourage the parallel process of bringing the chiefs of the smaller branches into contact with one another. Trade makes trade, and there is no single item of gunmaking which should not be carefully examined with a view to seeing whether every opportunity for doing business has been properly considered. The more one endeavours to read between the lines of Sir Cecil Herstlet's report the more evident it becomes that the magnificent aggregate results of the Belgian firearms industry are produced by a sub-divided trade, in which the chiefs of each branch are ever alert to place themselves in contact with all possible sources of supply. The cheapness of Belgian labour and the consequent low selling price of the goods manufactured need introduce no difficulty in applying to Birmingham the general rule which has been laid down. The Midland gunworkers give full value in exchange for the higher grade of pay they command, and the markets of the world are quite capable of absorbing the more expensive rate of output, so long as it continues to be recognised that the power of giving value for money is not confined to the group which represents the lowest wage-earning capacity. Satisfactory results have followed the efforts made of late years to revivify certain sections of the industry which had fallen into decay. The principle to adopt is to go for things selling in large quantities, and to trust that the customary prices can be made to cover a fair working profit.

THE GOVERNMENT AS INVENTORS.

Sir,—Your exceedingly apropos article in the April number of *Arms and Explosives* raises a very important question which certainly merits more than your able and delicately-suggestive remarks. It requires an indignant and vigorous protest. We had hoped that when the great Cordite case was ended it would have been a lesson to the Government that they would not have forgotten. Whatever the ultimate issue of that case was, there is no doubt that in the public mind Nobel was the aggrieved party and that the verdict was entirely against the weight of evidence obtained, as it generally is, being confused by a number of side issues more or less irrelevant to the main facts of the case.

For many years following all officials in Government employ were looked upon with distrust and suspicion, and the feeling which existed then is becoming more and more intensified to-day. The march of progress, and the placing of the War Office upon a "commercial" basis, is developing the lowest order of commercial genius.

It is necessary for a private individual who proposes anything novel to place his views before the military officials. The spirit in which ideas are received is not that they emanate from a thoroughly practical man who has made a life study of the thing he is suggesting, nor that his suggestion will either improve or cheapen the cost for the benefit of the public service. The view taken is rather that an outsider has made a good suggestion, and it is the duty of the military official to see whether the same thing cannot be achieved by similar methods which do not infringe the patent. Public money may be spent in trying to prove that it is no improvement on existing methods. I repeat that this is the spirit in which all inventions are received in the Ordnance Factories. It is a well-known fact that the red tape principle which governs war stores is such that they will fight against a good invention for the simple reason that they do not want to change their patterns. It may possibly mean no more than the alteration of a detail in a sealed drawing, the novelty being frequently limited to an alternative device interchangeable with existing parts. There are obvious objections to alterations which involve heavy expenditure, and a small improvement in detail would thus be required to stand over; but where existing munitions can be improved by a slight change of pattern without alteration to the general system, such arguments are inapplicable.

As regards the inventions by military officers and public servants employed under the War Office, it is highly desirable that the War Office should adopt exactly the same measures as in the case of large private firms.

The invention or improvement of a particular article, the knowledge of which was gained in the ordinary routine of work, is only in part, the property of the individual who possibly has this improvement actually forced under his nose. In that case, every patent, whether the War Office accept it or not for public service, should be registered in the name of the Inventor and the Secretary of State for War or the permanent Under-Secretary of State, so that the Nation can, at aay rate, share in the ultimate proceeds. As a general rule, the War Office do not as a matter of course adopt a thing which is good, and this sometimes leads to the officer responsible for the idea retiring from the Service and carrying his invention to a private firm, as a premium for his employment.

This is entirely wrong; but as the officials in the War Office are constantly being changed, it is possible that an invention of to-day is not recognised as a rejected staff invention of yesterday. If there is any doubt as to whether such a thing is possible let the War Office enquire how many officers who have cost the Nation, and incidentally the contractors upon whose stores they have practised, vast sums of money, retire from the Service to enter private trade. Whether it is that they get better pay, or whether it is that they are tired and ashamed of War Office methods, it would be interesting to know.

There is one department just now which is causing very great searching of heart, and that is the Explosives Committee. I am not disputing the genius of its officials nor their originality, but I merely point out that every suggestion from every source relating to explosives and similar materials is confidentially submitted to them for proof and analysis. I ask whether it is not reasonable that inventors should gravely mistrust this department. I do not suggest that the resulting inventions are circumventions of any individual invention, but I do suggest that where A, B, and C are all sending in their ideas, it is very easy to blend the information and produce a War Office invention.

NO AXE TO GRIND.

REVIEW.

Code des Explosifs. Recueil des Lois, Règlements et Circulaires concernant les Substances Explosives. André Dejean et Pierre le Play. Imprimerie Moderne, 7 Place du Wetz-d'Amain, Arras, 1906.

THE authors of this notable work little realized what was in store for them when they undertook to collect all the official enactments on explosives which systematic search would reveal. We in England have a well-staffed explosives department, and what its officers do not know the man in the trade is willing to pass by. In France there are more laws than the officials know of, and here we have them in full, partly the result of a labour of love, partly because the authors were both obstinate men, and refused to pause when the size of their self-allotted task came into view. The various sources of information which have been tapped include the various by-laws passed by the Ministry of War, of Finance, of Public Works, of Commerce, and of the Interior, the last-named signifying what we call the Home Office. Other material was derived from the Algerian department. We begin with a law passed in the fifth year of the Republic, which is tantamount to saying 1797, and we go on through a matter of 200 closely written pages. Further than this we cannot go by way of a review, beyond congratulating the authors on the accomplishment of a most valuable piece of work. *M.* le Play holds, by the way, an important office in the Société Générale pour la Fabrication de la Dynamite.

THE particulars of the new issue by the Morris Tube Company of 5 per cent. debentures to the amount of £12,500 were issued last month. The stock will make the total debentures £40,000, all ranking on an equal footing. The main object of the issue is to develop an electrical undertaking in which the company is interested.

THE PROOF MARKS OF VARIOUS COUNTRIES.

THE proof authorities in London and Birmingham have issued a circular giving very valuable information to the trade concerning the proof marks which are applied to various fire-arms in our own and foreign testing establishments. The last card giving the same class of information became obsolete some ten years ago, and it is pleasing to find that this arduous and complicated piece of work has been brought up to date. The information given as to the various countries is dealt with under separate headings, and in giving our readers the contents of the published sheet it has been found best not to depart from the arrangement of matter there adopted.

ENGLISH PROOF MARKS.

The Gunmakers' Company, London.

1 2 3 4 5

The Guardians of the Birmingham Proof House.

1 2 3 4 5

Single Barrelled Muzzle-loading Shot Guns must bear the marks 2 and 3 upon the Barrel and 3 upon the Breech.

Double Barrelled Muzzle-loading Shot Guns, and *Single and Double Barrelled Muzzle-loading Rifles*, must bear the marks 1, 2 and 3 upon the Barrel and 3 upon the Breech, or 4 only upon the Barrel and Breech.

Breech-loading Arms must bear the marks 1, 2 and 3 upon the Barrel and 3 upon the Action. In certain cases *Single Barrelled Breech-loading Arms* may bear the mark 4 only upon the Barrel and Action.

Choke-bored Barrels must bear, in addition, the word "Choke," and if rifled in the choked portion of the Bore "R Choke."

Express Rifles must bear, in addition, upon the Barrel the abbreviation "Ex," preceded by the decimal size of the cartridge.

Arms proved for use with Nitro Powders bear upon the Barrel, in addition to any of the marks above mentioned which may be applicable thereto, the mark 5.

Revolvers must bear the marks 2 and 3 upon the Revolving Cylinder and Barrel and 3 upon the Body. *Repeating Pistols* must bear the marks 2 and 3 upon the Barrel and 3 upon the Action.

All these marks occur in various sizes. There are other marks used, but they are always in addition to the above mentioned.

OLD BIRMINGHAM MARKS.

The following are the marks of the Birmingham Proof House which were in use prior to August 1st, 1904, and arms bearing them may be legally dealt with.

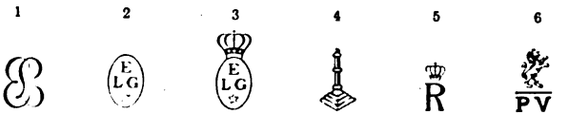
1 2 3 4

These marks were applied in the same way as those at present in use bearing corresponding numbers.

BELGIAN PROOF MARKS.

The Liége Proof House.

1 2 3 4 5 6



Single Muzzle-loading Shot Guns must bear the marks 1, 2 and 4, or 1, 3 and 4 upon the Barrel and 4 upon the Breech.

Double Muzzle-loading Shot Guns must bear the marks 1, 2, and 4, or 1, 1, 3 and 4 upon the Barrel and 4 upon the Breech.

Single Breech-loading Shot Guns must bear the marks 1, 3 and 4 upon the Barrel and 4 upon the Action.

Double Breech-loading Shot Guns must bear the marks 1, 1, 3 and 4 upon the Barrel and 4 upon the Action.

Choke-bored Guns must bear, near the proof marks, the word "Choke," and if rifled in the choked part of the Bore "Ch. B. Rayé."

Single and *Double Rifles* (except Rifled Choke) must bear the marks 1, 3, 4 and 5 upon the Barrel and 4 upon the Action, and *Express Rifles* must bear, in addition, the word "Express" upon the Barrel.

Muzzle-loading and *Breech-loading Pistols* must bear the marks 1 and 3 upon the Barrel and 4 upon the Breech or Action, and if Rifled 5, in addition, upon the Barrel.

Revolvers must bear the marks 3 upon the Cylinder, and when Rifled 5 upon the Barrel. *Repeating Pistols* must bear the marks 3, 4 and 5 upon the Barrel and 4 upon the Action.

The exceptions to the above are as follow:

Small Bore Guns, Rifles and *Pistols* (called "Carabines Floberts" and "Pistolets Floberts") of the following bores, viz., ·22 inch, 7 mm., 8 mm., 9 mm. must bear the marks 3 and 4, and if Rifled 3, 4 and 5 upon the Barrel and 4 upon the Action; and

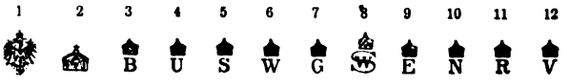
Military Rifles of less than 8 mm. (·315) bore, in which Nitro Powder is used, must bear the marks 3, 4 and 6 upon the Barrel and 4 upon the Action.

Arms of any description *proved for use with Nitro Powders* bear the mark 6 upon the Barrel and Action, in addition to any other marks applicable thereto.

There are other marks used, but they are always in addition to the above mentioned.

GERMAN PROOF MARKS.

1 2 3 4 5 6 7 8 9 10 11 12



Muzzle-loading Shot Guns must bear the marks 1, 1, 4 and 5 upon the Barrel and 1 and 4 upon the Breech, or 3 and 4 upon the Barrel and Breech.

Breech-loading Shot Guns of cylinder bore must bear upon the Barrel the marks 1, 1, 4 and 5; if choke-bored 1, 1, 4 and 6; if rifled in the choked portion of their bore 1, 1, 4, 6 and 8. The Action must bear the marks 1 and 4.

Rifles must bear upon the Barrel the marks 1, 1, 4 and 7, and if constructed for heavy charges (Express Rifles), the mark 9 in addition. The Breech or Action must bear the marks 1 and 4.

Under certain conditions, *Shot Guns* (except such as are choke-bored) and *Rifles* may bear the marks 3 and 4 only upon the Barrel, and the same upon the Breech or Action. Under the same conditions, *Military Rifles*, made according to Rifle Pattern No. 88, may bear the marks 2 and 10 only upon the Barrel, and the same upon the Action.

Revolvers must bear the marks 2 and 4 upon the Barrel, Revolving Cylinder and Frame or Body of the Action. *Repeating Pistols* and *Saloon Pistols* must bear the marks 2 and 4 upon the Barrel and Action.

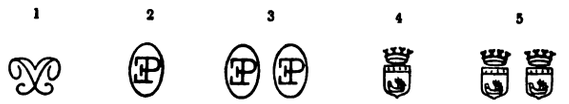
Arms which have already been proved and marked, but have subsequently undergone some alterations necessitating their being reproved, are, upon reproof, impressed with marks 11 and 3 upon the Barrel and Breech or Action, in addition to the original marks.

Upon the passing of the German Proof Act of 1821, Arms which were then in stock were not subject to the provisions of the Act if they were, before being dealt with, stamped with mark 12 upon the Barrel and Breech or Action.

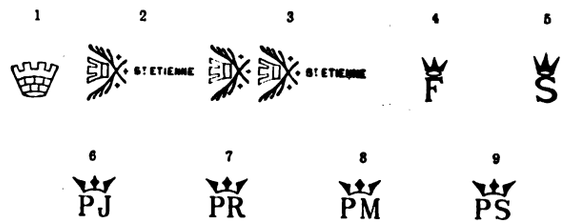
There are other marks used, but they are always in addition to the above mentioned.

FRENCH PROOF MARKS.

The Proof House of the Paris Chamber of Commerce.



The Proof House of the Saint Etienne Chamber of Commerce.



As the Proof of Small Arms in France is optional, and, consequently, an Arm may bear the whole, or any one only, of the marks, the Guardians of the Birmingham Proof House and the Gunmakers' Company of London, give notice that they do not consider a Gun or Rifle of French Manufacture sufficiently proved unless it bear, at least, one of the marks 1, 2, and 3 together with one of the marks 4, 5, 6, 7, 8 and 9, upon the Barrel, and one of the marks 4, 5, 6, 7, 8 and 9 upon the Breech or Action.

Saloon Guns, *Saloon Rifles*, *Saloon Pistols* and *Stick Guns* should bear mark 4 only for Paris, and 2 only for Saint Etienne, upon the Barrel and Breech or Action. *Revolvers* should bear the same marks upon the Barrel and Revolving Cylinder.

NOTE.—The above matter has been inserted as a source of future reference. Gunmakers and all interested should obtain the original sheets from one or other of the two Proof Houses.

TRADE MARKS IN BELGIUM.

The *Journal des Tribunaux* of May 3, 1906, contains a detailed report of the proceedings taken by the E.C. Powder Co., Ltd., against La Société Cooppal et Cie., Wetteren, Belgium. The report opens with a statement of the legal principles upheld by the case, from which the following translated abstract may be taken: "A special mark denoting the origin of certain goods may be the subject of an exclusive right. A name, a distinctive mark, figures or initials, not registered as a trade mark, but equivalent to the name of the producer, are protected by the ordinary principles of restricting their benefit to the original user of them, always provided that the brand or mark is the accepted description of a particular make of goods."

The following is a selection of the findings of the Court:—

That the benefit of being the first user of a distinctive mark as above cannot be taken away.

That the initials "E.C." (Explosives Company) denote that the goods so marked are of this Company's manufacture, and that the successive improvements are the outcome of their efforts.

It has been shown that the defendant has sold, or caused to be sold by its representatives, a smokeless powder, so identical in appearance with the plaintiffs' product that expert witnesses on both sides have failed to distinguish one from the other.

That it has been shown that there has been found on the market cartridges charged with the defendant's powder mixed with E.C., the whole described as being exclusively the latter.

That another witness reported that the defendant's representative described the powder made by his Company as *Poudre rose E.C.* (this is the name by which E.C. powder is known on the Continent), and that it was labelled: Cooppal et Cie., Poudre sans fumée rose E.C.

That it was shown in evidence that the defendant delivered similarly marked samples to gunmakers, starting in business, with whom they hoped to do trade.

That other witnesses confirmed this fact in reporting that Jean-Baptiste Vandevelde, on behalf of the defendant, in praising the superiority of the Cooppal Company's products, advised gunmaker customers to mix his powder with English E.C., adding that the cost of producing loaded cartridges could thus be reduced, and that no one would discover the substitution which had been effected. A notice was also supplied bearing the following words; "Pour les poudres rose, nouveau type E.C. 3, de 1903, 12 août 1903, signé P. Cooppal —J. B. Vandevelde."

That the identical appearance of the defendant's powder, when compared with that of the plaintiffs, the use of labels to deceive the purchaser, the use of the description E.C. 3 giving the goods the appearance of being the manufacture of a well-known factory, the various actions proved in the course of the proceedings, all justify the imputations made by the E.C. Powder Company, and establish the bad faith of the Société Cooppal.

That the defendant is held guilty of dishonest competition, and that he is forbidden in the future from applying to his products any of the following words or other words analogous to them: Poudre E.C., Poudre rose E.C., Poudre rose E.C. 3, Poudre E.C. anglaise.

The defendant must pay the plaintiffs as damages and interest the sum of 5,000 francs.

The plaintiff is authorized:—

(1) To publish the present judgment, and particulars of pleadings and evidence, under the description "Réparation judiciaire" in ten Belgian journals at the defendant's expense, the said cost to be recoverable on a simple publisher's receipt.

(2) To allocate all or part of the damages granted in giving the present judgment such additional publication as the plaintiffs may desire. The defendant also to pay costs.

ROUND THE TRADE.

The next sale of guns at Messrs. Debenham's has been fixed for Friday the 20th inst.

No. 17 issue of the "Ideal Handbook" has just come to hand. The work properly studied imparts a wealth of information about bullets, rifles, and charges.

The directors of the Cotton Powder Co., Ld., recommend a final dividend of 1¼ per cent. on the ordinary shares, making, with the interim dividend, 5 per cent. for the year ended April 30 last, and leaving £766 to carry forward.

The *Bulletin Mensuel de l'Armurerie Française* has issued a circular informing its subscribers that the non-appearance of their journal for the past two numbers has been caused by a printers' strike which they hope will shortly be settled.

The slander action taken by the Kynoch Company against Mr. G. H. Faber, M.P., in connection with certain allegations made in a speech with reference to the alleged exercise of improper influence to obtain Government orders resulted in a verdict for the plaintiff. For damages the company received £100, Mr. Arthur Chamberlain £50, the directors £10 each, and the secretary £25. Costs followed the damages.

The extraordinary tenacity of the British Government in sticking to the ·45 cal. for revolvers, when so many nations had adopted smaller sizes, has been fully justified by the recent decision of the United States War Department to adopt a ·45 cal. revolver in place of the old ·38, the change having resulted from the unsatisfactory stopping power of the small bore pistol when tried in the Phillipines under war conditions.

At the annual meeting of Greenwood & Batley, Ld., Mr. Arthur Greenwood reported a falling off in trade as compared with the previous year. The reduced profit prevented a further increase to the reserve fund, but they were able to provide £5,000 for depreciation, pay a dividend of 5 per cent., and carry forward about £100 more than they did last year. The Articles of Association were amended at a subsequent meeting to enable Mr. S. T. Batley to join the board though still holding another office under the company.

A scheme for the reconstruction of the New Explosives Co., Ld., was passed at a meeting of shareholders held on the 7th ult. The main cause for the step which has been taken is the keen competition amongst manufacturers of cordite consequent on the reduction of orders given out by the Government. Under the new arrangement three £1 shares will be exchanged for the existing £3 shares, and additional working capital will be provided by issuing them as having 16s. paid up. The further capital will be called up by instalments.

Mr. W. L. Powell celebrated his elevation to the honoured position of Chairman of the Birmingham Proof House Guardians by inviting his colleagues and a few friends to dinner on the 21st ult. Some very interesting speeches were made in the course of the toasts following the entertainment, and all things combined to make the occasion one to be looked back upon with pleasure. The Birmingham gunmakers have the happy knack of meeting one another in the kindest spirit of good fellowship, and Mr. Powell has certainly shown himself to be one around whom others will rally to promote a common cause.

Messrs. Bryant, of Drury Lane, have just completed a new type of gun case which is bound to meet with appreciation from gunmakers and sportsmen. It consists of green canvas stretched on a backing of millboard, the whole structure combining solidity, lightness, and convenience in use. The total weight is 6½ lbs., and the general arrangement of the lid and partitions reproduces the style of an ordinary oak and leather case. Great resisting power is provided by the wood divisions which hold the stock and barrels in appropriate position, so that the low weight is accompanied by adequate provision for the safety of the gun and implements which the case is designed to carry.

Messrs. Eley Bros. have issued a leaflet showing the design of a new cartridge turnover machine which appears to possess solid merit. The leverage of the working handle has been arranged on a new basis, with the result that the fatigue incidental to working these machines has been notably reduced. The force exerted in turning over a cartridge is regulated by spring pressure so increasing the efficiency of unskilled operators.

We have received a very neat gun catalogue from Messrs. George Manly & Son, of 78, High Street, Birmingham. The principle partner in the firm is Mr. John Manley, whose father carried on the business some time back. A direct and convincing bid is made for the sportsman's patronage, and a special effort is put forward to give a high grade of gun at a cost as low as can be arranged by keeping all dead charges at a minimum. One of the chief recommendations of the firm's guns is that a full appreciation of the mechanical aspects of gunmaking is supplemented by a lifelong experience of game shooting by Mr. John Manly and all the special knowledge which such a combination brings.

The Kynoch balance sheet for the year ended March 31 last shows a profit of £93,040. Debenture interest absorbs £12,000 and directors' fees £5,000, leaving £76,040. Adding the £55,907 brought forward from the previous account, deducting the usual 5 per cent. on the preference shares and 10 per cent. on the ordinary shares, both free of income tax, and writing £8,000 off capital account leaves £62.278 to be carried forward. On the assets side the capital expenditure remains unaltered. Stock-in-trade has increased from £306,423 to £369,615, sundry debtors have reduced from £212,775 to £185,453 and investments and cash have diminished from £95,081 to £84,662.

The recent announcement that the New Explosives Company have made arrangements to manufacture smokeless sporting powders, and for that matter rifle powders as well, necessarily arouses curiosity concerning the policy which will be pursued. As a result of enquiries addressed to the Company, we have been informed that three brands of sporting powder will be issued. "Red Star Powder" will belong to the 33-grain class, and every scientific precaution has been taken to ensure imparting to it the many good qualities which are associated with this particular group of explosives. "Felixite" is a 42-grain powder, and this again will be constructed to a specification primarily intended to produce a highly efficient nitro. "Neonite" is the name of a leaflet powder which aims at reproducing the noteworthy properties of the gelatinized powders. It will require a cone base cartridge, because it belongs to the condensed class; but when it is remembered that a guncotton leaflet powder has the power of producing certain combinations of result which are not readily obtainable with ordinary bulk powders there appears to be every justification for the introduction of this third member of the party. In respect to the more commercial aspects of the departure in policy which is represented by the decision to issue smokeless powders, it would be strange indeed if a company with Mr. L. G. Duff Grant for general manager, and with all the facilities for making and treating guncotton, did not add this extra string to its bow. That Mr. Grant has not lost touch with his old friends in the business is particularly shown by the circumstance that Mr. F. W. Jones has undertaken the responsible work of giving advice and assistance in connection with the new departure. The introduction of a new nitro-powder is not of course the gamble which it was ten years ago. The trade has settled down into regular channels, and manufacturers have ceased to assume that the only justification for a new powder is the discovery of a chemical novelty. The three new powders will not aim at novelty; their mission will as far as possible be confined to reproducing the accepted specification of ballistics with the greatest regularity which a carefully devised plant and a properly systemised inspection department can achieve. The powders will be sold both by bulk and in loaded cartridges, and the Company will at all times be prepared to consider proposals for the manufacture of special powders to fulfil special purposes.

THE NITROGLYCERINE PLANT AT WALTHAM ABBEY.

NATHAN, THOMSON AND RINTOUL'S SYSTEM.

LAST month's description of the new guncotton plant at Waltham Abbey may very appropriately be followed by a reference to the equally interesting process by which nitroglycerine is there manufactured. It is again a matter for comment that the Royal Gunpowder factory should be the home of a radical departure from established methods of making a product which has been a common article of commerce for so long a period. To make an original improvement in guncotton manufacture is a great accomplishment. To do the same with nitroglycerine is also an achievement to one's credit, but to bring off the double event savours of genius. The guncotton experiments could be conducted on a small scale with progressively increasing charges; but in the matter of nitroglycerine the whole idea, as well as the building and the lives of the operators, stood or fell by the first application of the idea on a commercial scale of manufacture. With the help of the accompanying illustrations the description which follows should sufficiently express the idea to be conveyed. The system has been in full work for some years, and has been adopted by some of our leading makers of nitroglycerine compounds. On every side it has received the highest praise. Generally speaking the nitrating vessel is of the usual construction, except that it is provided with an acid inlet pipe at the bottom and a glass separation cylinder with a lateral exit or overflow pipe at the top. The other essential parts of the plant are a pre-washing tank, a washing tank, and a final filtering tank.

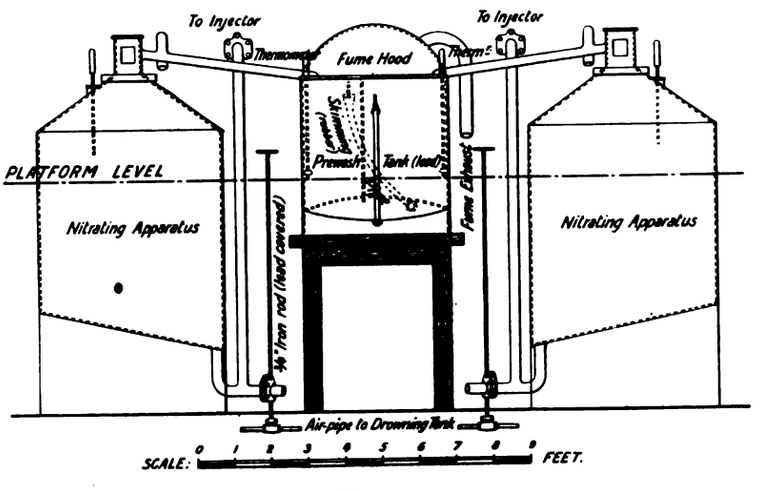


FIG. 1.

The method of operation is as follows:—The charge of nitrating acids is run from a high level gauge tank into the nitrating vessel, where it is cooled and agitated while the glycerine is run in. When the nitration is complete and the temperature has fallen slightly, the agitation is stopped. The separation of the nitroglycerine is allowed to proceed in the same vessel, and waste acid from a previous charge is caused to flow gently in from a high level waste acid tank through the acid inlet pipe at the bottom of the nitrator. The inflowing waste acid forms a layer at the bottom of the apparatus and gradually raises the whole charge till the level of the clear nitroglycerine appears in the separation cylinder, and flows over into the pre-washing tank, where it is drowned in water. The rate of inflow of the waste acid is regulated so to be equal to the rate of separation of the nitroglycerine. This is easily done by keeping the upper surface of the acid layer at a constant level in the separation cylinder, and just below the outlet. When the bulk of the nitroglycerine has separated a sharp line of demarcation appears in the separation cylinder. The subsequent manufacture is carried out in the usual manner. The above system of manufacture is fully described and specified in Patent No. 15,983, dated 1901.

Now as to the treatment of the residual acids left in the nitrator after the bulk of the nitroglycerine has been displaced. The contents of the nitrator are allowed to stand until a short time before the apparatus is required for the nitration of the next charge. This allows the recovery of as much of the nitroglycerine as possible. A small quantity of the clear nitroglycerine-free waste acids lying at the bottom of the apparatus is run off. The level of the acids is thus sufficiently lowered to allow of their being air-stirred without splashing over. The acids are then strongly agitated, and a quantity of water, equal to two per cent. by weight of the acids formed, is slowly added. The agitation of the mixture is continued until the temperature has begun to fall, when the air current is stopped, and sufficient waste acid is run in from the high level tank to raise the surface to a level with the separation cylinder. After remaining at rest for a short time to ensure that no nitroglycerine remains undecomposed, the acids are run off for storage or denitration. A sufficient quantity is raised to the high level waste acid tank for use as displacing acid for the subsequent charge. The apparatus is then in readiness for the next nitration. This method of treating waste acids is described in Patent No. 3,020 of 1903. Fig. 1 shows the general arrangement of a nitrating plant built in duplicate, and Fig. 2 shows the various falls required, and the economy effected in the necessary height of the building.

The advantages claimed for the new system of manufacture are as follows:—

1. Increased safety of manufacture.
2. Greater economy,
   - (*a*) Through increased yield of nitroglycerine.
   - (*b*) In capital required for the erection of a factory.
   - (*c*) In current expenditure—Wages, etc.

1.—INCREASED SAFETY OF MANUFACTURE.

When a charge of glycerine has been nitrated in the old form of apparatus, it is allowed to flow while still suspended in the acid mixture, through an earthenware cock into a second vessel of different construction, where separation of the acid and nitroglycerine takes place. The use of earthenware cocks has always been a source of great danger in the manufacture of nitroglycerine. This danger arises from the

friction of the earthenware key on the body of the cock, from the possibility of foreign substances getting into the key and causing jamming when turned, and from the confinement of unpurified nitroglycerine when the cock is closed. That these dangers are real and not hypothetical, has been proved by experience. In one case on record just after a charge had been run from the nitrator into the separator, a violent detonation occurred in the key of the cock, the fragments of which were thrown about with great force. Had this detonation occurred a few minutes earlier, the explosion would probably have been communicated to the body of the charge, and a disastrous result would have followed.

The same danger exists wherever acid nitroglycerine passes through earthenware cocks, and it frequently does in the method of manufacture hitherto used. The primary object of the new treatment is to obviate the necessity of passing nitroglycerine through any form of cock, and so greatly to decrease the dangers of manufacture.

A further increase of safety is obtained by the removal of nitroglycerine from contact with the acid as soon as it separates, and by the presence of cooling coils during "separation" and "after-separation," the latter rendering it possible to check at once, any undue rise of temperature. The new method involves less transference of both nitroglycerine and acid. In factories where nitration and separation are at present carried out in different houses, the undesirable operation of running the mixed acid and nitroglycerine down a more or less exposed gutter between the houses is avoided.

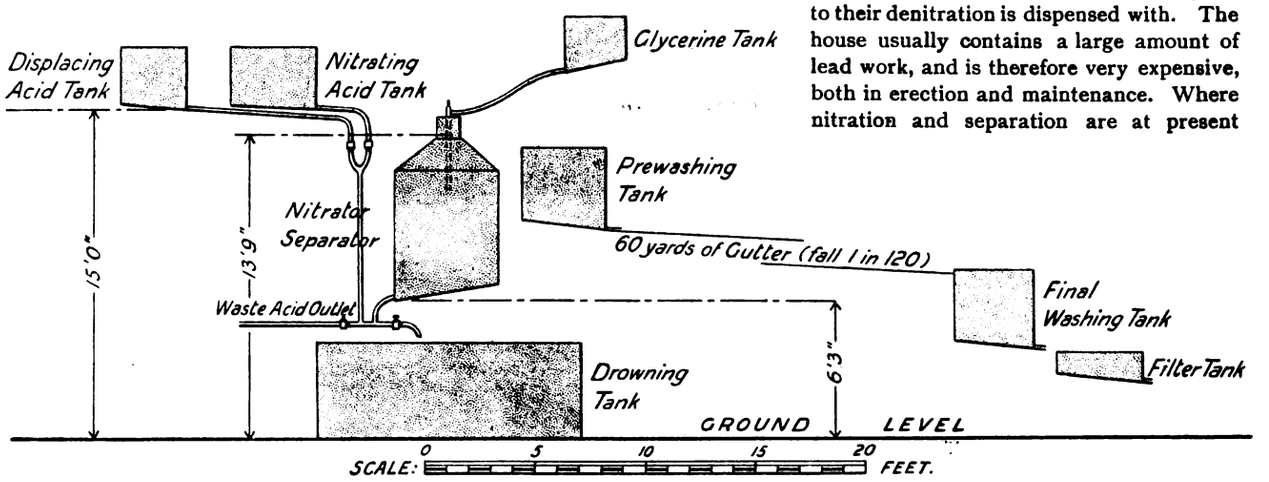


FIG. 2.

2.—GREATER ECONOMY.

(*a*) *Increased yield of Nitroglyerine.* — Owing to the presence of the cooling coils during separation and after-separation, the charge can be kept at a much lower temperature than would otherwise be possible. The amount of nitroglycerine retained in solution is therefore less than by the old process. The nitroglycerine is removed and washed as soon as it is separated, so that further action of the acids on it is prevented. There being fewer vessels to wash out, less nitroglycerine is carried away in solution in the water used for washing down the plant. These improved conditions allow of a considerably larger yield of nitroglycerine. From the results of working several plants, the increased yield is found to be equal to 5 per cent. on the amount of glycerine nitrated.

(*b*) *In capital required for the erection of a factory.*—The total fall required for a factory is lessened. Fewer buildings and less land are necessary, and the plant is simplified. It is customary to make use of gravitation, for the transference of nitroglycerine from house to house, during the different stages of manufacture. For this reason, the factory is usually built on rising ground, or the houses in which the early operations are carried out, are raised above ground level. The new apparatus greatly reduces the fall required, and therefore the capital outlay in building a factory. For example, an existing factory, built on the old principle, has a fall of 22 feet, from the top of the nitrating apparatus to the outlet for the finished nitroglycerine. If the new form of apparatus had been available, the height needed would have been 12 feet, a saving of almost one-half of the present height.

The after-separating house, where the last traces of nitroglycerine are removed from the acids prior to their denitration is dispensed with. The house usually contains a large amount of lead work, and is therefore very expensive, both in erection and maintenance. Where nitration and separation are at present carried out in separate houses, the separator house and its connections would be abolished. This reduction in the number of houses reduces the ground area required for the erection of a new factory very considerably, at times a matter of greater importance.

As the operations of nitration, separation, and after-separation are carried out in one vessel, there are fewer pieces of apparatus required. For instance, in a factory which is now being converted to the new system, there are at present:—One nitrator, one separator, one safety tank, and 16 after-separating bottles, making a total of 19 vessels. These will all be replaced by two new pattern nitrators. The connecting gutters between the nitrating and after-separating houses, and between the nitrating and separating houses, where these are separate, are also done away with.

(*c*) *Increased Economy in Current Expenditure.*—Owing to the simplification of the apparatus, and the reduction of the number of vessels, the plant may be worked by from three to five men less than are required at present. Those parts of the old plant, which were most apt to be corroded by the action of the acids, have been rendered unnecessary. The cost of repairs, renewals, and general upkeep is accordingly much reduced.

ESTIMATE OF THE SAVING EFFECTED.

An attempt has been made to estimate the monetary saving effected by this apparatus. The amount of this saving necessarily depends on the conditions which have to be met. Two cases only will be considered here, the first, supposing that a new factory is to be built entirely on the new principle, and the second, dealing with the conversion of an already existing factory, from the old to the new system.

Erection of a New Factory.

It has been estimated that the saving which would be effected by the adoption of the new system would amount from 7 to 10 per cent. of the total capital required for the erection of a new factory. The current expenses, that is to say, the wages bill, and cost of repairs to plant, would be reduced by about £300 per annum. The total yearly saving due to the new plant would therefore be £300, plus the interest on the 7 to 10 per cent. of the total capital, plus the value of the extra quantity of nitroglycerine nitrated during the year.

Conversion of an Existing Factory.

The cost of dismantling part of an existing plant, and converting it to the new system, is estimated at about £850. The annual saving in this case would be the amount of the reduction of current expenses, namely, £300 per annum, less the interest on the £850. To this saving must, however, be added the value of the houses thrown out of use and made available for other purposes. Even as in the case of a new factory due account must be taken of the saving due to the increased yield of nitroglycerine.

One must add that the reduction in fall, abolition of separating and after-separating houses, and the resulting saving in the land required, vary so much according to the conditions of individual cases, that these factors have not been included in the estimate of capital saved.

The foregoing refers only to the new method of Nitration described in Patent No. 15,983 of 1901. If the "Water method" of treating the waste acids detailed in Patent No. 3,020 of 1903, be used in conjunction with the above, the old method of after-separation would be unnecessary, and the capacity of the plant would be greatly increased.

Arrangement of the Plant.

In the adaptation of an existing plant, the separating and after-separating houses are no longer necessary. The plant in them may be disposed of, and the value of the old materials credited to the change, while the houses may be used for other purposes. The nitrating house is the only one in which alterations are necessary. As the existing gutters to the washing houses would most probably be retained, the level of the point at which the nitroglycerine must leave the house is determined.

The faucet of the pre-wash tank must be about 6 ins. above this point to allow for the connection between the tank and gutter. The height of the tank for pre-washing a 1,000 lb. charge in two portions should be about 3ft. 9in., and the nitroglycerine outlet from the separation cylinder should be 6 ins. above the top of the pre-wash tank.

As long as these falls are adhered to as minima, the plant may be arranged to suit existing conditions; but the pre-wash tank should be placed as near to the nitrator-separator as possible in order to shorten the gutter carrying the acid nitroglycerine from the latter to the former. The air and water entering and leaving the nitrator pass through the side of the vessel immediately below the level of the charge of mixed acids. This is done in order to avoid the corrosion which usually takes place above the acid level. The life of the coils is thereby prolonged. The faucet pipe of the nitrator is carried vertically downwards before meeting the pipe from the high level acid tanks. The passage of any nitroglycerine into this pipe is thus obviated.

The above alterations may necessitate the rearrangement of the platforms in the house, as only two are necessary for the new plant, and both will probably be lower than the former ones. The converted plant consisting of two nitrator-separators and one pre-washing tank is capable of nitrating six charges of glycerine per day, if the "water method" of treating the waste acid be employed.

The following table will give an idea of the working of the plant under average conditions, when artificially cooled water is not available:—

	1st Charge Apparatus A	2nd Charge Apparatus B	3rd Charge Apparatus A	4th Charge Apparatus B
Running in acids	Between 5.0 & 5.52 a.m.		9.15-9.22	11.23-11.30
Nitration (water at 14 c)	5.52-6.52	7.52-8.52	9.52-10.52	11.52-12.52
Separation ..	6 52-8.52	8.52-10.22	10.52-12.22	12.52-2.22
Pre-washing 1st hf	7.32-7 52	9.32-9.52	11.32-11.52	1.32-1.52
Pre-washing 2nd hf	8.22-8.42	10.22-10.42	12.22-12.42	2.22-2.42

If six charges are nitrated the last will be ready for the washing house by 6.42 p.m. The above times are estimated on the assumption that only one charge of nitroglycerine is allowed in the nitrating house at one time. In the case of the erection of an entirely new factory most of the above remarks would apply; but there would be no limiting point as to levels, so that these might be arranged according to the diagrams or as may best suit the local conditions.

This description has been purposely confined to the working, the arrangements, and the economies effected by the new system. The fact that it has been adopted by the Government factories points to its value, and this testimonial has been confirmed, by other manufacturers having taken up the new idea. Moreover the Chief-Inspector of Explosives in a recent official report described this system as "a new and improved method of manufacture." This view must be one mainly of safety, therefore the primary object of the inventors, viz: the reduction of danger attending the manufacture of nitroglycerine, may be fairly said to have become an accomplished fact.

APPLICATIONS FOR PATENTS.

MAY 21—JUNE 23, 1906.

11,875.* Field Plotter for Ordnance. C. L. E. Cederstrom, C. E. Ljungman, and R. O Berglund.
11,938. Smokeless Propellant Powders. A. Seip and Curtis's & Harvey, Ld.
12,066.* Explosive Projectiles. C. D. Abel.
12,155. Maxim Pack Saddle. J. Scott.
12,161. Loading Mechanism for Heavy Ordance. A. F. Petch and F. W. H. Shepherd.
12,224. Automatic Fire-Arms. J. Eastwick and T. A. Timmis.
12,265. Sights. A Winser.

12,426. Magazine Rifles. H. J. Blanch.
12,468. Small-Arm Gun Stocks. T. C. Bentley.
12,474* Trigger Mechanism. A. J. Boult.
12,513. Wind Gauges for Sights. E. Romer.
12,715. Aiming Fire-Arms Device. G. Lanino.
12,716.* Safety Explosives. B. G. Reschke.
12,747. Sliding Windgauge Sight. G. H. Hemmel.
12,791.* Explosive Prejectiles. Ç. Chronic.
12,807.* Explosive Projectiles. L. Reidel.
12,869. Toy Air Gun. A. Forbes
12,897. Ordnance Breech Pins. C. M. Rotter.
13,030.* Small-Arms. G. Rouy and R. L. Dusigne.
13,102. Sighting Apparatus. A. T. Dawson and G. T. Buckham.
13,108. Ordnance Breech Mechanism. A. T. Dawson and G. T. Buckham.
13,126. Cartridge Cases S. O. Cowper-Coles.
13,173. Air Gun and Miniature Rifle Target. J. H. W. Edmond.
13,203. Air Gun Target. W. Baker.
13,283. Time Fuses for Projectiles. J. Y. Johnson.
13,321. Machine Guns. M. Otto.
13,388.* Time Fuses for Projectiles. Fried Krupp, A.-G.
13,431. Projectiles, H. W. Gabbett-Fairfax.
13,486. Projectiles. H. W. Gabbett-Fairfax.
13,570.* Automatic Firearms. W. J. Whiting.
13,645 Wind Gauges for Rifles. W. K. Gregory.
13,684. Percussion Fuses for Ordnance. Sir W. G. Armstrong, Whitworth & Co., Ld., and W. H. Sodeau.
13,716. Air Guns and Sights. E. Jones and Kynoch, Ld.
13,816. Field Gun Mountings. A. Bremberg.
13,849.* Guns with Recoiling Barrel. Rheinische Metallwaaren und Maschinenfabrik. (Date of application in Germany, June 19, 1905).
13,865.* Range Keepers. A. T. Dawson and J. Horne.
14,023. Automatic Breech-loading Guns. Adlerwaffenwerk Zella St. Bl. and M. Hermsdorff.
14,194.* Cartridge Feed. A. B. Carey.
14,217.* War Repeating Rifles. P. Frère.
14,224. Eye Protector for Telescopes. The Telaupad Syn. Ld. and H. A. Cutmore.
14,237. Projectile. H. W. Gabbett-Fairfax.
14,316.* Percussion Fuses. Fried Krupp, A.-G. (Date of application in Germany, July 8, 1905).
14,327.* Pistols. Societa Siderurgica Glisenti. (Date of application in Italy, June 30, 1905).
14,373. Fuses for Projectiles. H. P. Merriam. (Date of application in U.S.A., June 23, 1905).
14,434.* Foundation for Guns with Recoiling Barrel. Rhenische Metallwaaren und Maschinenfabrik. (Date of application in Germany, September 14, 1905).

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MAY 31—JUNE 21, 1906.

7,733 (1905). **Target Apparatus.** T. L. Jones and the Auto-Electric Rifle & Target Co., Ld., London. Apparatus of the kind in which a pistol or other arm is mounted on a joint allowing its alignment on a target, an indicator is provided to denote on the target the direction of aim. Means for showing the alignment by illuminating sections of the target and controlling the duration of the light are specifically described. Accepted May 11, 1906.

8,866 (1905). **Military Rifle Sight.** C. White and Mrs. M. A. S. White, Bromley-by-Bow. A military form of leaf sight containing a multiplicity of notches, and apertures so disposed as to enable the user to align on objects at any distance by utilising the appropriate aperture, but without need to touch the sight itself. Three notches cut in the cross bar provide a selection of V's for shooting right, left or central in respect to a given mark. Briefly the leaf is a solid plate of metal containing the necessary assortment of apertures, etc. Accepted May 26, 1905.

9,966* (1905). **Time Fuses.** Fabrik Elektrischer, Germany.

10,092 (1905). **Fog Signals.** B. C. Simpson, London. Fog signalling apparatus for railways combining a connection with the signal cabin and other appliances to render the fog signal operative or inoperative at will, an automatic cartridge feeding magazine, and means for making an explosion with only such assistance from the passing train as is represented by the operation of a catch. Accepted May 12, 1906.

10,177 (1905). **Shell Primers.** J. W. Græme and R. W. McNeely, Navy Dept., Washington, U.S.A. A primer for shells having the property of denoting by external means whether its contents have exploded, the object being to minimise the dangers attendant on opening the breech of a gun after a missfire, when the noise in the neighbourhood makes it impossible to determine whether or not the priming composition has ignited. The specification describes certain points of construction which have been introduced with an idea of making ignition more certain than hitherto. Accepted May 10, 1905.

10,540 (1905). **Time Fuses.** J. F. Meigs and E. A. Gathmann, U.S.A. This patent refers to a method of introducing a sear into the mechanism of time fuses for projectiles of the kind which are normally restrained from operating, and can only be set for firing by the rotational action of the projectile acting in reference to air resistance. The specific claims cover the method of releasing the sear by the rotation of the dome, and a variety of conical caps specially designed to grip the air. Accepted May 10, 1906.

11,666 (1905). **Automatic Rifle.** General A. V. P. M. Berthier, Turkey. A system of automatic mechanism for military small arms of the type where gas is taken from the explosion of the charge and carried to a piston chamber where it produces certain movements incidental to the extracting and re-loading operations. Accepted May 31, 1906.

12,364 (1905). **Rifle Pull-through.** B. E. S. Stocker, New Zealand. A pull-through cleaner for rifles in which the length of cord usually used in combination with a weight is replaced by a piece of wire cable of sufficient stiffness to be capable of being pushed through from end to end so obviating the deficient drawing power of a weight let down a badly fouled barrel. The patentee states:—"I am aware that flexible wire rope has been previously employed for cleaning tobacco pipes, water tube boilers," etc. Accepted May 31, 1906.

14,133 (1905). **Shrapnel Fuse.** Col. E. Rubin, Switzerland. A construction of shrapnel fuse having special means for providing a large emission of gas on explosion and so making the point of impact visible from a long distance. Accepted May 10, 1906.

14,716 (1905). **Ordnance Aiming Device.** J. W. Frost, Ireland. An arrangement to be used in connection with aiming fire practice with breech loading guns. Accepted May 10, 1906.

15,050 (1905). **Picric Acid.** Rhenische Metalwaren-und Maschinenfabrik, Germany. A system of making up charges of picric acid and other explosives which are used melted into a receptacle, so as to overcome their known tendency to be difficult to ignite The remedy here proposed is to leave a cavity in the head of the charge adapted for the reception of a series of blocks or discs of compressed, but not melted, picric acid. The initial detonation first acts on these blocks, and the explosion of the main mass is assured. Accepted May 24, 1905.

15,565 (1905). **Explosives.** A. T. Cocking and Kynoch Ld., Birmingham. The subject matter of this patent is sufficiently expressed by the following statement of the claims:—"(1) In the manufacture of explosives of colloid form, the use of olive oil, substantially as and for the purpose described. (2) In the manufacture of explosives, the use of vaseline mixed with olive oil or other oil soluble in the incorporating solvent and having high molecular weight and great heat of formation, substantially, etc." Accepted May 10, 1906.

15,566 (1905). **Explosives.** A. T. Cocking and Kynoch Ld., Birmingham. This patent discloses the idea of employing nitrate of potassium and nitrate of barium in smokeless powders, various percentages being specified, also various alternative ingredients having the same object in view. Accepted May 10, 1906.

15,904* (1905) **Triggers for Air Rifles.** Birmingham Small-Arms Co., Ld., and G. Norman, Birmingham.

16,514 (1905). **Explosives.** W. Macnab and Ammonal Explosives, Ld., London. The use of a small percentage of potassium bichromate has been found to make it possible to increase the aluminium ingredient in ammonia nitrate explosives without the usual concomitant of greater liability to danger in fiery mines. Four per cent. of the new ingredient enables the percentage of aluminium to be raised from 3½ to 8. Accepted May 31, 1906.

17,037 (1905). **Fog Signals.** W Downing, Sheffield. An apparatus by which fog signals may be placed in position for exploding, and be removed after explosion, by the movement of a lever operated by hand from a convenient distance away. Accepted May 10, 1906.

17,089 (1905). **Sight Tester.** Sir W. G. Armstrong, Whitworth & Co., Ld., and J. Honner, R.N,, Newcastle-on-Tyne. An apparatus attachable to the muzzle of a gun and carrying a series of scales and attachments for testing the alignment of gun sights. Accepted May 24, 1906.

20,559 (1905). **Target Apparatus.** F. H. Ayres and E. Moore, London. A toy target depicting a forest scene and containing apparatus for presenting intermittently to view rabbits, deer, antelope, and other objects of the chase. Accepted May 31, 1906.

21,825 (1905). **Time Fuse.** C. P. Watson, U.S.A. A time fuse for shells containing amongst various details of construction a device which, upon discharge, is operated by centrifugal force to release the timing mechanism. Accepted May 24, 1906.

22,058 (1905). **Bullets.** A. Harper and H. Kernaghan, Belfast. A projectile of double cone or "tip-cat" shape with part of its sides parallel. It maintains its equilibrium in a straight line for a considerable distance after leaving the gun, owing to it being evenly balanced on its short axis or centre, and the bullet is not affected to any great extent by side winds. Accepted May 24, 1906.

22,550* (1905). **Breech Mechanism for Air Rifles.** L. Jeffries, Birmingham.

22,658 (1905). **Rifle Sights.** C. G. Bonehill, Birmingham. A back sight for miniature rifles, etc., mounted on a rocker. one of whose ends is controlled by an elevating screw. Another design is based on the system in which the elevating screw lies between the bar and the pivot. Accepted May 24, 1906.

22,681* (1905). **Miniature Rifle Sight.** Birmingham Small-Arms Co., Ld., A. H. M. Driver and G. Norman.

24,709 (1905). **Telescope Sights.** Fried. Krupp, A-G. Germany. A special construction of panorama-sighting telescope which is so arranged that the person looking into the eye-piece of the telescope can also sight independently of the revolving reflector for the entering rays. The two objectives can be alternately brought into optical connection with the eye-piece by means of an adjustable prism. Accepted May 24, 1906.

26,673 (1905). **Target Apparatus.** H. Jenischewsky, Germany. An iron sectional target made and mounted so that the impact of the bullet shall complete an electrical circuit flowing through the particular part of the target struck, and so produce the corresponding change on the face of the indicator. Accepted May 31, 1905.

2,240 (1906). **Target Apparatus.** G. Easdale, Z. C. and H. G. Ketchum, Canada. A rifle target which consists of a roll of paper representing a series of targets which are wound from one reel to another by suitable apparatus as required, and a bullet catcher to the rear. Accepted May 10, 1906.

6,469* (1906). **Aligning Device for Shot Guns.** W. M. Scott, Birmingham.

7,154 (1906). **Travelling Ordnance.** Fried. Krupp, A-G. Germany. To simplify design and lessen weight in regard to travelling ordnance the vertical axis is taken outside the central vertical plane of the gun and the separate part, acting as a carrier for the same, is dispensed with. The vertical axis in the present construction lies in one of the walls of the gun carriage. Accepted May 10, 1906.

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

SELECTED PATENTS.

TRIGGERS FOR AIR RIFLES.

15,904 (1905). Birmingham Small Arms Co., Ld., and G. Norman, Birmingham. The object of the present invention is to provide air rifles and other small arms with firing mechanism or combined safety and firing mechanism which will securely hold the main-spring and plunger against accident or inadvertent discharge and yet will admit of the sear or catch being disengaged by a light pull-off when the shooter desires to fire the rifle, and this

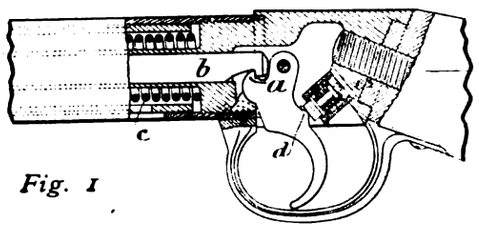


Fig. 1

Fig. 2

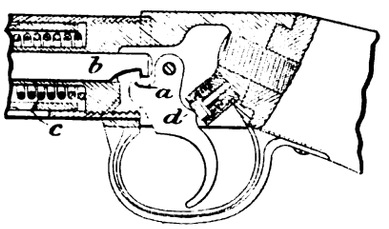
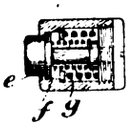


Fig. 3



object it is proposed to attain by the employment of a trigger and sear device which normally, when the main-spring is compressed, is in safe and positive engagement with the plunger, but is so arranged that in order to discharge the rifle, two distinct pulls or two stages of movement have to be imparted to the trigger, the first of which transfers the sear or retaining device from its position of safe engagement to a position ready for firing, whilst the second movement corresponds to the ordinary light pull-off and finally disengages the sear from the plunger.

In the accompanying drawings Fig. 1 shows the position of the parts when the trigger is cocked in the ordinary way; Fig. 2 shows the intermediate stage of release where a slight extra movement of the trigger will fire the rifle; and Fig. 3 is an enlarged view of the spring buffer which controls the two stages of movement The hook *a* on the trigger acts as sear, and engages with a corresponding recess in the extension rod *b* on the piston, the piston spring *c* representing the propelling agent which is released when the trigger is pulled. At the back of the trigger is the projection *d* which presses on the spring buffer.

Turning now to Fig. 3 it will be seen that the spring buffer consists of a cylinder having a sliding piston *e*. This piston is pressed forward by two springs, the light one *f* resisting the first movement, the spring *g* coming into action and supplementing the first spring when the piston has been pressed a certain distance. The combined effect of these two springs is such that the sear in the normal cocked position fully engages the bent of the propelling piston, but

that a long light pull carried out against a low spring resistance carries the sear very near to the final releasing point in the manner of an ordinary double-pull rifle action. The resistance then encountered, which is represented by the compression of the more powerful spring contained in the buffer, indicates to the shooter that the moment has arrived for giving the trigger the steady and powerful squeeze for the final release. Accepted May 10, 1906.

ALIGNING DEVICE FOR SHOT GUNS.

6,469 (1906). W. M. Scott, Birmingham. This invention has relation to the sighting of guns and rifles whereby such fire arms are adapted or made suitable for those sportsmen and riflemen who shoot from the right shoulder but who either from choice or

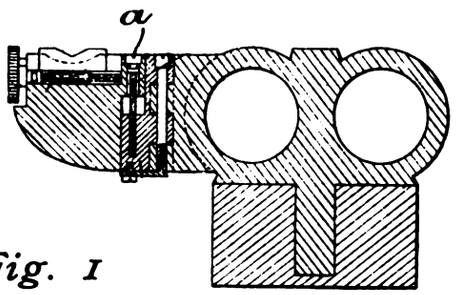
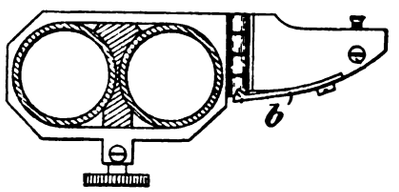


Fig. 1

Fig. 2



necessity use the left eye for aiming with, and who are known to gun makers and gun fitters as "left-eyed men." Persons who aim and shoot in this manner, have hitherto been compelled to use specially built guns or rifles in which the stocks are considerably "cast off" or are crooked or cranked from right to left so as to enable the shooter to bring the barrel sights into alignment with the left eye whilst holding the butt of the stock against the right shoulder. The present invention aims at obviating the use of such cast-off stock guns and rifles and at providing means which enable a left-eyed shooter to fire from the right shoulder with an ordinary straight-stocked gun or rifle without detriment to the ease and accuracy of his shooting.

This object it is proposed to attain by arranging a system of sights standing out laterally on the left side of the barrels of an ordinary double gun. The accompanying illustrations (Fig. 1 and Fig. 2) show the attachments which form the rear and front sights respectively. In Fig. 1 it will be seen that provision is made in the extending bracket for giving the backsight a certain amount of lateral adjustment so that the shooter may obtain the most favourable possible alignment. The vertical screw *a* represents a hinge which allows the extending bracket to be folded out of the way when not in use. The front sight bracket, as shown in Fig. 2 viewed from the front, is mounted on a simpler form of hinge, having the spring *b* for retaining it in position. Accepted May 17, 1906.

MINIATURE RIFLE SIGHT.

22,681 (1905). Birmingham Small Arms Co., Ld., A. H. M. Driver and G. Norman, Birmingham. This invention concerns a new form of backsight which has been expressly designed for use with miniature rifles. Its general design is based on that of modern military sights where the leaf is pivoted in front, and elevation is obtained by the bearing of a cross bar on inclined ramps, the sighting bar being at the back. The chief element of novelty in the sight now under consideration consists in the fact that the sliding piece which takes its bearing on the side ramps consists of a nut which screws up and down the stem of the leaf. The ordinary construction of sight provides a series of notches in fixed positions which give a definite series of elevations, leaving the intermediate adjustment to be provided by a supplementary screw attachment. In another system of sight a longitudinal male screw is made to turn and carry the sliding piece up and down. The essential feature of the present invention is accordingly the combination of a hinged screw forming the leaf stem, and a nut, which acts as the sliding piece, taking its bearing on the ramps or inclined planes.

In the accompanying illustrations Fig. 1 shows a side view of the new sight, in which *a* is the screwed leaf, *b* is the nut, and *c* is the sloping ramp, upon which the nut takes its bearing by virtue of the pressure exerted by the spring *d*. Lateral stiffness of the leaf is provided by the vertical posts *e* and *f* which support the squared portion *g* of the sight leaf. In Fig. 2 the same parts are shown looking from above. Fig. 3 illustrates the special arrangement

Fig. 1

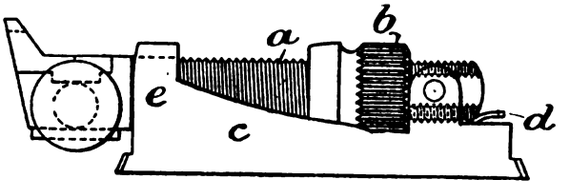


Fig. 2

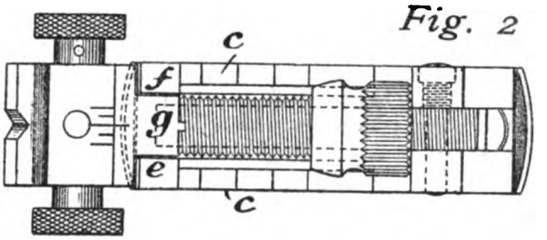
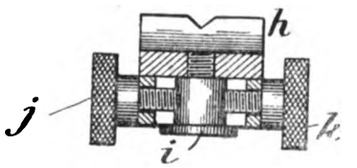


Fig. 3



which has been adopted for giving a cross movement to the sight bar for lateral adjustment. Its essential feature is the bar *h* held down by the screw *i*, and receiving its lateral adjustment from the horizontal screw *j* which is fitted with the locking nut *k* so as to prevent end movement. The screw head and the locking nut are made of similar shape so that the shooter may use one or the other for giving lateral adjustment to his rifle. Accepted May 10, 1906.

TIME FUSES.

9,966 (1095). H. H, Lake, London. It has hitherto been found impossible to render electrical time firing generally applicable for submarine mineral working, mainly because no time fuse has hitherto been obtainable which would adapt itself to all the requirements, sometimes very diverse, of the different geological formations and the methods of working them. In the case of dynamite blasting in very solid and compact rocks for example, a very important factor is that owing to the impermeability of the rock and to the firmness of the tamping the pressure of the gas within the bore hole may be exceedingly high, so that the speed of combustion of the retarding means in the time fuse is very greatly accelerated. It is for this reason that in solid rock and when the tamping is especially fast and tight the quick match time fuses hitherto employed have presented such a high burning velocity, and one varying with the nature of the tamping, so that it has been impossible to keep the time intervals separate for the various

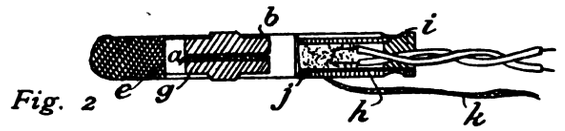


Fig. 2

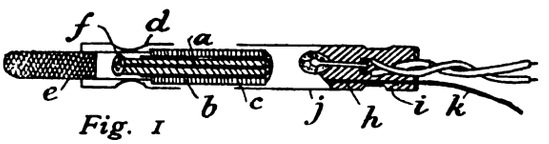


Fig. 1

groups. Naturally this defect is so much the more pronounced the longer the retarding means employed.

For such cases it has therefore been necessary to make the retardation as short as possible in order to keep the various fuse groups separate. As a result of this, the priming of the retarding means has of course been brought very close to the explosive, so that with the method of discharging the gas either forwards or laterally there was the danger that the explosive might be kindled by the firing action of the discharge of gas. In accordance with the present invention the gas is liberated towards the rear, that is to say upon the side away from the explosive. In the case of solid or firm tamping, that is to say when the tamping is effected with loam or clay, provision must be made for conducting the gases generated by the burning of the priming right out of the bore hole. This discharge of gas is here provided for by means of a cord or wire which is loosely fixed in or on the gas outlet and torn out of the blast hole after the tamping of the blast hole has been effected, thereby forming a fine discharge passage through the entire tamping for the escape of the gases.

In Fig. 1 a pellet fuse of a well-known kind has been selected as the electrical fuse, whilst in Fig. 2 a fuse in a paper case with loose charge, is shown. Retardation is provided for in Fig. 1 by a loose powder core *a* of any appropriate material, such for example as black powder, which is spun around in the manner of a quick match, and then surrounded by a metal envelope *b*, for example a sheet metal case and if desired is provided with a proper case *c* as an additional wrapping.

A special case *d* is provided for the reception of the detonating cap *e*, which may if desired be arranged in position on the spot when tamping the hole; this case is preferably formed of sheet metal. The retarding means also carries an igniting or firing charge *f* for the purpose of reliably igniting it, and the detonating cap, in case the material employed for the priming core *a* for the retarding means should be only a weakly burning, smouldering or difficultly ignited material. The priming core *a* in Fig. 2 is stronger and stiffer, for example cotton or asbestos threads impregnated with powder, or a compressed stick of powder, or threads of gun cotton, cordite or similar substances, are embedded within a solid cast block *g* of appropriate material such as sulphur, metals or mixtures of the two. The detonating cap *e* is arranged upon this cast block which, if desired, may also be provided with an envelope *b* of paper or sheet metal.

In both figures the arrangement of the gas discharge passage *h* is rearwards, that is to say, on that side of the fuse away from the explosive cartridge; in Fig. 1 it is carried through the cast block *i* of the fuse and in Fig. 2 externally beside the fuse casing *j*, which may be suitably crimped or bent in. For the purpose of forming a gas discharge passage through the blast hole after it has been tamped, in Fig. 1 a wire *r* is provided, which wire may be embedded in the gas discharge passage and which is torn out after the blast hole has been tamped. In Fig. 2 a cord *r* is stuck to the outside of the fuse and is likewise adapted to be readily drawn out of the blast hole after tamping has taken place.

It is not however, indispensable to attach the cord or wire to the fuse; when the fuse is tamped a suitable cord of sufficient strength may be arranged and after the tamping has been driven home this cord is drawn out through the latter. In the case of blast holes which have been very firmly tamped the provision of a discharge passage of this kind prevents the advantage that the retarding material of the fuse will burn quite uniformly even in such a hole. As the priming of the retarding material remains outside the explosive cartridge, and as the discharge of gas takes place towards the rear, that is to say away from the explosive cartridge, it is impossible for the fuse to explode or for the explosive to ignite.

The inventor admits that it has already been proposed to form air outlets for chemical fuses through the blast hole tamping by removing a cord embedded therein and he does not broadly claim such arrangement. Accepted May 10, 1906.

BREECH MECHANISM FOR AIR RIFLES.

22,550 (1905). L. Jeffries, Birmingham. The object of this invention is to simplify the operation of the well-known Jeffries pattern of air-rifle by causing the cocking lever to open and close the breech by automatic means. The two illustrations here given sufficiently explain the idea. The ordinary cocking lever *a* is fitted with the extension piece *b*, which is so arranged that when the lever is opened for setting the piston spring it pushes up the breech block *c* so as to expose the passage *d*, into which the slug is in-

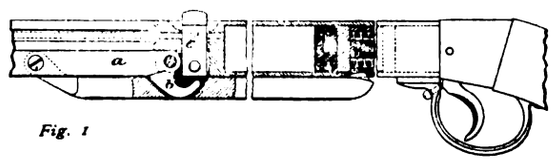


Fig. 1

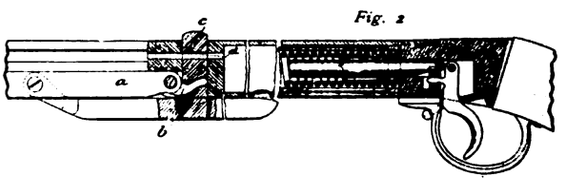


Fig. 2

serted. Two forms of the contrivance are illustrated. In Fig. 1 the sliding breech block is automatically raised but not automatically lowered. The lever can thus be closed before inserting the pellet, the shooter being responsible for pushing the breech block home into its place. In Fig. 2 the closing of the lever lowers the block. This makes it necessary for the shooter to insert the slug or pellet whilst holding the lever in the wide-open position. Accepted May 17, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Rooks and Rook Rifles.—In a letter which was forwarded by the Board of Agriculture to the Devonshire Agricultural Association it was mentioned that the attention of the Department has been called from time to time to the fact that in certain districts there has been a marked increase of rooks during recent years, and that the tillage area being now more restricted than formerly, the depredations of these birds have become more serious. The letter also mentioned that young rooks are not shot so systematically as formerly, and that the increasing use of the rook rifle in preference to the shot gun allows a larger proportion of the birds to escape. The letter concludes with a reference to the destructive habits of these birds, and a recommendation that owners of rookeries should be approached in the hope that more energetic action might be taken in the proper season to keep the birds within reasonable limits. Whether or not the Board of Agriculture is justified in believing that such an appeal would meet with a cordial and ready response is a matter for opinion. A request to be allowed to shoot a rookery as a rule receives little or no attention, even in those instances where the owner does not reserve the sport for himself and his friends. It is possible, however, that if the subject could be properly ventilated owners of rookeries would realise more fully than at present that they owe a duty to the owners of the neighbouring land upon which the rooks are in the habit of feeding. It is, however, more in respect to the allegation of inferiority which is put forward against the rook rifle, as compared with the shot gun, that we desire to enter a protest. There is no more deadly instrument than a well-sighted rifle of small bore in reducing the population of a rookery. The noise and recoil of the ordinary shot gun not only scatter the birds, but diminish the enthusiasm of the sportsman. In moderately capable hands a rook rifle will kill quicker and further, and will continue in operation for a longer period than a shot gun, whoever may be shooting it. If the Board of Agriculture wishes to associate itself with modern developments it could not do better than endeavour to take measures to bring the members of village rifle clubs into touch with owners of rookeries with a view to holding an annual fête, at which for once in a year the inanimate paper target would give place to a live target consisting of meat and feathers.

Government Orders.—Even when politics have a direct bearing on business the trade paper must be wary lest, in discussing such relations, political bias is disclosed. However this may be, there can be no doubt that the trades which depend on Government orders for war materials are having an exceedingly bad time now that the policy of curtailing military and naval expenditure is reflected in the number and size of the orders issued. Not only is the amount of material required less than in previous years, but a greater proportion of it seems on the whole to be reserved for manufacture in the Government establishments. The many extensions of manufacturing facilities, which at first received their justification from the enlarged war demand, are now accentuating the pinch. War Office orders are prone to fluctuate within certain limits according to the state of public opinion and the political outlook abroad. Economies in the purchasing of stores can frequently be effected without visible signs of decreasing efficiency, but it is to be hoped for public reasons that the policy of re-

trenchment will not be carried to the extent of unduly diminishing cartridge and other stocks. The manufacturer knows that the present lack of orders will be averaged by an enhanced demand in the future. He can afford to be patient for the moment, whilst using the leisure which comes with slack times to examine outside sources of demand, in the hope of building up a private trade diminishing his dependence on Government work. Those companies which have been able to turn their attention to allied lines of production have as a rule found that Government work represents a valuable training for all branches of manufacture. Quality of work, organisation of output, and the selection of standard articles in general demand form the basis of successful enterprise. Object lessons exist in every section of industry, showing that a large and important business can be built up on the basis of making a single article in general demand at a seemingly insignificant price. Conversely multiplicity of designs, and the willingness to supply a large variety of articles, trench too much on the functions of the retailer to represent a successful policy of manufacture. It is difficult to apply generalisations of this description to every individual case, but it is nevertheless certain that many firms, which were originally organised for Government work alone, have achieved their latter-day affluence by branching out into side lines.

Shooting Prospects.—All things considered there seems to be every reason for anticipating a successful shooting season during the months that are to come. The nesting period was unfortunately marked by inclement weather in many parts of the country; but when the warm spring weather first made its appearance prospects became much brighter, and there is every reason for anticipating a reasonable head of game, strong on the wing and generally healthy. Commercial conditions may not be as favourable as one would wish. Money has never attained the freeness which preceeded the time of the war. On the other hand of actual depression there is very little, and manufacturers are sufficiently busy to show that that better times are gradually advancing. All this is likely to influence in a favourable manner the outlook of the gunmaker, and the various manufacturers who are interested in the cartridge and its contents. With reasonable luck we may accordingly look forward to a period of active demand. Orders already placed indicate a healthy state of business, and it only now remains to hope that as the season advances each class of game will be found to exist in sufficient numbers to keep sportsmen busy. The new season will see the introduction of several new powders, which is a novelty compared with the experience of recent years. The old well-tried powders have been improved from year to year, and the methods of loading have shown an all-round improvement calculated to bring out the best behaviour of the gun. At no time in the history of cartridge loading has more attention been paid than at present to the many problems which arise in giving the sportsman his favourite charge in a form likely to enhance the success of his shooting. Amongst novelties in the way of special loading the use of shot charges of less than one ounce weight is likely to occupy general attention.

The Spurious Sports Bill.—The action of the Birmingham and Provincial Gunmakers' Association in addressing members of the House of Commons on the question of the Spurious Sports Bill represents a praiseworthy effort to safeguard trade interests. On the other hand it is always possible that such action may defeat its own ends by displaying too clearly the interested motive. If public opinion were in favour of restricting those sports which involve the taking of life the gunmaker would be the last person considered. On the other hand the Government of the country is mainly vested in the hands of the large landowners and others who take a healthy view of sport; and no Bill which encountered the organised resistance of this class would be likely to obtain a serious hearing. As a question of policy it accordingly seems more desirable that the annual attempt to pass a spurious sports bill should be dealt with by sportsmen than by persons interested in the business which sport maintains. The Field Sports Protection Association exists for the sole purpose of upholding the Englishman's right to shoot and kill in the manner of his forefathers. However sound may be the arguments put forward in favour of sparrow shooting, starling shooting, and the renovation of game preserves by putting down pheasants the fact remains that those arguments become worse than useless if urged for commercial motives. The subscripton list of the Field Sports Protection Association is at all times open to those anxious to maintain the present freedom of action, and substantial donations to this well-organised Association will do more to promote the best interests of sport than the action of other bodies less in touch with the thoughts and opinions of landowners and sportsmen.

The Society of Miniature Rifle Clubs.—The proceedings at the Annual Meeting of this Society suggest that it has been highly successful in getting its aims endorsed by the personal sympathy of men in high position. The granting of equal rights and privileges to those accorded to the National Rifle Association shows that the body which first brought miniature marksmen into public competition with one another is taken seriously by those whose approval counts for much. In the course of the proceedings it was tentatively mentioned that a large meeting of riflemen might be organised during the forthcoming year in the neighbourhood of the Metropolis. If a practical scheme is framed, and suitable accommodation found, it is possible that a meeting, truly representative of the large number of exponents of this branch of shooting will be brought together, and so show the need for a regularly organised annual function. The further one must travel to let off a full-size rifle the more important is it that the glories of the old Wimbledon days should be re-established by means of the miniature rifle. To achieve success in its most essential form it is desirable that such a meeting should be held on a public piece of ground, and that the limitations of indoor shooting should not be allowed to detract from its extent and usefulness. If thirty miles is an appropriate journey for service rifle practice surely the distance can be diminished to one-third in the case of the ·22 rifle. The great need of the present moment is the establishment of an annual rifle meeting little more than a 'bus ride from the Metropolis; and if the principle of utilising public land can once be established the national character of the gathering is assured. There are many difficulties in the way; but the personality of those who have connected their names with the junior rifle shooting organisation affords a reasonable prospect that a well-considered scheme will be properly considered by those who have the power to act if once their interest is excited.

BREAKING UP CARTRIDGES.

IT is a matter for regret that the remarks which appeared last month concerning the breaking up of cartridges should have created in Captain Thomson's mind an impression very different from the one intended to be conveyed. As we have nothing to amend or withdraw the question resolves itself into a simple difference of opinion on the interpretation of fact. On the one side there is the contention that the breaking up of cartridges is essentially a dangerous proceeding, and one which must under no circumstances be carried out in commercial quantities except in a properly licensed factory. The other contention is that the breaking up of cartridges is a necessary trade operation, and not unduly dangerous when carried out under suitable conditions. The accidents which have arisen from breaking up old ammunition are mostly attributable to a woeful disregard of common sense precautions. Commercially speaking the ammunition manufacturer finds that the materials recovered from breaking up cartridges pay for the cost of the operation, but that cartridges can be broken up only as a favour for important customers provided they are carriage paid to the works. Useless stock is not an item upon which the ordinary gunmaker will care to expend further sums by way of added loss. The present position is not a satisfactory one and last month's article was written in the hope that a remedy might be forthcoming.

If it is impossible under existing conditions directly to sanction the carrying on of the breaking-up process outside factory limits rules and instructions might at least be framed to show the precautions which should be taken to exclude all serious risk. The individual would still be responsible for carrying out the operation in a proper place. Most gunmakers, for instance, possess shooting grounds amply isolated from neighbouring buildings. Such grounds necessarily include some kind of shed, and in the nature of things the number of employees at work on the spot is strictly limited. The degree of danger incidental to the operation of breaking up cartridges is essentially based upon the amount of powder present in the building at any one time. Five pounds of powder is allowed in an ordinary loading shop on registered premises, and the same limit might assuredly be adopted in the case of cartridges to be broken up in an isolated hut. Every charge removed from a cartridge might be at once transferred to water, but this is objectionable for two reasons; first, because modern powders float on the surface and do not get properly wetted, and secondly, because wet powder is difficult to destroy. The better course to adopt would seem to be to remove the powder in pound or half-pound lots to a receptacle outside the house. When the original batch of cartridges had been broken up, the recovered powder could be laid in a thin train and burnt. Proper methods of breaking up the various kinds of cartridges might similarly be laid down. For instance, express cartridges containing nickel-covered bullets can be easily opened by grasping the bullet in a vice, and pulling on the case, using for handle a piece of rag tightly wrapped round so as to grasp the rim. The whole question in fact resolves itself into the choice of two courses: the one to show the best way of carrying out a definite operation; the other to withhold much needed advice because of the possibility that the operations in question might be carried out in an unauthorised place.

THE W. O. MINIATURE RIFLE.

IT is a matter for considerable regret that the arrangements connected with the issue of the new cadet rifle should have produced a state of misunderstanding which it is to be hoped will shortly be removed. The trouble seems to have arisen from the desire of the National Rifle Association to act in a trading capacity, and its subsequent disappointment that things have not worked out in the manner anticipated. The original intention was to produce a rifle which could be sold at a price lying somewhere between thirty and thirty-five shillings. The assistance of independent manufacturers was invited in the first instance, but the subsequent action of the authorities showed that the invitation of samples and estimates was not the fore-runner of Government orders. Bit by bit the original desire for simplicity gave way in carrying out the ideas of various persons unskilled in rifle design. This, that and the other refinement was added regardless of the cost entailed. In the end a pattern of rifle was adopted which manufacturers of many years' experience have agreed cannot be turned out at a less nominal price than forty-five shillings, forty-one shillings being the lowest net purchasing figure. Even then the best conditions of manufacture leave the rifle one of the least profitable items of the gunmaker's business. The N.R.A. refuses to accept the statement that a rifle, made jointly by several manufacturers and sold at their own risk, cannot be turned out so cheaply as under the conditions of a 20,000 order. It would be impossible in the compass of this article to state in detail all the points of the controversy which have been going on. The position may, however, be summarised by saying that the National Rifle Association desired to control the whole output of the rifle and to deal only with one manufacturer. The War Office on the other hand decided that every responsible manufacturer must be allowed to make the new rifle, and that no artificial restraints must be allowed to hamper distribution.

The cadet rifle represents a type of arm which is much needed in the country. It will prove of untold value as a means of extending miniature rifle shooting amongst all classes of the community. The progress which has already been made whilst using other and more costly systems of rifle and ammunition suggests that still greater results will be obtained when the new miniature rifle comes into use. It is accordingly the desire of everyone who sees clearly through the present mist of opposing views, that the N.R.A. will give cordial recognition to the new rifle, at the same time realising that it is not the fault of the manufacturer that the price originally in view has been rendered impossible by the turn which events have taken. It is no secret that the change of Government was responsible for abandoning the original intention that public funds should be used to cover the cost of the first delivery of rifles. The money was afterwards refused, and the rifle which emerged from the War Office Committee was certainly not one which would lend itself to economical manufacture on the necessarily small and uncertain scale of output which must exist when several manufacturers divide the business. To the practical gunmaker the surprise is not so much the high cost of the cadet rifle as its extreme cheapness. It is a military rifle on a small scale, and its low cost can only be justified on a price basis of so much per pound dead weight.

EXPLOSIVES REPORTS FROM AUSTRALIA.

VICTORIA.

Mr. C. Napier Hake has issued his report on the working of the Explosives Act in Victoria during last year. After referring to the special work carried out in connection with the bursting of Lee-Enfield rifles, full particulars of which have already been given in these columns, the Chief Inspector proceeds to deal with importation, and under that heading appears the following table showing the kinds and quantities, and estimated value of explosives which passed into Victoria during the year 1905:—

Gelignite	1,086,050 lbs., valued at	£48,872	5 0
Gelatine Dynamite ...	303,950 ,, ,,	15,957	7 6
Blasting Gelatine ...	166,050 ,, ,,	9,963	0 0
Cheddite	47,750 ,, ,,	1,313	2 6
Robbinite	4,000 ,, ,,	90	0 0
Powder, Fuse ...	70,050 ,, ,,	1,379	2 4
Powder, Blasting ...	232,500 ,, ,,	3,952	10 0
Powder, Sporting ...	53,700 ,, ,,	6,859	17 6
Total ...	1,964,050 ,, ,,	£88,387	4 10
Detonators	2,728,000 ,, ,,	£4,092	0 0

The above total importation of 1,964,050 lbs. compares with 1,786,750 lbs. for the year 1904, and shows a total increase of 177,300 lbs.

During the year under review the blasting gelatine imported from European ports was not of a satisfactory nature, 15,200 lbs. being condemned during the year. One consignment of 10,000 lbs. showed signs of instability. A chemical examination of the whole of the dates of manufacture contained in the consignment showed that the defect was confined solely to one batch of 2,500 lbs. This batch was destroyed, and the balance of the shipment (7,500 lbs.) was allowed to pass into consumption. One consignment of 4,750 lbs. was, on arrival, found to be exuding badly, and was destroyed. One consignment of 8,700 lbs., on arrival, was found to contain a considerable number of exuding cartridges, and was condemned as unfit to pass into consumption. At the request of the agent, however, the consignment was gone through cartridge by cartridge, with the result that 8,150 lbs. were obtained free from exudation, the same being passed for consumption on condition that it was used up at once. The exuding cartridges were returned to the port of origin. One consignment of 12,000 lbs. was, on arrival, found to contain a large proportion of cartridges which were exuding badly. The consignment was condemned, and treated similarly to the foregoing consignment, with the result that 4,600 lbs. were obtained free from exudation, and were conditionally passed. The balance of the consignment, viz., 7,400 lbs. was returned to the port of origin.

The whole of the cheddite imported during the year complied with the requirements of the Act. The gelatine dynamite imported during the year from European ports was of a very satisfactory nature, and practically the whole of the consignments was passed. The condition of the gelignite imported during the year was, taken as a whole, satisfactory. Only one consignment (70,000 lbs.) from a European port, was condemned for exudation. The consignment was treated in the same way as the exuding blasting gelatine, with the result that 32,400 lbs. (about 46½ per cent. of the consignment) were obtained free from exudation, and were conditionally allowed to pass into consumption. The balance of the consignment (37,600 lbs.) was destroyed.

A sample of safety fuse which failed to comply with the legal definition of safety was made the subject of some very interesting tests. A sample of the fuse was examined by means of X-ray photographs which showed that the column of powder forming the core of the fuse varied in thickness. In another piece a complete break in the continuity of the core was disclosed. The remainder of the report shows that the work of the department under the headings of manufacture, storage, licensed premises and so forth has been carried on with the usual care and attention. No accidents by fire or explosion occurred during the year in the manufacture, storage or transport of explosives.

WESTERN AUSTRALIA.

MR. E. A. MANN'S official report on the working of the Explosives Act in the above State for last year contains numberless instances of the safer and better organised conditions which have resulted from his work as Chief Inspector. The following table gives a useful idea of the nature and amount of explosives dealt with in the course of the year, the values referring to the importations during 1905:—

Blasting Gelatine	522,500 lbs., value	£32,797	
Dynamite	14,000 ,, ,,	616	
Gelatine Dynamite	240,000 ,, ,,	14,046	
Gelignite	2,384,600 ,, ,,	111,013	
Explosives (N.E.I.)	,,	2,501	
Explosives for the Army ...	,,	140	
Fuse	633,876 coils ,,	14,762	
Blasting Powders	240,400 lbs. ,,	5,026	
Sporting Powder	1,025 ,, ,,	97	
		£180,998	

The details are of a more complete and reliable nature than have previously been obtainable. The aggregate importations show a falling off as against the previous year, as the following comparison will show:—

Year	1901	1902	1903	1904	1905
Total Value	£152,287	£189,747	£178,836	£199,565	£180,998

There is every indication that the big storage reserve or depôt at Fremantle has proved a great success, in regard to both the speed and economy with which shipments of explosives can now be handled. Mr. Mann refers with great appreciation to the benefits which have been derived from the appointment of a travelling inspector in the person of Mr. A. J. Guest. Some notion of the distances which must be covered in the course of a round may be gathered from the following list of places which have received one or more visits:—Kalgoorlie, Coolgardie, Cue, Day Dawn, Mt. Magnet, Yalgoo, Black Range, Geraldton, Albany, Esperance, Norseman, Menzies, Kookynie, Malcolm, Leonora, Morgans, Laverton, and Lawlers.

Mr. Mann's work includes the making of a large number of analytical tests for various government departments, the total number for the year being 4,346, an advance of 827 on the previous 12 months. The staff includes, besides Mr. Mann and Mr. Guest, three clerks, eight analysts, two magazine keepers, and three watchmen.

THE BISLEY MEETING.

THE rifle meeting just passed has been voted a complete success by all who are in a position to compare one such gathering with another. It is not of course possible that one year can differ much from its predecessors, but the small distinctions which seem to count appear to favour the view put forward. Nothing of startling interest was brought into prominence by the ordinary volunteer competitions. The new 200 yards target was duly condemned in the manner anticipated for the reason that it unfairly punished all classes of shots because of the extreme smallness of the bulls eye area. The new short rifle was with equal expectedness condemned as a target weapon by the neglect it received from the various army teams, who would have used it as a matter of course had it been judged capable of seriously competing with the full-length service rifle.

The new windgauge sight was not by any means accepted as the boon which its designers expected it would prove. At 200 yards it was certainly used by most of the shooters, because it could be set once and for all to correct the prevailing wind of the moment, variations from shot to shot being very small at this distance and of a kind which can be corrected with a fixed sighting by aiming right or left of the bottom edge of the bull. At the other distances the impossibility of making fine corrections when once the shooter had raised the rifle to the shoulder caused the old bar sight with lines to be largely used. The windgauge not being fitted with a micrometer traversing screw, small corrections could only be made by carefully watching the scale whilst tapping the bar right or left with an empty cartridge case. With a thumbscrew to control the lateral adjustment the shooter would be able without removing the rifle from the shoulder to give the milled head a half or quarter turn. The reduced delay would thus make it possible to keep pace with ordinary changes of wind. Another point at issue confirms the relative desirability as an aligning mark on the backsight, of a plain bar with a white line and a V-notch. Some people maintain that the V-notch is preferable at all distances if it can be made sufficiently mobile; others contend that the plain bar gives the best conditions of aiming under all circumtances. The ordinary target shooter is by long custom attached to the plain bar, and his verdict on the subject is not strictly free from bias.

A good deal of interest was displayed in the working of the new rules for miniature rifle shooting. A shooter might use any rifle which his fancy favoured without regard to its precise cost, and there was no evidence of attempts to use weapons of exceptionally high value in order to secure a slight advantage. The necessity to use open sights did not prove a serious stumbling block, and it was pleasing to notice that some of the best known exponents of aperture sighted rifles showed themselves quite at home with open sights when defined with orthoptic spectacles. This clearly emphasised the old belief that a good shooter can show his true form under any reasonable variation of conditions. More than this the rifles whose reputation for accuracy is based on first-class records made with Lyman sights proved accurate and trustworthy when fitted with the simple notch and barleycorn. Both parties may claim to have scored from this experience. The advocates of the aperture sight have been right all along in saying that the person who learns to shoot with a rifle so fitted is acquiring the true art of marksmanship, and that if an aperture is allowed in the form of spectacles surely there is no logical objection to its attachment to the rifle. The open sight enthusiasts are equally entitled to claim that as there is no insuperable difficulty in securing reasonably good results with miniature rifles so fitted practice at short distances should be conducted on these lines. Even if neither side is quite satisfied with the attitude adopted by its opponents the fact is established that the National Rifle Association may push open sights, and the Society for Miniature Rifle Clubs the Lyman sight, without injury to one another, or to the cause which both are engaged in promoting.

The new revolver ranges have only produced one regrettable result, viz., to withdraw some of the small inducement which previously existed for visitors to go to the most unfrequented portion of the Camp. On the other hand the duplicating of the running deer range and the extended accommodation for miniature rifle shooting have to some extent filled the gap. It seems probable at least that in years to come the miniature rifle ranges will occupy a position of considerable importance. If the competitions can be framed on a more popular basis more shooters are likely to attend. The worst blot on the pleasant system is the undue intrusion of restrictions of definition. The result is that a separate rifle is required for practically every competition; and the shooter who thinks his own rifle good enough is unable to use it. Assuming that gunmakers are philanthrophists first of all there is no reason why the conditions of each competition should not be so restricted that shooters will look to the trade to supply the necessary equipment of rifles free of charge. If on the other hand there lies at the back of the gunmaker's mind a feeling that once in a way he would like to sell a rifle then the proper course will be to endeavour to bring about the throwing open of all competitions to every class of rifle, so that each marksman will make a point of purchasing a new and perfect arm of the particular type he favours, with a view to drawing first blood with it at the Bisley Meeting.

Ammunition successes have certainly proved an important feature of the meeting just passed. The Palma cartridge has more than upheld its former high reputation. The credit for its success is no longer shared with the Waltham Abbey factory, since Curtis's & Harvey have this year supplied the very perfect powder which is contained in this celebrated match rifle cartridge. With the King's Norton Company there remains as before the credit for turning out a brand of ammunition so perfect in regard to every detail that it passed the match rifleman's tests to the extent that the ammunition was never once blamed for being the cause of unaccountable shots. Eley's brand of ammunition, as supplied for use at the revolver ranges, is always good; but this year it seems to have gone one better than before if one may judge from the comments of the users. The Kynoch Company also enjoyed several notable triumphs for their club rifle cartridges. The best groups at the short ranges seem uniformly to have been made by this firm's loading. Everyone has thus had a show, even the Government with their ·303 ammunition. This, although not showing remarkable conformity as judged by laboratory testing, has nevertheless given evidence of general regularity and consistent elevation.

SINGLE-TRIGGER LITIGATION.

ROBERTSON v PURDEY.

Mr. Justice Buckley delivered a very important statement concerning events which have arisen in connection with the above case.

Mr. T. Terrell, K.C., and Mr. Courtney Terrell, instructed by Mr. George Cheesman, are counsel for the applicant, and Mr. A. J. Walter, instructed by Messrs. Ellis and Ellis, represent the respondent.

JUDGMENT.

Mr. Justice Buckley.—This is an application by the plaintiff in the action that he be at liberty to discontinue. After defence he took a further step in the action by serving a reply, and consequently under order 26, it is ruled that he can only discontinue with leave. Of course that rule provides that I can give the leave on such terms as to the costs, and as to any other action and otherwise, as may be just.

After the plaintiff had delivered his reply, the defendant on the 7th June applied for leave to amend his particulars of objections. On that there was disclosed to the plaintiff something the defendent wanted to set up. He had not set it up, and could only do it with leave. The defendant abandoned that summons, but Mr. Thomas Terrell in opening the case before me said very frankly that the summons for leave to amend the particulars of objections disclosed to the plaintiff something which assured the plaintiff that he was wrong and that his action would fail unless he could not only disclaim but make a correction in his patent. He has said quite frankly at the bar that what he wants to do is not to disclaim, which under Section 19 of the Act he could do with leave pending the action, but he wants to correct, which under that Section as it has been construed, the Judge could not give him leave to do pending the action.

The question for decision is whether in that state of facts I ought, or ought not, to impose as part of the terms, that he shall not bring any other action against the defendant in respect of any infringement alleged in the pleadings in this action.

I am of opinion that I ought to impose that term, and for this reason. After an action has been brought for infringement, Section 19 of the Act provides that the Court or a Judge may on terms allow the plaintiff, the patentee, to amend his specification by way of disclaimer; but it has been decided that that Section does not extend to allow an amendment by way of correction or explanation. So that in this pending action the patentee could not with any leave which the Court could give him sue upon a corrected patent, but he must in this action sue upon an uncorrected patent, and if upon the uncorrected patent he would fail, he must fail.

That being the state of facts, if I were to give him leave to discontinue this action without imposing the term in question I should be doing this: I should leave him in a position to bring a subsequent action in which he could sue upon the same footing as if in this action I had given him leave to correct his patent, which is the very thing which, under the Act of Parliament, I cannot do. In other words he wants leave to discontinue this action upon the terms that he shall be at liberty to bring a subsequent action, with a cause of action open to him which could never be open to him in this action.

It seems to me that that would be unjust. Of course on this application for leave to discontinue the action the sections of the Act of Parliament are, in a sense, not applicable at all. I am not deciding anything under the Act: but I have to consider how my judicial discretion ought to be exercised, bearing in mind what the effect of the Act is, if this action goes on. In that sense it seems to me that if I were to give leave to discontinue this action without imposing this term, I should be, so to speak, repealing the Act of Parliament: I should be enlarging Section 19 so as in substance, though not in form, to allow the plaintiff in the action to correct his patent pending the action. That is the very thing which the statute, as construed, says I ought not to do.

For these reasons it seems to me that in this case I have this special circumstance, that the plaintiff says:— "I want the order to discontinue to be given me in such a form that I shall be able to sue on a corrected patent, which in this action I cannot do." It seems to me the defendant is entitled to say that it is not fair to go on with this action in such a form as the statute allows, or discontinue this action if you will, on payment of costs, which is merely money, but then your new action must be brought upon the same terms as if you had gone on with this one.

I think, therefore, that the proper order is this, that the terms imposed shall be that the plaintiff shall not bring any other action against the defendant in respect of any infringement alleged in the particulars of this action, and that he shall pay the defendant his costs of the present action, with a direction to include therein costs of the defendant's particulars of objections as if they had been certified as reasonable and proper at the trial. On those terms I will give leave to discontinue, if not, I refuse this application, and if the latter alternative is taken, then there will be no order upon the application except that the costs be the defendants costs in any event.

Mr. Courtney Terrell.—My client will decide to take the risk and go on with the action.

Mr. Justice Buckley.—Very well, then there is no order except that the costs be Mr. Walter's costs in any event.

Mr. Courtney Terrell.—If your Lordship pleases.

In the third edition of *Modern Rifle Shooting* Mr. L. R. Tippins, after giving a table of rifle bullet densities, says: "This table was supposed by the editor of a technical paper to have been copied from his publication; and he for this reason or some other unknown to the writer, had the distinction of publishing the only 'nasty' review of the book which ever appeared in print. It is sufficient to say here that the table was the writer's own independent idea, and was drawn up and completed months before the table from which it was supposed to be copied was published." We deny the sufficiency of this explanation. Priority goes with publication, and the table was first published in *Arms and Explosives*. Moreover Mr. Tippins was forced to admit that a part of the table had been copied from this journal. Following this admission we specified other coincidences which seemed only to be explainable on the same basis, but no further reply was vouchsafed. We should not have referred to the matter again, but misleading statements which are put forward after the lapse of a period sufficient to deprive the question of authorship of the slight interest it may have originally possessed,

ROUND THE TRADE.

The next sale of fireams at Debenham's auction rooms has been fixed to take place on the 15th inst.

The Roburite directors have declared an interim distribution on the preference shares at the rate of 10 per cent. for the six months ending June 30.

It has been reported that the Coventry Ordnance Works, Ld., contemplates the erection of a large works in Canada for the manufacture of the ordnance requirements of that dependency, in addition to the establishment of a regular engineering business.

A correspondent, who forwarded a report on Chinese gun manufacture to the *Toronto Globe*, states that the gun factory near Shanghai is in full operation and that the manufacture of the '88 pattern Mauser rifle does not exceed 300 per month, a rate of working which represents about 25 years for the arming of 100,000 men.

According to the *Gorny Journal* the B. V. Vinner Powder Company, whose manufactures cover various types of explosives, have closed its seventh (1905) working year with a profit of £24,854 against £28,444 in the preceding year. The sum of £13,800 will be distributed by way of profit, making a little over 9 per cent., as against rather more than 11 per cent. in the previous twelve months.

In connection with the re-arrangement of the shares of the New Explosives Co., Ld., and the finding of fresh capital, a new company has been formed, with the addition of the year 1906 to the title, for the purpose of taking over the business and assets of the old company. When the transfer arrangements have been completed steps will doubtless be taken to resume the old name.

At the annual meeting of the Kynoch Company Mr. Arthur Chamberlain spoke with great confidence of the business prospects. Orders from the Government occupied a less important position than formerly, but there had been a compensating increase in other directions. In the course of the proceedings mention was made of the loss sustained by the death of Mr. J. P. Lacy, one of the directors.

The latest addition to the ranks of metropolitan shooting schools is one which has been installed at Worcester Park, in Surrey, a spot situated within approximately equal road distace of Wimbledon, Sutton, and Surbiton. Mr. Brooking, late of Blagdon, is in charge. The school aims at meeting the requirements of those gunmakers who are unpossessed of their own establishment for gun fitting and practice.

Messrs. Charles Osborne & Co., Ld., are wise in their determination to pursue their policy of issuing apart from their ordinary catalogue a list of standard guns and rifles of assorted prices which can at all times be supplied from stock in large and small quantities. The temptation of cataloguing a needless number of variations of a parent type of arm necessarily exists in every business where manufacture is largely carried on with the aid of hand labour. Messrs. Osborne have been amongst the first to recognise that hand labour, like machinery, can be organised to do cheaper and better work if attention is concentrated on a limited selection of models. Granting that the principle underlying the new edition of the standard list is good, the same praise cannot be unreservedly applied to the manner of its carrying out. Many of the blocks used are obviously old fashioned and worn out, being certainly unworthy of the paper and type used in connection with them. It is interesting to observe that the manufacturers' selection of mechanism, with its wealth of technical phraseology has been omitted, except in the case of muzzle-loading guns. The buyer is obviously most interested in the weight of his gun, the boring of the barrels, their length and weight, the latter affording a useful indication of balancing properties. The particulars given under these headings might be somewhat enlarged, as also the statistics of barrel calibre and degree of choke, points upon which the modern sportsman is oftentimes desirous of having information.

The directors of the Vickers-Maxim Company have declared the usual half-year interim dividend of 15 per share.

The B.S.A. and London Small Arms Companies have presented several rifles for prizes in competitions taking place at the Boys' Bisley Meeting. The firm of Bonehill have also given ten Britannia air rifles in the same connection.

In Tiverton, North Devon, the fire brigade was called out by the novel device of projecting an exploding rocket into the air. Whatever may be the public sentiment towards fireworks for such a purpose, the fact remains that there was a rapid muster of the brigade.

A meeting of the shareholders of the Birmingham Small Arms Co., Ld., was held on the 16th ult. to consider a resolution with regard to the building up of an undisclosed reserve. The resolution was carried by a large majority, in spite of active opposition by certain shareholders.

The new Eley catalogue continues to merit the high praise which recent issues have elicited by reason of the many valuable statistical *data* which its pages contain. The tables of military and sporting cartridge values for velocity and bullet energy are most useful and quotations from these tables have the full authority of official figures. The table of standard shot-gun loads is good as far as it goes, but it might with advantage be carried much further.

Amongst the novelties on show at the Bisley Meeting was the Essex-Barratt repeating magazine rifle, the same being specially designed to allow exceptionally rapid recharging of the magazine whereby a high rate of fire can be maintained for a sustained period. The claim that 40 shots can be fired in a minute should of course be supplemented by information as to the state of the rifle after undergoing this treatment. An ordinary military rifle suffers very severely from the heating effect due to the number of cartridges which can be fired in a minute.

The Reloading Miniature Ammunition Co.. Ld., is the name of a syndicate which has been formed to take over the manufacturing and trading rights of a device for rifle practice at short ranges. It is generally understood that it is the Trask system of adapter which is referred to. This consists of a steel dummy in the form of a cartridge case into which a bullet can be inserted at one end, and a self-contained cap and powder charge, in the form of a blank-fire cartridge, at the other. The adapters can be used over and over again, and the shooter re-charges a supply of these steel cases previous to each series of shots.

The London Small Arms Co., Ld., have forwarded to this office a copy of their descriptive pamphlet on the new War Office miniature rifle. As an example of high-class printing and well-arranged make-up, this booklet is one of the finest pieces of work it has been our pleasure to examine. The wash reproductions of various views and parts of the rifle represent a standard of illustration far beyond ordinary experience. Notwithstanding the view that good wine is not improved by advertisement, one cannot help feeling that a rifle will the more easily find a wide market if attractively described in a handy booklet. This essential to commercial success the London Small Arms Company have certainly secured for the new cadet rifle.

Major Cooper-Key has issued a report relating to the accident at the Blackbeck Gunpowder Mills which took place on the 30th of April last. Although it is difficult in such cases to find any definite evidence of the promoting cause of the accident there appear in this instance to be grounds for the belief that a loose shafting connection possessed an amount of play quite capable of causing the ignition of the gunpowder dust which strews the house where the corning operation is carried out. An examination of the loose shafting caused Major Cooper-Key to allege bad workmanship on the part of the erectors, Messrs. Stevensons, Ld., of Preston. This firm in their defence claim that they cannot admit responsibility in view of the fact that the work was put in as long ago as the year 1900 and that since then the machinery has neither been inspected nor repaired by them.

LECTURES TO YOUNG GUNMAKERS.

XXXVII.—OBSTRUCTIONS IN GUNBARRELS AND THE EFFECTS PRODUCED.

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

No excuse is needed for bringing this subject to the notice of our readers. A year never passes without barrels being burst; and the gunmaker has frequently to exercise his judgment on the causes likely to have produced the clearly evident results. Obstruction is the most frequent explanation; but sometimes this has to be put forward because no other seems possible, even when there is a lack of evidence, other than that of the injured barrel itself, to support the case. Such doubts mainly exist because no details have been published with regard to the exact effects produced by various known forms of obstruction, and also because there are rival theories of the manner in which an obstruction gives rise to excessive pressures. There is no doubt about an obstruction being able to ring-bulge or burst a barrel, because many have been the examples cited to show that a weighty body in a barrel will act disastrously when a shot is fired. A clear and comprehensive understanding of the causes which give rise to the high pressure produced by an obstruction is the first essential to a proper diagnosis of a burst barrel. When an estimate is formed of the amount of pressure necessary to produce a bulge or burst, and note is duly taken of the character and mass of the obstruction which would produce such a pressure it becomes a simple matter to sift the evidence and ascertain, not only if an obstruction was the cause, but also within limits the nature of this obstruction. To take an example, a sportsman one day on firing the first two rounds in his shot gun bursts both barrels at the same distance from the breech, viz., about 15 ins. The bursts have the characteristic appearance of those produced by obstruction. The barrels are thin at the place of injury, and it is estimated that they would give way under a pressure of less than two tons. Now this pressure would arise from an obstruction weighing about sixty grains, or in the presence of causes producing a resistance equivalent to that arising from an obstruction of this weight. The most reasonable assumption is, at once, that the shot gun had been left filled with some substance at the time of last cleaning which had not been removed.

Having access to a large number of experiments on bursting barrels by means of obstruction, and also to measurements of the actual pressure produced in a test barrel of great weight by similar obstructions, we are able to speak precisely on a subject which has hitherto been considered mainly on the basis of speculative theory. The only rational way of setting out the conclusions to be derived from these experiments is in relation to the ideas which it was intended to confirm or refute. The views which have at times been put forth to explain why an obstruction ring bulges or bursts a barrel must be examined first of all. The imprisoned air theory presupposes that the air between the moving shot charge or bullet and the obstruction is compressed and so gives rise to the high pressure which produces the damage. This view was for a long time the prevalent one. It is reasonable to suppose that Professor George Forbes' paper, printed in the proceedings of the Royal Society, Edinburgh, 1878-9, on "The Bursting of Firearms when the Muzzle is closed by Snow, Earth, Grease, etc.," must have given birth to this notion. Professor Forbes showed that owing to the projectile moving at nearly the same rate or faster than air can expand the obstruction will not merely be pushed out, but that the projectile will strike the obstruction with full velocity and the pressure necessary to impart velocity to the obstruction is the pressure which causes the burst. The Professor assumed that this pressure exists in the imprisoned air, and never for a moment did it appear to him that this active pressure might be in the powder gases in the rear of the projectile. It can be shown that the pressure must be in the powder gases. There are other doubtful assumptions in Professor Forbes' paper which do not concern us.

The following experiments have been made in a 12-bore to test this theory. Brass obstructions were made of a weight equal to 1⅛ oz. of shot and the usual wads. One set were made with a hole through them half the diameter of the bore, and the other set solid. In the first instance these were shot in a single barrel, and the burst with respect to the original position of the obstruction was noted. This information was used in taking the pressures, the obstruction being placed so that the high pressure would arise on a pressure piston. The two classes of obstruction, viz., those with a hole and those without a hole, gave what must be considered under the circumstances as identical results, both as regards the tests in the proof barrel and in the ordinary shot gun barrels. This proved that the air imprisoned in ordinary cases of obstruction between the obstruction and the moving charge is in no way responsible for the effects produced. Again, when testing barrels made of different steel, an obstruction was used which consisted of seventy grains by weight of ⅛in. copper wire bent into a coil just gripping the barrel. The hole allowing free egress of air was thus half-an-inch in diameter. This obstruction bulged or burst ordinary 12-bore barrels in the usual manner. One may, therefore, dismiss as untenable the imprisoned air theory.

The air theory has been criticised by experts on many occasions. In its place it has been suggested that it is the compression of the moving shot charge or of the obstruction, and possibly of both, which produces ring bulges and burst barrels. This idea was certainly mooted in respect to the widespread destruction of express rifles which arose under the old system of proof. Formerly these rifles were proved with comparatively long columns of black powder and a long heavy soft lead bullet. This proof ring bulged a considerable number of barrels during a single year, and one experimenter who replaced the lead projectile by a steel one and observed no ring bulges came to the conclusion that the compression of the long column of lead was the cause of the trouble. This conclusion could be shown to be inaccurate in the light of more recent rifle experiments, but it is sufficient to rely on the results of certain 12-bore gun experiments, the same forming part of those quoted earlier. In the trials under this head the cartridges used were loaded with the usual shot and also a brass solid cylinder weighing 1⅛ oz. The obstructions consisted of a charge of shot together with the usual wads, and also the solid and hollow brass pieces already mentioned.

Under all combinations of test with these cartridges and obstructions the pressures recorded were practically identical, so showing that the compression of the bodies impinging on one another as not responsible for the high pressure which causes the injury to barrels.

This brings us to the last theory which it is hoped may ultimately be accepted as the true explanation, viz., that the high pressure produced in barrels when the projectile meets an obstruction and is thereby checked in velocity, owes its origin to the moving gases in the rear of the projectile. Before the shot strikes the obstruction the forward powder gases are moving at the same rate as the projectile. When the velocity of the projectile suddenly receives a check the powder gases tend to move on and produce a localised wave of pressure of such intensity that the cushion of gas so formed might rebound in the manner of a rubber ball striking a hard surface. In a highly elastic medium such as the hot powder gases the layer nearest the projectile will obviously be the most compressed, and, therefore, would produce the small area of high pressure which is manifested by the characteristic ring in a barrel injured through the presence of an obstruction. This theory would stand accepted by the process of climation which has been adopted, but the acceptance of the most plausible of the explanations suggested, is not sufficient in itself, being at best only a negative reason. The conviction of the reader can be carried much further by showing that the pressure produced by an obstruction is directly proportional to the decrease in velocity such obstructions effect in the projectile. It is also possible to quote some actual pressure readings conducted by M. Vieille under conditions closely reproducing those which obtain where a projectile strikes an obstruction.

If we ignore the effect on velocity which the wave of pressure might have, then when a projectile of one ounce weight strikes an obstruction of one ounce the velocity will be reduced to one half, and generally if a projectile of weight w having a velocity v strikes an obstruction of weight M then the velocity after impact will be

$$v \frac{w}{w + M}$$

the reduction in velocity $v \left(1 - \frac{w}{w + M}\right)$. We have found that if the reduction in velocity is multiplied by $\frac{134}{10,000}$ the product is the rise in pressure produced. The following calculated and average observed pressures are now put in for argument and to be dealt with later in detail:—

OBSTRUCTION PRESSURES.

Calculated.	Average Observed.
4·0 tons	4·0 tons
6·3 ,,	7·7 ,,
7·4 ,,	7·1 ,,
8·3 ,,	7·6 ,,
8·7 ,,	8·6 ,,
9·0 ,,	9·3 ,,

This empirical rule supports the wave theory to this degree that the greater the reduction in velocity the more excess velocity will the powder gases have and obviously the greater will be the wave pressure produced. Mathematicians who are able to give an opinion say that the subject is beyond mathematical analysis, so that we cannot confirm this empirical result by *a priori* considerations. We can now consider evidence of an entirely different nature. *M.* Vieille published in 1890 in the *Memorial des Poudres et Salpetres* a research entitled the "Study of Wave Pressures produced by Explosives in closed vessels." Now when a given weight of an explosive is fired in a closed vessel the pressure produced must always be the same, because it depends on the heat and volume of gas given off by this given weight of explosive. We ignore the condition which exists when the rate of burning is so slow that cooling affects the maximum pressure. This being so the method of firing and the disposition of the charge in the closed vessel cannot affect the maximum pressure unless it brings into play some other factor. For instance if the gases were given a motion in any direction these gases if they struck the piston's base would compress the crusher more than if this movement did not exist. In artillery abnormal pressures are at times observed and called wave pressures. These are produced by the movement *en masse* of the powder gases due to the ignition not being general. Vieille's investigations were made to illustrate this. We will consider only one of his closed vessels, viz., that having a diameter of 0·866 in. and a length of 35 inches. This vessel had a crusher apparatus at each end. Only two kinds of loading concern us, one where the explosive lies uniformly the whole length of the tube (symmetrical loading), and the other where it is placed all at one end (unsymmetrical loading). The following table will illustrate the evidence which may be brought to bear on the problem under consideration:—

Explosive used.	Density of Loading.	Pressure when loading is		Percentage increase of pressure due to wave.
		Symmetrical.	Unsymmetrical.	
B. F.	0·1	7 tons	11 tons	57
,, ...	0·2	15·5 ,,	47·5 ,,	207
B.S.P... ..	0·2	13·0 ,,	29·7 ,,	128
Smokeless Sporting S. ..	0·2	5·7 ,,	13·0 ,,	128
Black Powder	0·5	14·5 ,,	40·3 ,,	178
Nitro-Cotton ..	0·1	11·0 ,,	35·5 ,,	222

In these experiments for the unsymmetrical loading the powder ignited at one end is transformed into gas and rushes forward, strikes the opposite end and develops a wave of pressure which is reflected backwards and forwards with less and less violence until the movement finally stops. This action was shown by mounting a closed vessel as a pendulum and noting the swing. Can we not say that there is a little doubt that the effects produced by obstructions are due to the velocity of the projectile sinking below that of the powder gases, the base of the projectile thus behaving similarly to the ends of the Vieille closed vessel the wave of pressure arising as explained.

In the next issue certain details of experimental results will be quoted at length with a view to showing the bearing these results have on barrel construction, assuming meanwhile that the present instalment has sufficiently sorted out and given a proper place to the various fundamental theories which have been advocated at one time and another. The relation of barrel strength to the pressure caused by obstructions will be shown amongst other matter.

THE EXPLOSIVES REPORT FOR 1905.

In this year's Explosives Report the statistics of accidents have been amplified in a way which gives a true measure of the comparative immunity from fatal accidents which is enjoyed by the workers in the danger area. In the ordinary reports the bare statement of deaths per annum has been difficult to express in correct statistical form by reason of the lack of knowledge of the number of persons employed. The missing items are supplied every five years, and the very interesting graphical chart which is reproduced in the current report shows that during the past 20 years the number of persons employed in danger buildings has risen from 2,136 to 5,888, truly a marvellous tribute to the growth of this important industry.

The death-rate per 1,000 from explosions in manufacture for each quinquennial period during the years under review is shown to be respectively: 4·2, 1·9, 1·2, 1·0, and 1·5. The total accidents being so few the records, even when smoothed by 5-year averages, show a certain amount of fluctuation, not on the right side as regards the last value, but generally speaking the records form a monument to the care of H.M. Inspectors of Explosives. The diminished death-rate has been accompanied by such a vast increase in the size of the factories as to leave no doubt that the Inspectors have done their work without hampering trade. Possibly the effect of the policy for which they are responsible has been to diminish cost of manufacture by lowering the losses due to destructive accidents. However this may be, it is interesting to notice that if the life risk of a danger building employee is taken at 1·2 per 1,000, in 25 years' service 30 men in every 1,000 would lose their lives by explosion. This gives a chance, roughly, of one in 32, which means that of 33 men who look forward to 25 years' service in the danger area of an explosive factory only one will be cut short during his career.

In Dr. Dupré's report on the chemical work of the department he mentions that the number of samples rejected during the year is again rather high, due mainly to the number of permitted explosives, whose composition was found not to be within the limits laid down. Although no special work of general interest has been done during the year, much time has necessarily been devoted to working out the methods of analysis for the various explosives submitted. Their composition has become increasingly complex, so adding to the difficulties of analysis. A new method of estimating moisture as distinguished from volatile matter has been devised. It depends on the evolution of acetylene from carbide of calcium, over which the vapours from the explosive are made to pass. Some interesting research work has been carried out in connection with the heat test. One of the points receiving special attention relates to a method of eliminating the action of oxidising agents, such as active oxygen or peroxides which may be present in the explosive.

The following particulars of importations are abstracted from the list given in an appendix to the report:—

Baelenite—J. Russell	4,600 lbs.
Ballistite—	
Chilworth Gunpowder Co., Ld.	2,362 lbs.
E. J. Coste	30,000 lbs.
Blasting Gelatine—	
Alliance Explosives Co., Ld.	100,000 lbs.
W. Marden & Co.	345,050 lbs.
J. Russell	2,300 lbs.
J. R. Watson & Co.	26,000 lbs.
Carbonite—Carbonite Syndicate Ld... ...	260,600 lbs.
Celtite—	
A. J. Brown & Co.	43,000 lbs.
W. Marden & Co.	25,000 lbs.
Chilworth Smokeless Powder—	
Chilworth Gunpowder Co., Ld.	18,100 lbs.
Cooppal Powder—J. R. Watson & Co. ...	1,600 lbs.
Detonators—	
Alliance Explosives Co., Ld.	1,340,000
W. N. Blakeley	60,000
A. J. Brown & Co.	795,000
E. J. Coste	1,500,000
W. Marden & Co.	7,455,000
C. G. Mueller...	7,648,300
Nobel's Explosives Co., Ld...	4,000
S. Salisbury	1,620,000
J. R. Watson & Co.	8,470,000
Detonators for Fuses—C. G. Mueller ...	200,000
D.R.P.C./00.—Chilworth Gunpowder Co., Ld.	38,785 lbs.
Dynamite—	
Alliance Explosives Co., Ld.	364,750 lbs.
W. Marden & Co.	178,750 lbs.
National Explosives Co., Ld.	17,350 lbs.
Nobel's Explosives Co., Ld.	100,000 lbs.
E. J. Coste	75,000 lbs.
Electric Detonators—	
W. T. Bridges & Co...	4,000
E. J. Coste	1,000
Electric Fuses—C. G. Mueller	20,000
Fuse Heads—Nobel's Explosives Co., Ld. ...	6,300,000
Gelatine Dynamite, or Gelignite—	
Alliance Explosives Co., Ld.	147,500 lbs.
W. N. Blakeley	29,250 lbs.
A. J. Brown & Co.	256,000 lbs.
W. Marden & Co.	1,108,200 lbs.
National Explosives Co., Ld.	12,600 lbs.
J. Russell	20,000 lbs.
J. R. Watson & Co.	12,000 lbs.
Normal Powder No. 2—	
Normal Powder and Ammunition Co., Ld.	12,000 lbs.
Phœnix Powder—	
A. J. Brown & Co.	31,000 lbs.
W. Marden & Co.	15,000 lbs.
Picric Acid—	
W. T. Bridges & Co....	20,000 lbs.
E. J. Coste	82,036 lbs.
Nobel's Explosives Co., Ld.	82,500 lbs.
Watts, Watts & Co.	89,600 lbs.
Russell Gelignite—J. Russell	56,900 lbs.

The references in the report to the administration of the storage regulations by local authorities calls forth the usual remarks to neglect, inattention and general ignorance. A particularly flagrant example is given in connection with the desire of the Inspectors to obtain certain returns from the local authorities in view of the circumstances that the present report completes the thirtieth year of the operation of the Act. The first requisitions were sent out on the 1st May, and on the 21st of June, the time when the returns were required to be sent in, there were 148 defaulters. A second requisition demanded that the missing returns should be sent in within one month, and at the expiry of this period there were still 22 instances of continued inattention. The returns themselves were woefully inaccurate, and the Inspectors quite rightly complain of the difficulties incidental to the decentralisation of control under so technical an Act.

In the section of the report relating to accidents some interesting paragraphs appear dealing with the precautions

which should be observed when firing blasting and other charges. Manufacturers who issue pamphlets of instruction concerning the preparation of charges will do well to revise these publications, in order to make sure that adequate stress is laid on the necessity for taking precautions against those forms of neglect which constitute for the time being the most prolific sources of accidents.

Capt. Desborough's report on the working of the Woolwich testing station contains a most important judgment upon the recommendation and views which have been put forward as a result of comparing continental and English methods, particularly with reference to the adoption of the "charge limite." Upon this point we give the full text of Capt. Desborough's remarks:—

In order to obtain data at first hand regarding this method of testing explosives by firing unstemmed shots, the vertical gallery at Woolwich has been adapted for the purpose. This gallery is constructed of boiler plate, and is circular in section; its diameter is four feet nine inches, and its height is thirteen feet. Pipe connections have been made, so that the gallery can be put in circuit with both the gas holder and the circulating-fan, the inlet pipe is about four feet above the ground level, and the suction pipe three feet lower, so as to ensure a more thorough mixture of the gas and air.

I obtained some explosive from Germany which the manufacturers stated had been tested there with the result that the "charge limite" had been fixed at 500 grammes. For the purpose of obtaining comparative results, I fired this explosive in both the vertical and horizontal galleries into an atmosphere which contained 10 per cent. of coal gas. In the vertical gallery I eventually obtained an ignition with a charge of 375 grammes, but a second charge of this weight failed to fire the gas mixture. Unfortunately there was not sufficient of the explosive available to carry out further experiments, but I do not think it unreasonable to assume that its "charge limite" would be about 350 grammes. When firing the same explosive in the official gallery, with the paper diaphram placed thirteen feet from the gun so as to keep the same length of chamber as with the vertical gallery, I found that the "charge limite" was below 50 grammes.

If the assumption is made that our 10 per cent. mixture does not differ greatly in sensitiveness from the mixture of methane and air used in Germany, the following comparative results are obtained, showing the effect of the varying sectional areas of the galleries:—

Sectional Area.	0·456 sq. metres.	1·65 sq. metres.	1·91 sq. metres.
"Charge limite."	under 50 grammes.	350 grammes.	500 grammes.

Since I have no means of definitely ascertaining how far I am correct in assuming that the 10 per cent. mixture I employed was not more sensitive than the methane mixture used on the Continent, I think that these results can only be taken as showing that, other things being equal, the "charge limite" of any given explosive varies according to the sectional area of the gallery. The reason given us on the Continent for fixing the sectional areas of the galleries at about 1·9 square metres was that this was a sectional area commonly met with in a mine.

If my contention that the weight of the "charge limite" depends very largely on the sectional area of the gallery is correct, it is logical to conclude that this system of testing explosives for use in coal mines draws a purely arbitrary line between those which are relatively safe to use and those which are more dangerous, and only proves that explosives which have a high "charge limite" when used under the same conditions as those to which they were subjected during the test, are only relatively less dangerous. There is another point in which the "charge limite" system appears to be misleading, in that no allowance is made for the variation in power of different explosives. For instance, if we suppose a certain explosive has a "charge limite" of 800 grammes and is only half as powerful as one which has a "charge limite" of 500 grammes, and it is desired to employ a charge of the first explosive equivalent to 450 of the second explosive, the charge required will be 900 grammes, which exceeds the "charge limite" and clearly shows that in this case the explosive with the lower "charge limite" is actually the less dangerous of the two. I am aware that the figure denoting the power of an explosive can only be considered as being empirical; but it is desirable to attempt to classify explosives according to their relative safety, I am inclined to think that the more logical method would be to assign to each a figure of merit arrived at by dividing the number of grammes forming the "charge limite" by the number of grammes which represents such a charge of the explosive as is determined to be equivalent to a standard weight of a standard explosive, such as 100 grammes of No. 1 Dynamite, or by the method given by MM. Watteyne and Stassart in "Les Explosifs de Sureté, 1905," who tabulate the volume of material displaced by the "charge limite."

A few shots were fired to ascertain how far we have been justified in stating that the 15 per cent. mixture used for the official test was considerably more sensitive than the 10 per cent. mixture as formerly used. In the case of the explosive used in the series of experiments I have detailed above, and the "charge limite" of which I have assumed to be about 350 grammes, when fired in the vertical gallery into a 15 per cent. mixture ignitions were invariably obtained with charges of 50 grammes. These experiments were repeated with Carbonite with precisely similar results, but as I did not carry out the series with this explosive in the 10 per cent. mixture above charges of 400 grammes, I have not yet determined its "charge limite," and can only state that it must be not less than 400 grammes in a 10 per cent. mixture; whereas, when the mixture is enriched to the extent of 15 per cent., it is below 50 grammes.

The results of the two series of experiments indicate that in our official test we have two factors which render it in certain respects far more sensitive than the Continental system of testing, namely, the relatively small sectional area of the gallery and the very sensitive gas mixture. So much is this the case that I have always found that charges of a few grammes of any explosive will cause ignitions when fired without stemming; hence the use of stemming is absolutely necessary in our official test. That there is some definite relation between the "charge limites" of explosives when fired with and without stemming appears to be probable from the results of the experiments carried out at Frameries by MM. Watteyne and Stassart; unfortunately the practical difficulties in carrying these experiments to a definite conclusion seem to have prevented these gentlemen from determining the exact relationship.

The three points I have mentioned above, namely, the small sectional area of our gallery, the sensitiveness of our gas mixture, and the use of stemming have such a marked effect upon our test that I do not think with our present knowledge it is reasonable or even possible to compare the Woolwich test with the continental system.

CORRESPONDENCE.

BREAKING UP CARTRIDGES.

To the Editor of *Arms and Explosives*.

Sir,—My attention has been called to your Editorial Note on the subject of breaking up cartridges in the number of *Arms and Explosives* published on the 2nd inst. I have read this with much surprise, remembering the assistance which your journal has given in the past in discouraging illegal and dangerous practices. You seem to be totally unaware that the breaking up of cartridges is regarded by every expert as the most dangerous operation in connection with ammunition manufacture, and is the one which has caused more serious accidents than any other operation of such manufacture. Your article reads as though, immediately after a disastrous explosion in Dublin, you wish to

encourage other gunmakers to pursue the same rash and illegal practice.

Your argument as to the slitting of a single sporting cartridge appears to me to be neither fair nor logical. There is a principle in English law which is expressed in the Latin words *de minimis non curat lex*, and it is most improbable that if any one were detected in opening a single cartridge in that manner he would be prosecuted for illegal manufacture. What the law intended to prevent is just what you appear to wish to encourage, viz., the breaking up of waste ammunition on unsuitable premises.

I believe you are quite wrong in supposing that ammunition manufacturers would refuse to break up waste ammunition for any of their customers.

I have the honour to be, sir,
Your obedient servant,
J. H. THOMSON, Captain,
H.M. Chief Inspector
of Explosives.

Home Office,
54, Victoria Street, S.W.
July 18, 1906.

APPLICATIONS FOR PATENTS.

JUNE 25—JULY 28, 1906.

14,556. Targets. N. Hall.
14,634.* Cartridge Belts. J. Y. Johnson.
14,635.* Progressive Cartridge. A. W. Schwarzlose.
14,715. Targets. G. A. Peters.
14,762.* Time Fuses for Projectiles. Fried. Krupp, A-G.
14,810. Ordnance Sighting. A. F. Petch and F. W. H. Shepherd.
14,811. Ordnance Sighting. A. F. Petch and F. W. H. Shepherd
14,812. Ordnance. A. F. Petch and F. W. H. Shepherd.
14,903. Artillery Sighting. J. D. B. Fulton.
15,073. Sealing the Breech of Fire-arms. G. D. Grant-Suttie.
15,081. Cupro-Nickel Solvent. A. T. Cocking and Kynoch, Ld.
15,114. Ammunition Wrist-band. A. T. Clifton.
15,159.* Sighting. Siemens Bros. & Co., Ld., and F. Turner.
15,185. Shells. J. Donaldson and T. Ansboro.
15,216.* Fire-Arms. B. Behr.
15,236.* Small-Arms. Soc. Anon. Fabrique Nationale d'Armes de Guerre. (Date of application in Belgium, July 11, 1905.)
15,247. Rifling. E. Jones and Kynoch, Ld.
15,323.* Sighting Telescope Mounting. Optische Anstalt C. P. Goerz, Aktienges. (Date of application in Germany, November 7, 1905.)
15,436. Gas Check for Fire-arms. T. Gilbert Russell.
15,464. Ammunition Hoists for Ordnance. A. F. Petch.
15,566 Miniature Rifle Range. G. Collins.
15,665.* Machine Gun Carriage. A. W. Schwarzlose.
15,684. Rifle Range Recorder. V. T. Murché.
15,760. Gun Recoil Brakes. E. J. Mead.
15,769. Foresights. J. Betteridge.
15,837. Projectiles. R. A. Hadfield and A. G. M. Jack.
15,877. Musketry Instruction Device. A. J. Cuming.
15,905. Cartridges. J. Olsson.
16,143. Range finding Apparatus. E. L. Perry.
16,186. Fuses. Sir W. G. Armstrong, Whitworth & Co., Ld.
16,266. Artillery Field Carriages. A. F. Petch and R. Redpath.
16,312.* Percussion Fuses. Fried. Krupp, A-G. (Date of application in Germany, October 16. 1905.)
16,333.* Toy Pistols. C. Adrian.
16,367. Explosive. J. Blum.
16,431.* Apparatus for Instructing Gun-Layers in Pointing Guns. R. D. White
16,488. Breach-loading Rifle. A. Sibenik, S. Sibenik, and A. Sibenik.
16,517.* Projectile Fuses. The Electric and Ordnance Accessories Co., Ld., and R. F. Hall.
16,523.* Sighting Apparatus for Ordnance. Rheinische Metallwaaren und Maschinenfabrik. (Date of application in Germany, May 8, 1906.)
16,588. Range Finders. M. G. Farquhar.
16,076. Nitrocellulose. A. T. Cocking and Kynoch, Ld.
16,700.* Water Cooling Jackets for Guns. O. Imray.
16,725.* Smokeless Powder. C. Claessen.
16,813.* Target. P. M. Justice.
16,882. Explosive. C. E. Bichel.
16,902. Range Finders. J. A. Collett and R. M. G. Knight.
16,975.* Firing Mechanism. P. M. Justice.
17,007.* Percussion Fuses. M. J. C. Dennis and W. Charlesworth.
17,026.* Detonator Fuses. F. Render.
17,060.* Shrapnel Shells. Fried. Krupp, A-G. (Date of application in Germany, December 14, 1905.)

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JUNE 28—JULY 19, 1906.

COMPILED BY HENRY TARRANT.

12,794 (1905). **Aerial Mine.** T. G. F. McCombie, Monkstown, and T. B. S. MacIlwaine, Foxrock, Co. Dublin. The explosive mine described in this specification is designed on the lines of a shell, and is adapted to be thrown from a gun. Its action is similar to that of an ordinary submarine mine. When it strikes a ship and falls in the water a certain water pressure opens a valve and brings about ignition. Accepted June 21, 1906.

13,459 (1905). **Machine Gun Mechanism.** W. Schmied. The machine gun mechanism here dealt with is applicable to that type of gun possessing two barrels—the breech of the one being worked by the movement of recoil of the other. The mechanism is modified in order to simplify it. The breech of one barrel and the cartridge carrier is worked by the recoil of the other through a system of toggle levers. Accepted June 28, 1906.

13,459A (1905). **Cooling Barrels of Machine Guns.** W. Schmied. In order to obviate loss of energy, due to the packing which prevents escape of cooling liquid in the ordinary construction of machine gun, the heat created during firing is transmitted to a metallic body closely surrounding the barrel. This metallic body is directly cooled by water or other liquid. Accepted June 21, 1906.

16,192 (1905). **Bomb Construction.** B. F. S. Baden-Powell, London. A small thin steel case of venticular shape is designed to contain a charge of explosive and a detonator. Such bombs are distributed on the ground to be covered by an advancing foe, and the weight of a man or wheel is arranged to explode them. Accepted June 21, 1906.

16,725 (1905). **Working of Turret Ordnance.** A. T. Dawson, London, and G. T. Buckham, Barrow-in-Furness. The machinery controlled by hydraulic pressure for working turret ordnance is so modified that adjustment and better control may be obtained, more especially in the creeping movements in bringing the gun on to the object. Accepted June 14, 1906.

16,892 (1905). **Semi-Automatic Ordnance.** W. H. Bevans, U.S.A. The semi-automatic device described in a previous patent, No. 8,385, 1901, is arranged so that it may be constructed with or attached to rapid fire guns. It is designed to fulfil its functions no matter how reduced the recoil may be. Accepted June 28, 1906.

19,577 (1905). **Line Marker for Back Sights.** T. A. Pool, Hayle. An attachment is designed to slide upon a bed clipped to an ordinary vernier. The vernier is adjusted upon the back sight to allow for the necessary amount of wind, and a paint brush secured to the attachment is depressed until it touches the sight bar.* A sliding movement of the attachment carries the brush across the bar and leaves a perfectly straight white line. Accepted June 14, 1906.

20,238 (1905). **Grenade Construction.** B. Pedersen, Belgium. A grenade or illuminating bomb with a stick of the same calibre as the gun from which it is discharged, is provided with wings which do not enter the gun. When the grenade is thrown into the air these wings are designed to steady its flight and so give it greater range. Accepted June 14, 1906.

21,350* (1905). **Duplex Single-Trigger Mechanism.** J. Carter, Birmingham.

21,528 (1905). **Improvements in Instructional Apparatus for Training Gun Layers and Gun Setters.** J. E. Bray. (This specification is a secret document.)

22,125 (1905). **Use of Explosives for Motor Driving.** J. de dios Tejada. This patent deals with a method of using high explosives safely for the purpose of producing movement in driving mechanism. A series of charges are detonated in a detonating chamber, and the resultant gases are stored until they are wanted. They are conveyed through reservoirs to separate apparatus for generating power. Accepted June 14, 1906.

3,142 (1906). **Repeating Rifle Mechanism.** J. Lauber, Austria. The breech mechanism and consequently the loading and ejecting operations of the repeating rifle are worked entirely by a very long trigger pull. The breech bolt is pushed forward and a spiral spring is extended through the medium of a system of "lazy" tongs when the trigger is pulled to discharge. At the moment of firing a breech-lock is pushed upwards by the tongs. When the trigger is released the spring contracts and pulls the breech mechanism back into its original position. Accepted June 14th, 1906.

4,053 (1906). **Barrel Recoil Ordnance.** Fried. Krupp, A-G., Germany. Two stops are constructed, one on the crank which automatically operates the breech block, and the other on the side wall of the cradle. These stops are out of contact when the barrel is in the firing position, and they yield to each other when the barrel recoils; but on the return movement they co-operate to open the horizontal movable breech wedge automatically through the crank. The patentees know of the existence of mechanism described in Patent No. 13,738, 1904. Accepted June 21, 1906.

5,507 (1906). **Fuse Cutter and Detonator Plier.** J. W. Ibberson, Sheffield. A hand implement taking the form of a pair of pliers is designed to combine two functions in its construction. The pliers are fitted with a knife blade for fuse cutting, and just above the pivot is a star-shaped opening in which the neck of the detonator case is placed to compress it around the fuse cord. Accepted June 21, 1906.

6,314* (1906). **Manufacture of Nitroglycerine.** H. W. Lake, London (Agent for *Dynamit A-G. vormals A. Nobel & Co., Germany*).

6,925 (1906). **Gas Check for Bullets.** J. H. Barlow, U.S.A. A thin expansible metal cup is so attached to the bullet base as to leave a peripheral recess between the inside of the cup and the base. When passing through the rifling of the barrel the cup is designed to form a gas check and to protect the base of the bullet. It falls away from the bullet after leaving the muzzle. Accepted June 28, 1906.

7,682 (1906). **Ordnance Sighting.** Fried. Krupp, A-G. Germany. Worm gearing is modified by the patentees to adapt it for use with ordnance sights. It is applied to the telescope attachment and serves to bring about the sideway adjustment of the telescope carrier. Accepted June 28, 1906.

8,631 (1906). **Wedge Breech Mechanism for Ordnance.** Fried. Krupp, A-G. Germany. Breech mechanism of the wedge type is provided with an automatic safety device to insure against premature discharge. The safety is arranged to act reciprocally with various other safety devices. Accepted June 14, 1906.

9,748* (1906). **The "Greener" Improved Single-Trigger Mechanism.** H. Greener, Birmingham.

10,562 (1906). **Ammunition Wagons.** Fried. Krupp, A-G. Germany. Ammunition wagons of the class in which the ammunition is carried upright, and the wheel axle and the shaft pass through the body of the vehicle, are strengthened and lightened by the provision of a specially designed ammunition box bottom. The bottom has parts rising from it constructed to embrace the shaft. Accepted June 14, 1906.

10,670 (1906). **Butt Plate for Rifles.** F. T. Murray, Birmingham. A form of butt plate designed to be produced at a lower cost than that at present in use on the Service rifle is dealt with in this patent. Instead of cross drilling the plate to form a hole for the reception of the joint pin of the trap cover, a hinge is formed the various elements of which are held together by a modified construction of spring. Accepted June 28, 1906.

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

SELECTED PATENTS.

MANUFACTURE OF NITROGLYCERINE.

6,314 (1906). H. W. Lake, London *(Agent for Dynamit A-G. vormals A. Nobel & Co., Germany)*. The patentee explains that many attempts have been made to reduce the freezing point of nitroglycerine by adding certain admixtures. Among such additions are acetin, acetic ether, acetone, nitroluse aliphatic nitrates, and particularly monodinitroglycerine. It is asserted that these additions have been of little material value in attaining the desired end, whilst they tend to diminish the effectiveness of the explosive and to develop injurious fumes. Parts of these bodies it is said are even soluble in water.

It has also been proposed in the German Patent No. 58,957 to add polyglycerine procured by heating the glycerine before nitration with concentrated sulphuric acid. According to the patentee's experiments the formation of impurities is greatly increased by this process. No proof based upon experiments for ascertaining whether diglycerines or polyglycerines are formed by the above-mentioned reaction has ever been secured. Any application of the process has for this reason never been put to practical use.

It has been discovered by the patentee that simply by heating nitroglycerine without any admixtures to boiling point for a certain period under atmospheric pressure, and by taking precautions to eliminate the water formed during this procedure, it is formed into diglycerine when the glycerine is allowed to settle, If the temperature of the solution is allowed to rise to 15° C. above the boiling point of pure glycerine a solution of from 60 to 70 per cent. of diglycerine and at the same time a small quantity of polyglycerine is formed.

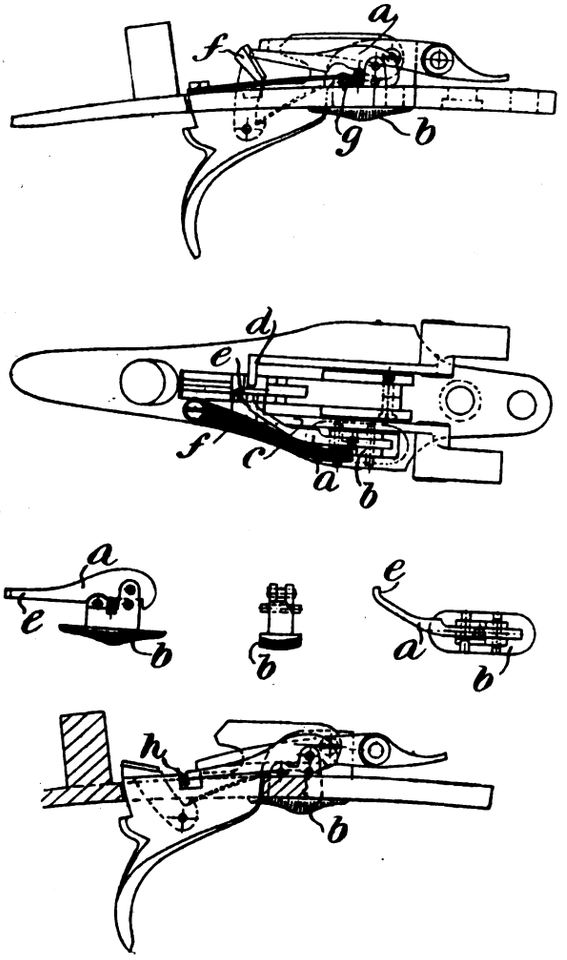
The diglycerine obtained in this way can be added directly to glycerine either in the form of the product resulting from the reaction or after it has been purified by distillation *in vacuo*. This may be done before nitration, or it may be nitrated, and the product of nitration—tetranitrodiglycerine—can be mixed with trinitro glycerine in any desired quantity. For reducing the freezing point this is said to be a much improved method. An addition of 18 to 25 per cent. of diglycerine or tetranitrodiglycerine gives satisfactory results. A nitroglycerine obtained by nitration of a glycerine containing 25 per cent. of diglycerine does not congeal by cooling it to 18° C. Accepted June 28, 1906.

THE "GREENER" IMPROVED SINGLE-TRIGGER MECHANISM.

9,748 (1906). H. Greener, Birmingham. The Greener single-trigger system dealt with in Patent No. 4,156, 1898, is improved by the "selective" device which forms the subject of the present specification. By means of a slide arranged on the underside of the trigger plate a "selecting lever" is arranged to govern the order of firing the two barrels, whether right first and then left or left first and then right. The mechanism is of the kind in which a pendulum is adapted to engage the two sears in succession and which is thrown out of operation by the recoil of the first discharge to prevent involuntary discharge of the second barrel.

With reference to the drawing reproduced herewith the selecting lever *a* is pivoted to the sliding bolt *b* which works in a slot cut in the trigger plate. The bolt *b* is chequered or roughened to allow of its easy manipulation by the finger of the user. The right-hand sear *c* is shorter than the left-hand sear *d*. To arrange for the discharge of the right-hand barrel first, the bolt *b* is impelled rear-

wards so that the tail *e* of the lever *a* is caused to push the pendulum *f* from beneath the left-hand sear and to form a connection between the trigger and the right-hand sear. The first pull raises both the lever and the right-hand sear tails and they are both held in the raised position the sear being "false gaited" and the lever being pushed up by the spring *g*. After the recoil the pendulum returns and takes up its recently vacated position beneath the left-hand sear.



When the lever is in its forward position the tail *e* lies above the slot *h* in the trigger blade and the lever is not raised when the trigger is pulled to discharge the left-hand barrel first. After this barrel has been first discharged the returning pendulum after recoil takes up a position beneath right-hand sear tail and discharges the corresponding barrel when the trigger is again pulled. Accepted June 28, 1906.

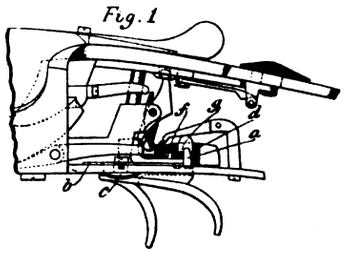
THE "CARTER" DUPLEX SINGLE-TRIGGER MECHANISM.

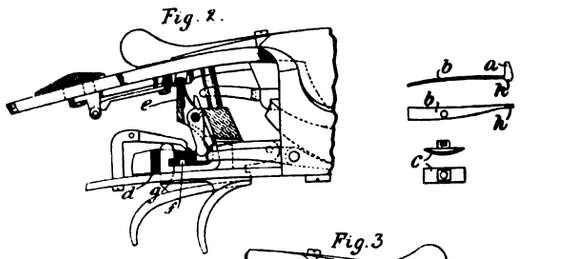
21,350 (1905). F. Carter, Birmingham. The improved duplex single-trigger mechanism set out in this specification should be considered side by side with the first invention, a full description of which appears in Patent No. 20,208, 1904. The duplex system consists briefly in adapting the ordinary double-trigger arrangement not only to fulfil its own function of discharging either barrels through the medium of its corresponding trigger, but also to discharge in the right first and then left order by two successive voluntary pulls on the forward or right-hand trigger, or to discharge in the left first and then right order by two pulls on the rearward or left-hand trigger. When the gun is used as a single trigger, whichever trigger is first pulled discharges its corresponding barrel and a part is released which couples the two triggers together and so lifts the second trigger and discharges the remaining barrel when the same trigger is pulled again.

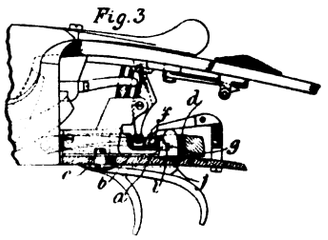
The improvement dealt with in the present patent provides a part which is adapted to be shifted by the thumb or finger so as to remove the coupling device and to allow of the use of the gun and its two triggers in the ordinary way.

The mechanism is illustrated by the appended drawings. The "clutch stop" device *a*, which forms the subject of this patent consists of a stud or projection rising from the sliding bar *b*. This bar is mounted upon the bottom strap of the action and movement is given to it through the external finger piece *c*. The finger piece is arranged in a position convenient to the fingers when firing the gun.

The trigger clutch or coupler *d* is adapted to slide on the strap, and is impelled backwards or forwards through the medium of the spring operated and rod pushed pivoted lever hanging above. When the first trigger has been pulled this clutch is impelled rearward by the spring *e* (fig. 2), and it is caused to couple up the two triggers through the engagement of its side projections *f* and the recesses *g*







in the trigger blade. The second pull lifts both triggers, the involuntary pull due to recoil having been nullified.

In order to render this coupling clutch inoperative, the projection *a* is pulled forward by means of the finger piece *c*. This action brings the stop *a* up behind the side projection *f* on the clutch (fig. 3) and prevents the spring *e* pushing the clutch rearwards again after the first discharge. To allow the clutch to fulfil its coupling duties the stop is merely pushed back to the position illustrated in Fig. 1. The stop is retained in either of its two positions by arranging that the sliding bar *b* shall be spring-like in nature and that a tooth *h* on its underside shall occupy either one of the two locking notches *i* or *j* in the strap top. Accepted June 7, 1906.

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CONTENTS.

CURRENT TOPICS.

The N.R.A. and the W.O. Miniature Rifle.—When writing in last month's issue on the subject of the W.O. miniature rifle reference was made to the alleged desire of the National Rifle Association to act in a trading capacity with regard to this rifle. This remark has caused a regrettable amount of annoyance to members of the N.R.A. Council. We ourselves referred only to the process of buying and selling; but it is the opinion of those who object to the term used that the absence of intention to make a profit made such a phrase inappropriate and unfair. We accordingly have pleasure in setting right as far as possible any wrong impression which may have been created. The most encouraging feature of our conversation with Col. Crosse on this subject is the assurance that the N.R.A. is most anxious to see the new rifle attain wide recognition and general popularity. When all is said and done the new rifle is the offspring of the N.R.A. efforts to provide an arm representing the best conditions for miniature range practice, as a preparation for the use of the service rifle at the usual military distances. The National Rifle Association will accordingly do all in its power as an official body to give the rifle the position it was always intended it should occupy. No more active exponent of this policy exists than Lord Cheylesmoré himself, chairman of the N.R.A. and founder and prime mover in the idea of the Boys' Bisley.

Our Lecture on Obstructions.—Few questions appear at first sight less fitted for that process of systemisation of which Mr. Jones seems alone to hold the secret than that of obstructions. Long experience has taught the gunmaker that whenever a barrel shows forward injury due to internal pressure the obstruction explanation may be insisted upon with every reason for believing that it will stand against all other arguments. There are of course a few instances where bursts arise from defects in the metal, but the class of injury caused by an obstruction shows such overwhelming evidence of preliminary bulging and general violence that the prime cause is seldom in doubt. It is, however, a very different matter to provide a scientific explanation for the influences at work, and to reduce to an arithmetical basis the amount of enhanced pressure which is brought about. The underlying theory which has directed recent researches was published some years ago by Mr. Jones, and he was unmercifully snubbed for his pains. The theory has, however, survived the test of time, and it is now regarded as the only explanation which fits in with the observed facts. A mere analysis of powder action would never have sufficed to evaluate the many factors to which definite figures must be applied. The strength of the barrel wall must be known within the working limits of shotgun construction, and several years of patient study have made it possible to lay down with precision an exact pressure curve for the powder gases in a gun. When this pressure is compared at every point along the barrel with the resisting power of the metal at the corresponding places it is possible to determine within very narrow limits the amount of margin which exists between ordinary service pressures and the strength of metal supplied to resist them. This work follows very closely on the lines of the monumental researches which were carried out in Birmingham some years ago; but what

distinguishes the present from the past is the circumstance that our extended scientific knowledge has given the results obtained a greater practical meaning. This more recent work is by no means divorced from the efforts of the two proof houses to safeguard the standard of safety in the guns submitted to them for test. Mr. Jones is consulting expert to the two proof authorities, and in that capacity he has doubtless given close attention to the balance which must exist between service pressure and the possible resisting power of a well-made gun barrel. The knowledge which enables a complicated problem to be solved is derived from many sources, and it is interesting to gather that present proof house procedure takes full account of the scientific relations existing between the work of the steel maker on the one side and of the powder maker on the other. Possibly the most illuminating aspect of Mr. Jones's article is the relative influence which is exerted by increased thickness of metal and improved quality of material respectively. To gain a material enhancement of strength by increasing the thickness of the barrel necessitates an addition of metal which is prohibitive from a practical standpoint. On the other hand a steel of high tenacity adds vastly to strength without introducing impossible conditions of weight. It unfortunately seems evident from examining the pressure and other curves reproduced in the article already referred to that it is impossible to give the shooter any practical degree of immunity from the effects of weighty obstructions lodged in the barrel. The only available policy accordingly becomes that of prevention, and it rests mainly with the cartridge loader to observe every possible precaution for preventing the powder supply from running short in the filling machines, and so bringing about the conditions which introduce the obstruction into the barrel.

The Pistols Act Farce.—When gunmakers were opposing the principles of the Pistols Act their argument that the ten shilling licence would never prevent crime fell on deaf ears. Failing a practical remedy for murders and suicides the legislative authority determined that the public must have a sop of some sort, and the Pistols Act resulted. A man who wants a pistol for a legitimate purpose objects to paying the ten shilling fee; but the wrong-doer is indeed in a bad way if so slight a bar will prevent him achieving the object of his desire. The suicide which occurred a few days ago in a Strand hostelry provides a most valuable object lesson in the working of the Pistols Act. The gunmaker's assistant obligingly sent round to the post office for the gun licence, and the customer in paying for the pistol also paid the Inland Revenue authorities their commission on the deal. The coroner suggested that the sole object of the tax was to enhance the revenues. The Pistols Act certainly forbids the sale of pistols to persons of unsound mind, but the gun trade is not thereby compelled to keep a mental specialist on the premises. Hence the rule can only be applied within practicable limits. The unfortunate purchaser in the case under review was according to the evidence afflicted by mental trouble; but it is certain that there could have been no visible evidence of this when he expressed a desire to purchase a pistol. The faculties of a first-class salesman in a gun shop by way of sizing up a customer must be regarded as a special sense not possessed by the remainder of humanity. To find out within a £5 note what price a man will be willing to pay for a gun requires a gift in thought reading which the average phrenologist would be happy to add to his supposed power of estimating character by the shape of the head. When, therefore, a gun salesman passes the purchaser of a pistol as sound in mind it may be reckoned that his behaviour is strictly normal. In one instance a customer who was under suspicion refused to be put off by evasions and excuses. This was before the days of the Pistols Act, and the assistant knew that if disappointed in one instance the unwelcome customer would have no difficulty in finding another trader of a more obliging disposition. The assistant retired to the workshop, and neatly broke the striker off the hammer of the pistol, knowing full well that in cases of suicide the rule of try, try again is frequently not applied by reason of the unfortunate's return to a saner estimate of life.

·22 Cal. Service Cartridges.—The announcement in the *Times* that the War Office has given orders to contractors for eight million rounds of ·22 calibre ammunition for the new War Office cadet rifle contains several items which cast a doubt upon its authenticity. It is well known of course that the War Office has adopted the ·22 rim-fire cartridge for service use. It is also generally understood that arrangements are in progress for utilising waste rifles for miniature practice by fitting them with a modified bolt and a ·22 calibre barrel. In fact it is more than likely that if any cartridges have been ordered, they are intended, not for the ·22 W.O. miniature rifle, but for ·22 Lee-Enfields for short range practice by soldiers. The W.O. miniature rifle is not being manufactured by the Government but by private firms for sale to rifle clubs; and the War Office would hardly abandon the caution it exercised in refusing to issue contracts for miniature cadet rifles by launching out in ·22 calibre ammunition intended for the same users. The War Office can force the soldier to use whatever is issued to him; but twenty War Offices would fail to force the civilian rifle club member to use a brand of ammunition of which he did not approve. The authorities at Pall Mall know for instance practically nothing about the fulminate composition for rim-fire cases; and whatever composition they may in their ignorance adopt it is likely to give unsatisfactory results. Their only chance in fact would be to leave the selection of a composition in the hands of the contractor, a course which is followed with other ammunitions. Then, again, the War Office still believes that miniature ammunition has passed a test for accuracy when 95 per cent. of the shots fall in a two-inch circle at 25 yards. Ammunition accepted under any specification could only be used up under compulsion. One may, accordingly regard the extended reference to the cadet rifle which follows the first statement in the *Times* merely as padding. If the War Office has ordered, or contemplates ordering quantities of ·22 rim-fire ammunition, the same will certainly be utilised in rifles of Lee-Enfield pattern. Whether these will be fitted with Morris tubes adapted to fire the rim cartridge, or with specially bored barrels we have no information beyond the circumstance that the latter contrivance has formed the subject of a number of important experiments during recent months. Later information received is to the effect that various firms tendered for the above contract, but that the whole of the order has gone to the Kynoch Company.

LIGHT BULLETS AND HIGH VELOCITY.

SINCE the idea of the Spitzer cartridge came into prominence our military experts in the first place, and later on those interested in sporting rifles, have made experiments and calculations to determine the foundation value of the new principle involved. History seems inclined to repeat itself in a most remarkable fashion. Whilst the ·450-bore heavy bullets were used for military purposes the sporting express rifle mostly contained a cartridge of approximately similar type, except that the bullet was shorter and lighter, and in the more popular grades of cartridge gave a materially higher velocity. Following that came the introduction of the modern high-velocity jacketed bullets of full military length. These were found to be effective for sporting use, since they gave flatter trajectory than the short length express bullets, even when the latter had a substantially similar muzzle velocity.

The sporting rifle manufacturer was not long in applying the lesson imparted by the military rifle; and the task of adaptation was greatly facilitated by the extraordinary experimentation which cordite proved to possess for varying conditions of bullet and charge. In this way the big game shooter was equipped with sporting rifles firing bullets of military density propelled at military velocity, and therefore reproducing in large calibres the flat trajectory of the military cartridge. In the ordinary course it would have been appropriate for the manufacturers of express rifles and cartridges to specialise the lighter bullets of each calibre by imparting enhanced velocity as a compensating factor for loss of weight. It has, however, come about that military experts have been first in applying this idea. At first sight it seems inconceivable that any practical addition of velocity could compensate at extreme military ranges, for a material loss of density in the bullet, and yet experiments seems every day to emphasise more clearly than ever before that the new combination is of military utility. The great objection to express rifles as now constructed is that the relation of diameter and weight of bullet is unfavourable for big game shooting. Given a bullet of a certain weight, and having the necessary velocity to ensure flat trajectory, the striking effects of the bullet are less than would be expected from the energy it possesses. Soft-nose bullets which expand on impact are only a partial remedy for the lack of stopping power, in that expansion is a variable factor depending on the nature of the beast and the portion of its anatomy which receives the bullet.

The old express idea seems eminently applicable to the conditions which have now arisen. Sir Charles Ross, Col. Fremantle, and others who have used high velocity light-weight bullets at the Bisley ranges, have found that a less angle is required for 1,000 yards shooting and a correspondingly less wind allowance is necessary than in the case of ordinary ·303 bullets. If an advantage is shown at 1,000 yards it is absolutely clear that at ordinary sporting distances the gunmaker has a very ample margin to play with. The shorter the bullet can be made within practical limits, the nearer it approaches to the ideal combination of diameter and weight, which represents the best sporting conditions. It may be wondered why, with several weights of bullet for every calibre of high-velocity express cartridge, no one appears to have thought of the idea of modifying the powder charge so that the same flatness of trajectory could be obtained over sporting distances as is the case with a full-weight bullet. The stopping power of the cartridge would in any case be above suspicion in view of the widely-acknowledged difficulty of usefully employing the whole of the calculated striking energy of a high velocity bullet. The new conditions would provide sufficient extra velocity to enhance such mushrooming effect as is provided by the formation of the bullet. The striking power as represented by the bullet weight would still be ample, since no one ever denies that the old black powder lead bullets were markedly effective when once they struck their object. The idea of the modern express rifle and cartridge has been rather to flatten trajectory than to produce any material increase of effectiveness on impact. So long, therefore, as the number of grains of lead in the shortened bullets represents a sufficient amount of weight for stopping purposes, the efficiency of the bullet is assured. A certain amount of practical adjustment by way of selecting suitable bores for different classes of sport would certainly be required in view of the novel conditions introduced by way of the extraordinarily high velocities which would be available.

The most likely explanation for the absence of endeavour to harmonise a given amount of added velocity with a given reduction in bullet weight seems to be that the jump of the rifle would be influenced to such an extent as to make existing sights unsuitable. However, now that the Spitzer cartridge has cleared the way there can be little doubt that a new era in sporting rifles is in sight. It is possible that changes in the ammunition alone will provide a satisfactory solution of the problem; but if previous experience is to be repeated it seems more than likely that the rifle and cartridge will be modified together. The sights must certainly be changed. To get the best conditions in the chamber it seems likely that the position of the lead must be modified to suit a new length and probably a new shape of bullet. A question which will at once arise is what inducements can be laid before the sportsman to encourage him to invest fresh money in revising his armoury. The present express trajectories are so flat that a slight extra increase of efficiency in this respect is unlikely to provide a sufficiently convincing argument. The new system or combination must, therefore, stand or fall by the material reduction of recoil which follows as a naturul consequence from diminishing the weight of bullet, whilst enhancing the velocity to a sufficient extent to give a somewhat flatter trajectory over sporting distances. The lowering of recoil will exercise a considerable influence on the permissible diminution of the weight of rifle to be used. A certain amount of metal will necessarily be required to provide the needful strength of breech; but there appears to be a sufficient margin in this respect to make it clear that practical fluctuations of weight are mainly controlled by the recoil-giving properties of the cartridge. Definite statistics are not for the time being available; but there can be little doubt that with the help of the comprehensive knowledge of ballistic conditions which is now available it will be a very simple question to tabulate specific values when once the needful experimental *data* have been determined.

CARTRIDGE LOADING FOR THE CURRENT SHOOTING SEASON.

ALTHOUGH the number of reports of game preserves depleted by unfavourable weather is unpleasantly numerous, there are still grounds for supposing that the stock of game will at least show average dimensions. Trade orders at this time of the year are not a reliable index of the progress which sport is making. Every retailer lays in a considerable stock for the early part of the season's demand, and each shooter follows suit in his own smaller way without special regard to the amount of sport in view. The real state of the head of game is determined by the aggregate experiences of the sporting community, as judged by the number of cartridges they use up when they go out shooting. If sport is active the day's stock is fully consumed, whereas when the conditions are less favourable the unused surplus shows that a less quantity will be required on succeeding occasions. When the first delivery of cartridges approaches exhaustion the retailer receives fresh orders; and it is on the results of the second demand that the season's prospects can best be gauged. If retailers are clamouring for hastened deliveries through September, October and November the season may be pronounced a good one; but if the original stocks laid in need but little replenishment then it follows that the results encountered in the field are disappointing in the aggregate.

The present year seems to show no departure from the prevalent opinion that cheap cartridges are good enough for use in expensive guns and for firing at expensive game. The gunmaker has been successful in educating the sportsman into the belief that success is largely influenced by a well handling gun of perfect workmanship throughout; but he has not been equally effective in preaching the superior merits of the gas-tight or half-brass cartridge, as compared with the nitro or even cheaper brands. In some trades the cheaper classes of goods produce a higher rate profit than those of more substantial construction; but in the cartridge trade this is not so, and a large proportion of the ammunition distributed brings less than a living profit to the man who sells it. No rule for ameliorating this condition of affairs can be put forward other than unremitting endeavours to keep up quality in every grade of cartridge, whilst educating the user to discriminate under conditions of practical use.

The powder maker has certainly done everything in his power to provide a nitro explosive which, when loaded upon satisfactory and well understood lines, will give the best possible combination of result. The various specifications of charge which have been so widely published of late years, display a singular variety of combinations such as will enable the conscientious loader to give for each gun the precise charge and size of shot which best suits the conditions likely to be encountered. The retailer is in constant touch with his customers, and if he makes a close study of the various powders on the market and the loads which show them at their best he can do a great deal in a modest way to educate the consumer in the knowledge that carefully loaded cartridges of high quality give superior results to the cheaper trash which human nature still seems to favour. Expert opinion in the trade is now agreed that fanciful variations of loading are unsatisfactory in the long run. At first sight it might appear good business to impart special or imaginary qualities to a cartridge by some system of ingenious variation from recognised treatment. But as these things seldom succeed in practice it is becoming well understood that variations should be limited to those recognised by the powder maker. Considering that for each gun there are three or four permissible variations in the amount of the shot charge, and about half-a-dozen alternative sizes of shot these alone give some 24 combinations, all of which in varying degree have their special features and advantages for various guns and various conditions of sport.

In the matter of powders we have the two main groups represented by Schultze and Amberite on the one hand, with E.C. powder as the parent type of such successful nitros as Smokeless Diamond and Nobel's Empire. Condensed powders form another group, but they are not, however, equally adaptable to the loading appliances installed on ordinary premises. Assuming that the gunmaker stocks at least four different types of powder, he has a further multiplication of varieties which gives him something in the region of 100 recognised variations, all of which produce practical cartridges. Each powder, although belonging to a recognised group, has its reputed special properties. Some of these are more or less of a fanciful nature, but the human element in the sportsman gives him more confidence when using his favourite nitro, loaded in the manner that best suits him, than when shooting an equally good cartridge of another type. The numerous grades of cartridge case produce another source of variation, so emphasising the importance of maintaining an up-to-date loading shop, not necessarily because cartridge filling is a paying operation, but because the ability to load satisfactory cartridges distinguishes the gunmaker from the mere retailer, and provides him with a constant source of practical information, such as reacts on the value of any advice he may be called upon to give.

To load cartridges is in itself an excellent advertisement, and the value of the work is strictly governed by the intelligence with which the various operations are carried out. This year, powder presents in the aggregate less loading difficulties than ever before existed. There are very few amongst the number that need special humouring by way of using wads other than those recommended in the usual published instructions. The chief points to which attention must ever be directed are the checking of all measured charges with the aid of an accurate balance, and the insertion of a sufficient quantity of good quality wadding to ensure a tight and compact cartridge when the turnover has been made. Provided a proper amount of powder and shot has been used, a satisfactory result should be achieved. The practical efficiency of the cartridge must at all times depend on the quality of the cartridge case and the employment of a grade of wadding closely approximating in texture the kind which alone is recognised by the powder maker for regulating his product. The business qualities of every cartridge loader must be primarily directed towards securing the co-operation of the purchaser by way of getting him to pay a price which will permit the use of a cartridge case and wadding of a quality proportionate to the skill and care exercised in the manufacture of the powder. To the man who spends his time constantly in touch with loading operations the subject loses all its difficulties, and no trouble is experienced in picking out for each customer the combination likely to prove the best testimonial for the care and time expended in the operations of loading.

EDGAR HARRISON'S DISSERTATION.

Since the days when Charles Lamb dissertated upon roast pork few writers have possessed the confidence to head their essays with this highly expressive term. However Mr. Edgar Harrison dissertates to some purpose when he writes on the subject of guns and shooting. As a London manufacturer in close touch with his retail customers he is able to tackle many questions of gun construction and price such as the ordinary shooting writer hardly dares to touch upon. In the chapter on quality in a gun the author speaks feelingly on the issue so frequently raised in conversation, and in newspaper articles concerning the relation which exists between workmanship and the price charged. As one would expect from a gunmaker various details of manufacture are considered with reference to their influence on the finished article, the general tendency being to favour a reasonable expenditure on a gun in order that satisfactory service may be obtained from it. Some particulars relating to the loading and behaviour of cartridges form an appropriate introduction to the consideration of the patterns produced by various borings of gun. The blocks illustrating the different kinds of pattern obtained are singularly well reproduced and convey the right idea.

On the subject of gun fitting Mr. Edgar Harrison writes with the authority of one who has throughout his career specialised in the art of giving users of his guns the benefit of perfect fit and balance. If the book contained nothing else of special interest, its publication would be more than justified by the comprehensive particulars which are given with reference to the fitting of guns to suit the idiosyncrasies of the individual. This information whilst quite intelligible to the sportsman is of a kind which no amateur could convey. The gunmaker alone has sufficient experience of the many types of shooter and the trick each possesses, to generalise on a subject where the ordinary individual would be fogged by the mass of seemingly contradictory detail. A good deal has also been written concerning the problem of the master eye, a subject whose proper treatment involves a considerable knowledge of the influences which are at work inside the eye itself, and for that matter in the brain and nerves besides. Mr. Borland's well known series of stereoscopic photographs are here reproduced, for the first time in a permanent form, and they help very materially to clear up some of the points which are necessarily left vague by mere verbal description. The point that a right master eye does not necessarily imply greater power of vision is made quite clear, and the alternative explanation that the right eye is master because the nerves carry the right eye impression to the brain, whilst disregarding what the left eye sees, is well emphasised. Mr. Borland's pictures are accompanied by reproductions of photographs showing the alignment of a gun when directed towards the camera under the alternative conditions of correct right-eye alignment and incorrect alignment from the left eye across the muzzle to the object aimed at.

Part II deals in a popular fashion with various aspects of practical game shooting. While it hardly lies within our province to review this portion of the book reference may at least be permitted to be made to a series of full page illustrations by Mr. J. G. Millais. The correct shooting attitude has been most faithfully portrayed, and leaves nothing to be desired from the point of view of technical accuracy. Mr. Harrison is certainly to be congratulated on having brought out an interesting book in which the various aspects of guns and shooting have been dealt with, fortunately not loaded with technicalities exclusively of interest to the expert.

The following points on gun fitting have been extracted from Chapter XIV, and will serve to illustrate the practical kind of advice which is given:—

Length of Arm.—This must be judged in conjunction with the drop from the eye to the shoulder, and by the manner in which the gun is raised, i.e.., whether it is thrown forward and then back, or merely glided upwards.

Chest and Shoulders.—Sloping shoulders and a long neck require more bend than the reverse conditions. Fulness of chest influences length of stock, especially at the toe. In the same way very narrow shoulders make a narrow butt desirable. Very broad shoulders might cause the butt to be mounted further out, so requiring more bend. Excessive length of toe must be avoided, since it may cause the butt to take an uneven bedding, and so be liable to rock sideways. This is known as "canting" the gun, which, while detrimental to success, may generally be overcome by alterations of the stock.

General Carriage.—It is necessary to note where the gun is grasped by the left hand, and whether the weight is properly disposed on the forward leg. If the weight is wrongly distributed between the two legs the head is generally held in a bad place for making proper contact with the face of the stock. * * * Such mannerisms must be studied with a view to deciding which of them should be allowed for in the gun, and which must be eliminated by careful tuition.

Normal Types.—From the point of view of gun-fitting shooters may be divided into (1) short thin men; (2) short stout men; (3) those of medium build; (4) tall spare men; (5) tall stout men; and (6) tall men with sloping shoulders. These are further sub-divided according to whether they tend to show evidence of left-eye shooting, central vision shooting, throwing the head to one side, holding the left hand too far back, undue bulkiness of chest, and slowness of movement and general deficiency of activity.

Consistent Mounting.—The most essential requirement for good shooting is the consistent mounting of the gun to the shoulder. * * * Everything must be so adjusted that the recoil is taken on the shoulder, and the hand moves back with the gun and is not struck by the guard.

Cast-off on the face.—It is generally supposed that the cast-off is solely the amount that the bump of the stock lies out of line with the barrel. The main object of cast-off being to centre the eye in line with the rib, it will be apparent that the essential quality of a properly cast-off gun is that the face of the stock shall be so recessed as to leave room for the shooter's cheek. Cast-off at the heel throws the gun further out on the arm, whereas the correction is oftentimes needed on the face of the stock. A slight bevel on the heel of the stock will frequently produce a better effect than one-eighth of an inch cast-off in the case of a stout person.

Short and Long Forefinger.—Should the shooter possess a very short forefinger he will * * * very likely slip off on the second trigger, so bringing about a double discharge. * * * The obvious remedy is a single trigger. * * * If, on the contrary, the finger is very long, the hand or grip should be made very full and the comb set further back than usual, or a half pistol hand be utilised.

NOXIOUS FUMES IN MINES.

To the person unfamiliar with the vagaries of technical terms a book on "Gassing" would hardly convey any serious meaning. Yet a booklet so entitled has reached us from Perth, Western Australia, and the author is Mr. E. A. Mann, Chief Inspector of explosives and government analyst. In it he treats of the noxious fumes encountered in mines, what produces them and what measures to take to remedy their effects. Mr. Mann's name is already connected by his previous work with this important subject, but as the purpose of the book is purely utilitarian and not a record of scientific research the author acknowledges his indebtedness for various paragraphs quoted from a paper which was read by Drs. Macaulay and Irvine before the Chemical Metallurgical, and Mining Society of South Africa in November, 1905, a paper which he characterises as one of the best publications dealing with the matter.

The gases treated of as dangerous are:—

(1.) *Carbon Dioxide* which arises from natural causes, as well as from firing blasting charges, and is only dangerous when allowed to collect in unfrequented spots.

(2.) *Carbon Monoxide* which is mainly derived from the partial combustion of inflammable bodies. It is almost certain that it does not arise from nitroglycerine explosives, unless they are incompletely detonated, but it is found after the normal explosion of blasting powder.

(3.) *Nitrogen Peroxide* appears to be derived solely from the partial combustion of nitroglycerine explosives. It is probable that cases of poisoning by these two last-named gases are very much more common than is generally supposed, and are frequently fatal.

Carbon monoxide and nitrogen peroxide, it will be seen, arise simultaneously from the same causes—they therefore occur together, though the nitrous fumes may be partially laid by their solubility in water, so that in wet places the other gases will predominate. Almost all cases of gassing are therefore to some extent cases of mixed poisoning. In practice, however, the symptoms of one or other of these gases predominate, sometimes to the exclusion of the appearance of poisoning by any other gas.

(4.) *Cyanide Fumes.* These consist chiefly of prussic acid gas, and are derived from various sources connected with cyanide treatment of ores.

As there is no fire-damp in the Western Australian coal mines, and only small charges of gunpowder are used, the question of gassing as discussed by Mr. Mann concerns only metalliferous mines. The dangers arising from the presence of carbon dioxide are not regarded as of special danger because of susceptibility to treatment by ventilation, and the warning which is conveyed by the behaviour of a candle. Carbon monoxide on the other hand is a colourless, tasteless and inodorous gas. Its presence cannot be perceived by any of the senses and it has no extinguishing effect upon flame. The gas is, however, only under very special circumstances present in the air of the W. A. mines in anything approaching dangerous proportions.

As regards the production of nitrous fumes if nitroglycerine, or its compounds, is detonated by proper means the gases formed are entirely different from and much less noxious than those produced if the explosive is simply ignited by a flame. The conditions and products of "detonation" and "combustion" are quite different. Certain provisos must be made, however. If the most noxious gases are to be avoided, the explosive must not only be compounded on certain scientific principles, but must also be in good order and undamaged, and the detonator must be of sufficient strength for the charge.

The explosives imported into this State (Western Australia) comply with the first condition, but it is necessary that they should be stored at all times with proper care and attention so that they may not be rendered unsuitable for use. Explosives kept in a hot moist atmosphere in an improperly ventilated magazine, or left lying in damp workings, will deteriorate in quality with undesirable results. The author recently had submitted to him a sample of gelignite which had evidently been wet or had been stored in a moist atmosphere. The result was that the saltpetre which it contained had been partially dissolved out and on drying had been left in crystals on the wrapper. These crystals could be felt at once on handling the wrapper and could be rubbed off in the form of a dry white powder. In such a condition an explosive should not be put in the bore hole. This sample was part of a quantity which had been used by some miners, had partly burnt in the hole and had thereby caused the death of one workman with all the symptoms of poisoning by nitrous fumes. Detonators must also be carefully handled. If subjected to a moist atmosphere they rapidly lose their strength and will give rise to incomplete detonation.

The principle danger with nitrogen peroxide is that the immediate effects afford no measure of the risk which is being run, and miners should accordingly be instructed in the ready detection of its fumes. The practice of watering the dirt thrown out by a blast is effective in dissolving the fumes and preventing their respiration, but the watering must be thorough and reach well down. As the conditions which give rise to $N_2 O_4$ also give rise to C O, which is not soluble in water it has happened that the watering has destroyed the first, taking away the smell, but that a sufficiency of the inodorous carbon monoxide remained to give rise to symptoms of a different order from those attributed to the fumes which the water was used to correct. This explains in some measure diverse opinions held by miners as to the effects of water on fumes.

Amongst the regular preventatives recommended in the case of fumes not influencing the flame of a candle is the use of tame mice, whose rapid respiration makes them far more susceptible to a noxious atmosphere than human beings. A very definite and sensitive test for nitrous fumes is the bright blue colour produced upon a solution of starch mixed with iodide of potash. Pieces of porous paper dipped in this solution were used by the Mining Commission to detect small quantities of these fumes. Such a precaution would be difficult to establish, but its adoption might be secured in carrying out a previous suggestion, viz., to concentrate the work of shot firing to a specially skilled firing party, instead of leaving each gang to work on independent lines.

Other portions of the booklet, of which mere samples have here been given, deal with the practical treatment of persons afflicted by the unpleasant consequences of inhaling poisonous gases and fumes. For cases of illness the first-aid instructions are clear and common-sense in their outline. Mr. Mann certainly appears to have produced a most useful departmental booklet.

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ROUND THE TRADE.

Major W. E. Edwards, R.A., Chief Experimental Officer, Woolwich, brought forward some very interesting views on armour and its attack at the recent meeting of the British Association at York.

Messrs. Holland & Holland received a very flattering notice in a recent issue of the *Field* of their new Recoilite cartridge which seems to give first-class results with a 1⅛ ounce charge of shot.

Mr. Herbert White has recently been elected Managing Director of the firm of Jos. Lang & Son, Ld., in recognition of the fact that his efficient conduct of the business justifies a more important office than is represented by an ordinary directorship. Messrs. Jos. Lang & Son, Ld., in consequence of an ever increasing demand for their high grade work have taken a three-story building in the immediate rear of their premises in Bond Street.

Mr. A. P. Humphry has issued a second edition of his *First Hints on Rifle Shooting*, the same being published at the price of sixpence by the National Rifle Association. The booklet contains 32 pages of pithily written notes which emphasise the various points which must be borne in mind by those aspiring to become rifle shots. The title "Rifle Dynamics" has been selected as a heading to Part II. which contains six pages dealing with the more technical aspects of the behaviour of the rifle and the cartridge.

Messrs. Hunter & Warren of 19 Waterloo Street, Glasgow, have sent us a price list of their patent dynamo exploders in which a half-turn of the handle develops full power. For the present they are only issued for low-tension circuits. A great advantage of the dynamo, as distinguished from the magneto generator, consists in the fact that the magnets are self-exciting, and, therefore, do not require periodic recharging, if such a term may be allowed. The book only contains four pages of letterpress, but the printing is of the very best, and all necessary information can be gained at a glance.

We have received from the *Sporting Goods Review* a copy of this year's loading card for nitro powders which contains the usual information in a singularly well-arranged form. When the recommended charges are examined in detail it becomes obvious that certain anomalies and disproportions which existed in the previous edition have been removed. The cartridge dealer as well as the loader will be well advised in securing a copy of the new card without delay, because although no changes of a vital nature have been incorporated it is unwise economy to risk divergencies from the recognised loading even where the change is too small to make any material difference. In the case for instance of the smaller bores several of the recommended charges have been reduced to a more proportional basis than before. The same remark applies, but in a less measure, to some of the calibres larger than 12.

Capt. O. Bouvier, the respected manager of the Chilworth Gunpowder Factory, died on Monday, the 6th ult., from meningitis after a very short illness. The Company will miss him very much, as not only was he very popular with the men, but at the same time he had excellent methods of discipline, which always called forth very complimentary remarks from the Home Office Inspector of Explosives as regards the management and general condition of the factory. *The Surrey Times* paid a well-deserved tribute to the memory of the deceased, special emphasis being laid on the fatherly interest he took in the employees of the factory, encouraging them in cricket and in other sports. The funeral was attended by members of the directorate and by practically the whole of the Work's staff. The large number of local residents and personal friends, who were also present, provided further evidence of the loss which has been sustained in the district. Capt. Bouvier was 59 years of age and had been manager of the Chilworth works for about 20 years. Prior to coming to England he had served in the German Royal Artillery and saw active service in the Franco-Prussian War.

Messrs. Eley Bros. have issued a leaflet notifying the successful results obtained with their revolver ammunition at the recent Bisley Meeting. Commander Christian's flat-nosed bullet was in great demand amongst the shooters.

Messrs. F. H. Edwards & Sons, agents for Nobel's Explosives Co., Ld., and Curtis's & Harvey, Ld., after occupying offices at Forth House, Berwick Street, Newcastle-on-Tyne, for the last 35 years, have moved to more extensive and suitable premises at Bath Lane (opposite Rutherford College), in the same city.

It has come to our knowledge that the arrangement for controlling the wholesale prices of cartridges and components, which continues to the end of this year, will not be renewed on the present terms. It is indeed more than doubtful whether any common policy can be defined to suit the divergent methods of business of the three cartridge makers in this country.

The Schultze Gunpowder Company have issued a new brand of their well-known 33-grain Imperial Schultze. Great improvements have been made in the granulation by way of attaining increased hardness, more regular size, and a very smooth surface, all of which qualities tend to assist the loader in turning out a good cartridge. The well-known rule to seat the wads firmly on the powder can be carried out without risk of undue compression, and the extreme hardness of grain will enable a tight and well-shaped turnover to be applied to every cartridge without risk of getting an uneven height of top wad by reason of the powder giving way under compression.

Messrs. Curtis's & Harvey, 3 Gracechurch Street, have issued by way of a showcard a series of typical shot gun patterns at various distances from the muzzle. Results are shown at 15, 20, 30 and 40 yards for improved cylinder, half-choke and full-choke guns, making twelve patterns in all. These are handsomely displayed on a varnished card some 16 in. square and the whole thing is got up in a form worthy of exhibition in gunmakers' premises and the sportsman's own gun room. On the reverse side of the card two tables are given, the one showing the total number of pellets in a variety of shot charges, and in the other the number of such pellets that will be found in the conventional 30 in. circle at 40 yards for the borings of barrel respectively as above.

Another seasonable gift from Messrs. Curtis's & Harvey is a neat pocket diary entitled *The Shooters' Year Book*, the shooters' year in this instance running from July to July, an arrangement of dates which will not only please the sportsman, but will be useful for booking spring appointments during the closing months of the year. The first twenty pages are devoted to a variety of gun and cartridge statistics. For instance the various calibres of gun are duly stated, together with the decimal diameter, the size of wadding, the various lengths of case, and the appropriate weight of gun when so chambered. A large selection of loads is then specified, having reference to the class of game to be dealt with, the personal characteristics of the shooter and the kind of gun used. The well-known *Field* tables of striking velocity and allowances for crossing shots also appear. Following these are the same tables of shot pellets and patterns, as appear on the showcard. A page of useful values and a table of grains to grammes come next. The Gun Licence Act is then briefly digested, as also is the Pistols' Act. No attempt is made to summarise the game laws, but the reader is referred to three standard volumes on the subject. Another table specifies the individual weight and various other statistics of the small sizes of shot. The four remaining pages of shooting interest conclude with a list of the Metropolitan Shooting Schools, the evident idea being that these establishments would be more widely patronised even than at present if the town visitor possessed a memorandum of their addresses. The only distinguishing feature about the diary portion of the book is that the times for moon rising and setting are specified for every Wednesday and Saturday, this information being very useful to wildfowl shooters and others. The diary concludes with a game register, yet the total weight of the booklet is less than three-quarters of an ounce.

LECTURES TO YOUNG GUNMAKERS.

XXXVIII.—CALCULATING THE PRESSURE PRODUCED BY OBSTRUCTIONS.

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

FROM what was explained in the previous issue it should be clear that the high pressures resulting from obstructions are produced by the powder gases acting on the rear of the projectile. These excessive pressures arise from the powder gases having a general rate of movement in excess of that of the bullet when the progress of the latter is interrupted from any cause. Anything which influences the relative movement of the projectile and the powder gases during their passage down the barrel would give rise to intense local pressures. In the case of an obstruction the velocity of the shot suffers diminution, because a part of its energy is absorbed in putting the obstruction in motion. The powder gases then have a general tendency to overtake the shot, and as their forward movement is checked by the bullet a local piling up of the gases results, the same being commonly spoken of as a wave pressure.

For a proper understanding of the subject the pressure and bullet velocity existing at each point of the barrel should be known. Absolute details are not available, but a very close approximation to the truth can be obtained. In Lecture No. III., published in January, 1900, the relation existing between gas pressure and shot velocity at various points along the barrel was carefully explained, and by such relations it is possible to check velocity results against pressure readings. An intelligent interpretation of available data combining these two sources of information enables one to draw reliable curves representing the pressure and velocity at each point along the barrel. Powders are, as a rule, standardized to give nearly the same results in shotguns, and this renders it unnecessary to consider more than one powder. For illustrating the problem under consideration a 42-grain powder firing 1⅛ oz. of No. 6 shot has been assumed. The following would be regarded as standard behaviour:—Breech pressure, 3 tons; 6-inch pressure, 1·6 tons; beyond 12-inch, pressures under 1 ton; as regards velocity, muzzle to five yards mean 1,250 feet per second, which according to the latest evidence is equivalent to 1,300 f.-s. at the muzzle.

From the consideration of a large number of pressure readings taken in multiple crusher barrels the curve of pressure in Fig. I. was drawn. To combine this curve with a muzzle velocity of 1,300 f.-s., it has to be assumed that the resistance of the shot and wads as they pass along the barrel is equal to 50 lbs. This is an arbitrary assumption. To those disposed to differ it should be pointed out that a higher resistance would increase the pressure of the powder gas, and a lower one would decrease the pressure. The effect on the velocity curve by either of these changes would be immaterial for the purposes of this lecture. Reference will be made later on to these two curves when explaining the new method of calculating the pressure produced by an obstruction of given weight.

When an obstruction of a weight not sufficient to burst the shotgun under test is placed in the barrel, the resulting ring bulge does not appear at that part of the barrel where the obstruction is placed, but nearer the muzzle. In other words the projectile moves some distance after impact with the obstruction before the wave of pressure has collected. A large number of tests were made to indicate this with an obstruction consisting of a coil of wire weighing 70 grains, and in these experiments the amount of movement was between 2 and 2½ inches. The movement was within these limits, no matter what powder was used, whether Schultze, E.C. No. 3, Ballistite or Black, and without regard to the weight of obstruction adopted. With a cartridge containing the usual 1⅛ oz. weight of shot, the usual cards, and a ⅞-inch felt wad, the whole measuring 1¼ inches in length, the ring bulge or

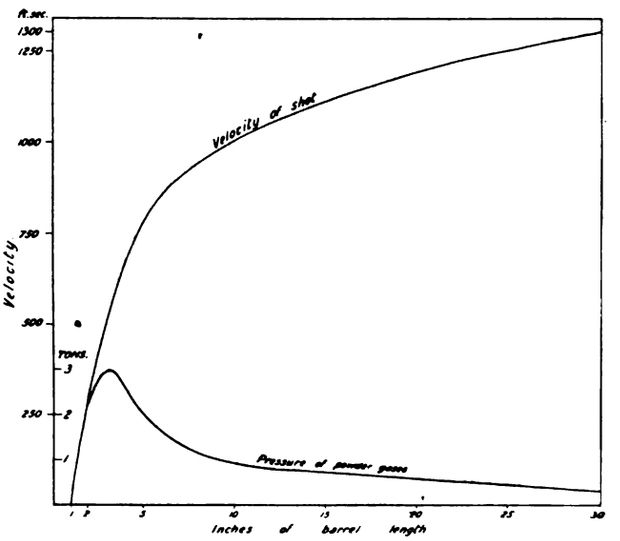


FIG. 1. CURVE SHOWING THE RELATION OF PRESSURE AND VELOCITY AT DIFFERENT PARTS OF THE BARREL FOR 42 GRS. SCHULTZE AND 1⅛ OZ. OF SHOT, THE SAME HAVING BEEN DEDUCED FROM THE MOST RECENT STATISTICS.

burst occurred ¾ to 1¼ inches nearer the muzzle than the face of the obstruction. In other words the movement was 2 to 2½ inches. These details were necessary for making tests in the multiple crusher proof barrel which was used for the experiments, because the wave of pressure is of such a local nature that it is only by paying attention to this movement that it was possible to arrange for the high pressure to occur on the spot where the recording piston is situated. With this information available the pressures given below were obtained in a stout proof barrel. Copper crushers were used throughout. In the case of a wave pressure produced by an obstruction the pressure is so rapidly developed that it is necessary to assume what is known as dynamical loading to exist. This means that the pressure comes on with the suddenness of a blow, a condition which requires that the pressure readings obtained be divided by 2 to get the correct dead weight or statical value of the pressure exerted. Only one further observation is necessary, viz., that the pressures so obtained may be less than the real.

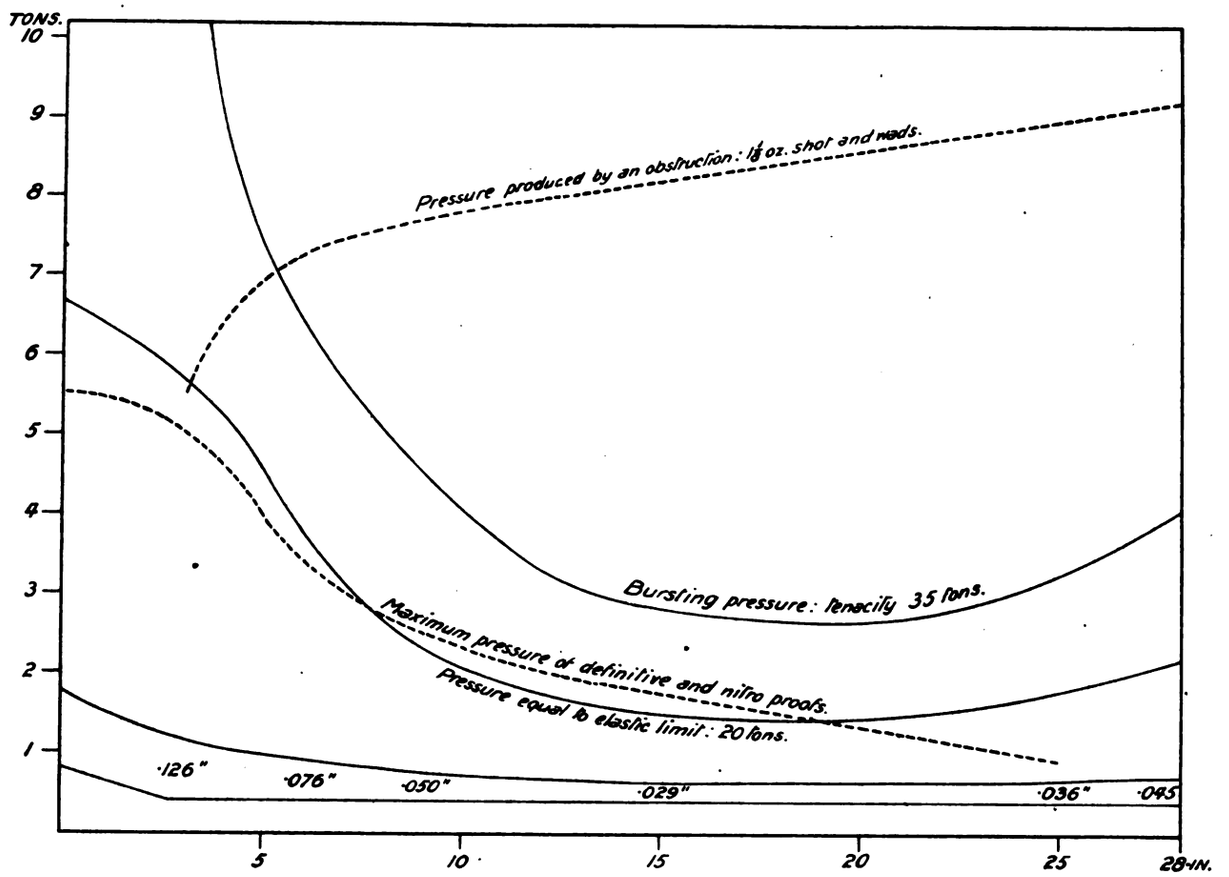
In taking pressure readings in the presence of an obstruction a 42-grain powder was used with the standard charge

and wadding and 1⅛ oz. of No. 6 shot. The obstructions were placed so that readings were obtained at the following pistons, viz., 9 in., 15 in., 21 in., and 27 in. respectively measuring from the breech face.

PARTICULARS OF EXPERIMENTS.

9-in. Piston.—Obstruction: 1⅛ oz. of shot and the usual wads, altogether weighing 539 grains. Pressure readings: 6·51, 6·43, 7·12, 6·00 = Av. 6·5 tons.

15-in. Piston.—Obstruction as before. Pressure readings: 7·57, 7·03, 6·61 = Av. 7·0 tons.



21-in. Piston.—Obstruction as before. Pressure readings: 8·60, 8·38 = Av. 8·5 tons.

27-in. Piston.—Obstruction as before. Pressure readings: 9·27, 9·28, 8·47 = Av. 9·0 tons.

27-in. Piston.—Obstruction consisting of wads and shot, altogether weighing 270 grains. Pressure readings: 7·75, 7·75 = Av. 7·7 tons.

27-in. Piston.—Obstruction consisting of wads and shot, altogether weighing 135 grains. Pressure readings: 4·06, 3·96 = Av. 4·0 tons.

27-in. Piston.—Obstruction: solid brass weighing 539 grains. Pressure readings: 7·59, 9·73 = Av. 9·66 tons.

Also at 27-in piston the shot in the cartridge was replaced by a solid brass cylinder weighing 1⅛ oz.

Obstruction: solid brass ... ... Pressure: 9·27 tons.
„ brass with ¼-in. hole „ 7·95, 9·28 „

These last five pressures were regarded as showing that neither the air imprisoned between the projectile and the obstruction, nor the lead composing the projectile nor the obstruction was responsible for the high pressure developed, a result proved equally well by the bursting of barrels with coiled wire.

With these results before us an attempt can be made to develop some empirical rule for estimating the wave pressure resulting from an obstruction of any given weight. If the wave is due to the relative general movement of the powder gases with respect to the projectile the wave pressure, one would think, is a function of the decrease in velocity of the projectile on meeting an obstruction which is:—

$$v\left(1 - \frac{w}{w + m}\right)$$

where v is the velocity of impact, w the weight of shot and wads, and m the weight of the obstruction. In the above experiments m equalled w, $\frac{w}{2}$, and $\frac{w}{4}$, and the reduction in velocity after impact would be $\frac{v}{2}$, $\frac{v}{3}$, and $\frac{v}{5}$. It has been found that if this reduction in velocity be multiplied by $\frac{134}{10,000}$ the product represents approximately the rise in pressure. For instance, taking the 21-in. piston where m = w the decrease in velocity equals $\frac{1,200}{2}$ f.-s. Then $600 \times \frac{134}{10,000} = 8{\cdot}03$, plus the gas pressure at that point, viz., 0·54, equals 8·57 tons.

The following table sets out the calculated values which may be compared with the actual pressure obtained:—

Piston.	Weight of obs.	Decrease in Velocity.	Rise in Pressure.	Barrel Pressure.	Total Wave Pressure.
9 ins.	539 grs.	487 f.-s.	6·56 tons	1·0 tons	7·56 tons
15 ,,	,,	557 ,,	7·46 ,,	0·71 ,,	8·17 ,,
21 ,,	,,	600 ,,	8·03 ,,	0·54 ,,	8·57 ,,
27 ,,	,,	637 ,,	8·50 ,,	0·40 ,,	8·90 ,,
27 ,,	270 grs.	423 ,,	5·67 ,,	0·40 ,,	6·07 ,,
27 ,,	135 ,,	320 ,,	4·30 ,,	0·40 ,,	4·70 ,,

In connection with the range of pressure produced by an obstruction, the curves in Fig. 2 have been drawn. A best London gun was taken as representing the highest standard of construction. This gun was examined with the object of ascertaining the degree of safety existing for the shooter when the barrel contains a charge of shot by way of obstruction. For our purpose a specification for the steel used had to be assumed. Possibly the steel of this barrel had a higher elastic limit than 20 tons per sq. in. section, although this is not usually exceeded. The curves show that an obstruction equal in weight to a full charge of shot is likely to burst the barrel at any point beyond 5 inches from the breech. The actual strength of the barrel, assuming the steel has an elastic limit of 20 tons and a tenacity of 35 tons, is given in the following table:—

Distance from Breech.	Thickness of Barrel.	Pressure producing a Bulge.	Bursting Pressure.
0 inches	·172 inches	6·7 tons	14·9 tons
3 ,,	·126 ,,	5·7 ,,	10 8 ,,
6 ,,	·076 ,,	3·5 ,,	6·3 ,,
9 ,,	·050 ,,	2·4 ,,	4 6 ,,
15 ,,	·029 ,,	1·5 ,,	2·7 ,,
25 ,,	·036 ,,	1·8 ,,	3·3 ,,
28 ,,	·045 ,,	2·2 ,,	4·1 ,,

The use of high-grade steel improves these figures very much, an increase in tenacity and elastic limit produces more effect than any practical increase in the thickness of the barrel walls. For instance, assuming that a steel is used having an elastic limit of 30 tons and a tenacity of 55 tons, not an outside specification, the permissible pressure, *i.e.*, not exceeding the elastic limit, becomes, at 15 ins., $1{\cdot}5 \times \frac{30}{20} = 2{\cdot}25$ tons, and the bursting pressure $2{\cdot}7 \times \frac{55}{35} =$ $= 4{\cdot}25$ tons. To produce this effect by increasing the thickness of the barrel walls, the ·029 in. of thickness would have to be made ·045 in., an impossible alteration on account of weight and balance. Moreover, this improvement in the steel specification would shift the danger of bursting by an obstruction equal to a full charge of shot from 5 ins. to 9 ins. along the barrel. By retaining the higher class of steel, and by keeping the thickness of the walls ·055 of an inch up to 12 ins. from the breech, this danger zone would be removed to beyond the last-named distance.

The curve showing the pressures given by the definitive and nitro proofs is put in for general information. It seems remarkable that the barrel selected for consideration should show that for an assumed elastic limit of 20 tons the thickness of wall should so very closely coincide with the curve of proof pressure for the best part of 20 inches of its length.

CORRESPONDENCE.

RIFLES FOR ROOK SHOOTING.

To the Editor of *Arms and Explosives*.

SIR,—Before recommending rifles for rook shooting, I think it would be advisable to re-assure the shooting public of the safety of using rifles for that purpose. Everything that has made for increased range in modern miniature rifles has increased the danger of using them for such a purpose. In this neighbourhood I was one of the last to give them up; but when I saw the performance of one of Holland's ·250 rifles when it was brought out some twelve years ago at 200 yards range I took to a shot gun and waited until the rooks were strong flyers and also tabooed the use of the rifle by any of my guests. When a rifle was popular we only used pea rifles with a spherical bullet and a pinch of powder or a No. 3 saloon, then if the rookery was a quarter of a mile from the village we reckoned it safe to all but ourselves. Now it is different, and the ·22, inefficient as it is at rooks, constitutes a real danger to the vicinity. It is the waiting until the exact night the young rooks are strong enough to shoot with a shot gun that causes so many to fly away, they are shootable as sitters for nearly a fortnight, but an error of two or three evenings in judging their strength of flight and they nearly all escape. WALTER H. BAXTER.

Sherborne, Dorset. Aug. 17th, 1906.

[Our correspondent raises a somewhat novel objection against the ·22 rifle as a weapon for rook shooting, as the following list of rook cartridges will serve to show:—

1. ·380 bore rook cartridge, bullet weighs 124 grains.
2. ·300 ,, ,, ,, ,, ,, 80 ,,
3. ·250 ,, ,, ,, ,, ,, 56 ,,
4. ·22 ,, long rifle ,, ,, ,, 40 ,,
5. ·22 ,, short ,, ,, ,, 30 ,,

In the earlier days the ·380 cartridge was much used against rooks, and it is still employed in the old rifles in spite of the heavy cost of ammunition. The gun trade pattern of rook rifle is still chambered for cartridges 2 and 3, and the consumption of the two kinds is of substantially equal proportions. Whatever arguments may be urged on grounds of safety against the comparatively weighty bullets used in past decades, the employment of 40 and 30 grain bullets seems to provide a fair answer. So far from the ·22 cartridge, whether short or long, being inefficient, practical experience over several years enables us to state that in every instance we have been able to polish off the birds available for shooting in various rookeries in record time as compared with previous statistics supplied by persons on the spot. The short cartridge is quite efficient in a well sighted rifle for all distances up to 50 yards, but for shots beyond it is desirable to carry a small reserve of the more powerful L.R. brand. The modern air rifle with a 10-grain slug and a muzzle velocity of about 500 feet-per-second represents the limit of strength for killing rooks. Several birds were brought down by a single shot, but in too many instances they flew away after being struck. The muzzle energy of the ·22 short cartridge may be taken at 66·5 ft.-lbs. as compared with 5·46 ft.-lbs. for the air gun slug. The striking energy at 30 yards would show a greater proportion of difference. If an air gun slug with x energy will kill a rook surely one with more than twelve times x energy may be regarded as satisfactory for all shooters except those who desire to see the bird explode when struck.—ED.]

MONUMENTA PULVERIS PYRII.

THE chronicles of explosives manufacture have recently been enriched at the hands of Mr. Oscar Guttmann by a notable and luxurious publication bearing the above title. With its heavy paper, quaintly tooled leather back, oak boards and matt brass clasps, it is highly suggestive of the antiquity of the explosive, viz., gunpowder, here dealt with. Only 270 copies of the work have been published, and the list of subscribers given at the end of the volume forms in itself an eloquent testimony to the character of the book, no less than to the importance of the explosives industry at the present time.

As industries advance and science displaces mystery, the apparent crudities of pioneer work sometimes obscure the right judgment of the so-called up-to-date person as to the value and difficulty of the steps up which the climb to perfection has been made. The author has, therefore, done good work in gathering together during his thirty years of connection with explosives these pictorial records of men and machines concerned in the early days of the history of gunpowder. This illustrated historical treatise starts from the thirteenth century, when Roger Bacon was the exponent in England of the knowledge that had come down through many ages of the explosive and destructive effects produced when saltpetre is inflamed in the presence of sulphur and a carbonaceous substance.

The first plate is reproduced from the only portrait of Friar Bacon which can lay any claim to antiquity, the original being in the collection of Lord Sackville at Knole, near Sevenoaks. The face is benevolent and typically clerical and not suggestive of devotion to the black art. Bacon's formula for gunpowder runs as follows:—

"Let the whole weight be thirty, but of saltpetre take seven parts, five of young hazel twigs and five of sulphur, and so thou wilt call up thunder and destruction if thou know the art." Whether Bacon's art went further than the calling up of thunder and destruction is very doubtful, and the application of gunpowder for propulsion of projectiles was doubtless of a later date than 1242, though earlier than 1345, because from that year in the reign of Edward III. "we have preserved in the Record Office reliable accounts of the purchase of ingredients needed for the fabrication of gunpowder and the shipping of cannon for France.(a)

What was the exact contribution made by Berthold Schwartz to the development of gunpowder it is now very difficult to discover, as the date usually ascribed to his so-called discovery, viz., 1354, is obviously too late, but the author suggests that Schwartz's genius found scope in the application of gunpowder to artillery. However this may be, plates V. to XIII. are a most interesting collection of pictures of Schwartz, and some of them are very definite in their depiction of the partnership alleged to subsist between him and the devil. One interesting point is clearly brought out in the Schwartz pictures, viz., the origin of the mortar as a weapon. It has been suggested that a laboratory accident, in which the contents of the mortar exploded, blowing away the cover and projecting the pestle, led Schwartz to use a similar device on a large scale for warfare. In designing the clasps of Mr. Guttmann's book, Miss Agnes Guttmann has cleverly worked in two devices, one of a laboratory mortar with the pestle being blown out, and the other of the siege mortar on its carriage with a ball leaving the mouth.

Passing now to processes of manufacture, we have in plates XVII. to XXXIV. a pictorial record of the methods adopted for the preparation of saltpetre. In these days of vast shipments of nitrate from South America the necessity of collecting it from the efflorescence on walls or of exposing nitrogenous matter in presence of a base to bacterial action appears from the pictures to be excessively laborious, but it is quite possible that in less than a century hence the present day methods of manufacture of nitric acid may appear as much out of date in comparison with processes of nitrogen fixation still to be developed. The pictures take us through the whole history of the collection, the refining, and the testing of saltpetre. Some of the instructions are very quaint, thus:—

"When thou buyest saltpeter or manufacturest it, and wilt see if it be good or not, then thrust in thy hand; if it become damp then the saltpetre is not good, but if it remain dry then all is well. Also touch thy hand with thy tongue; if the hand is salt then the saltpetre is not good, if the hand be sweet then the saltpetre is good." Plate XXVI. shows a man and woman carrying out this test.

Plates XXXV. and XXXVI. illustrate the methods in use for refining sulphur, and XXXVII. shows an expert testing sulphur by holding a roll to his ear to listen whether or not it will crackle, the following being the instructions for the test as taken from the Codex Germanicus:—"Wilt thou see if sulphur be good or not, then take a lump in thy hand and lift it to thine ears. If the sulphur crackle so that one can hear it crackle it is good, but if the sulphur keep silent and do not crackle it is not good, and must be treated according to what thou shalt hear later on how it should be treated."

The author points out that this primitive test is really very exact, for sulphur which contains more than 1 per cent. of impurities no longer crackles.

The importance of suitable charcoal appears to have been understood from quite early times, and small twigs of selected woods were frequently employed; thus in Bacon's formula hazel twigs were specified. The operation of charcoal burning was conducted not in heaps but in furnaces or pots, and plates XXXVIII. to XLII. are clearly descriptive, one form of charcoal pot being a barrel lined with bricks. The slaking of the hot charcoal was also regarded as an important matter, and good wine was recommended for the purpose. One instruction from the Munich Code Germanicus may be quoted: "Thus shalt thou make good charcoal. Take wood of the lime or poplar, that is the best, and roast it well in a baking oven, and burn it wholly and entirely, and put of this a goodly quantity into a basin, and turn another basin over it and so close up the charcoal. But if thou wouldst make the very best charcoal that ever man may have then burn the charcoal to the utmost and slack it with burnt wine or else with good wine, and dry the charcoal in the sun. Thus shalt thou have good charcoal."

Possibly the dry nature of the operation made the master powder maker also personally susceptible to the advantage of a proper slaking.

Other materials employed were camphor and sal ammoniac, the idea being to increase the amount of gas. Camphor vapour is stated to be specially harmful to women.

(a) Ency. Britt., 1880, Vol. XI., p. 318.

Plates XLVI. to LX. are of peculiar interest in so far as they trace the evolution of powder machinery from the simple laboratory pestle and mortar through various stages until the stamp mill driven by water power and a somewhat archaic incorporating mill are arrived at. Plate LX. taken from the Cordex palatinus No. 126 of the Heidelberg University, dated 1496, shows a corning sieve worked in a closed box by hand, the worker possessing an anxious cast of countenance truly commensurate with the risks involved in handling a dusty explosive.

The drying of gunpowder was usually conducted in pots placed in a species of bakers oven, one instruction from the Munich Codex running thus:—"Put the pots into a baking oven that glows no more and wherein bread has been baked and let the powder thus well bake in the oven." At first sight this description of a drying operation almost causes a shudder, but it is not so crude after all, for a baker's oven in which bread has been baked is free from grit and the temperature well below that at which black powder inflames.

Plates LXVI. to LXVIII. deal with powder testing and show a sort of flash test being performed to ascertain whether any residue is left indicating insufficient drying or bad mixing, a mortar test in which a weight is projected from a small mortar and the height observed to which it is thrown, and a pistol test in which a graduated wheel, carrying on its periphery a plug bearing against the end of a short pistol barrel, is caused to revolve by the explosion of the powder charge through a smaller or greater angle according to the quality of the powder.

The mortar test dates back to 1627 and the pistol test to 1702, but it is not certain what was the test employed in England in 1633 when James I. prohibited the manufacture except under the King's commission and directed that all gunpowder should be proved and marked by the sworn proofmaster.

Figures LXIX. to LXXVIII. depict the primitive guns in use from 1320 to 1526 the evolution being from pots firing arrows to tubular guns projecting stones. The author refers to an MS. in the Musée Asiatique in St. Petersburg, probably compiled by Schems Eddin Mohammed about the year 1320, and he gives in Plate LXX. an illustration of a "Medfaa," a tubular gun which was fired by filling it to about one-third of its depth with a finely powdered mixture of 10 drams of saltpetre, 2 drams of charcoal and 1½ drams of sulphur. A wooden plug and then a ball or bolt were to be fixed over this. This is particularly interesting as the ingredients are in about similar proportions to those now in use, the necessity for a wad was understood and the weapon was a gun and not a mortar. In view of this the value of Berthold Schwarz's contribution to explosive or artillery development becomes even more problematical than indicated in the early part of this review.

Plates LXXIX. to XCI. are pictures and portraits of master gunners dating from 1405 to 1644, and though not absolutely germane to the subject of black gunpowder, the excellent portraits of Berthollet, Lavoisier, Howard, Schönbein, Sobrero, Nobel, Sprengel, Vieille, Berthelot and Majendie (the date of whose death is given as occurring in 1891 instead of 1898) link the past with the present and emphasize the rapid changes which take place in an industry when once genuine research replaces the secrets and formulæ resulting from centuries of labourious rule-of-thumb work.

It may be added that the letterpress of this work is in English, French and German, and that it is printed by the Artist's Press, Balham, to whom as well as to the author and Miss Guttmann the preservation of the mediæval spirit in the printing and get up has evidently involved an immensity of care and skill.

The following list of authorities cited, though only a very small proportion of those which have been at the disposal, or are in the possession of the author, may prove useful to any one desiring to make historical research into this subject:—

Roger Bacon. De mirabile potestate artis et naturæ, 1242. Bodleian Library, also British Museum, Sloane MSS., 1256.

De officiis regum, 1325. Oxford.

Kurzer Unterricht in der Artillerie Wissenschaft. Heinrich Vogel. Zürich, 1756.

Joh. Stumpf. Schwyzer Chronik, 1534.

Modelles artifices de feu et divers instrumens de guerre. Boillot, 1598.

Rust und Feuerwerk buych, a 15th Century MSS. in the town library of Frankfort O.M.

Beschreibung aller fürnehmsten mineralischen Ertzt Lazarus Ercker. Frankfort, 1598.

De re metallica. Agricola. Basle, 1561.

Codex Germanicus in Munich No. 600 of the court and state library, 1350 circa.

An artillery book of the 16th Century in the grand ducal library at Weimar.

Codex palatinus No. 126 Heidelberg University.

Corona et Palma Militare de Artegliera. Allessandro Capo Bianco. Venice, 1598.

Neueste Geschützbeschreibung Michael Miethen. Frankfort and Liepzig, 1583.

Frescoes in the Church of St. Leonardo in Lecetto near Siena.

15th Century MSS. in British Museum, entitled "Chroniques de Saint Denis."

W. D. B.

APPLICATIONS FOR PATENTS.

JULY 30—AUGUST 25, 1906.

17,132. Projectiles. F. von Madaler, W. Michaelis and J. Morley.
17,165.* Gun Carriages. G. Barié. (Date of application in Italy, July 31, 1905).
17,213.* Safety Fuse. W. Menzel.
17,414.* Safety Explosives. B. G. Reschke.
17,547. Ordnance Sighting. A. T. Dawson and G. T. Buckham.
17,577. Cartridges. M. Mullineux.
17,844. Range Keepers. A. T. Dawson and G. T. Buckham.
17,891.* Nitroglycerine Explosives. Westfälisch - Anhaltische - G-A-G.
18,034.* Firing Mechanism for Guns. J. Küpper.
18,078. Gun Sights. L. E. Ballantyne-Dykes.
18,087. Practice Projectiles. B. A. Firth and A. Anderson.
18,172. Sighting for Turret Guns. Sir W. L. Wix.
18,222.* Ordnance Breech Mechanism. Fried. Krupp, A.-G. (Date of application in Germany, December 19, 1905).
18,223. Explosive. C. G. Luis and J. C. Williamson.
18,346. Breech-loading Small-Arms. P. T. Godsal.
18,391.* Telescope Sight. A. J. Boult.
18,410.* Sighting. C. P. E. Schneider and E. Rimailho.
18,477.* Gun Carriage. C. P. E. Schnieder and E. Rimailho.
18,614. Registering Target for Shooting Machines. J. S. Richardson.
18,637.* Breech Loading Guns. C. P. E. Schneider and E. Rimailho.

18,675. Combined Automatic Sight and Control Gear for Guns. R. D. Timmins.
18,734. Ordnance Sighting. A. T. Dawson and J. Horne.
18,805.* Sighting. C. P. E. Schneider and E. Rimailho.
18,815. Times Fuses. Sir W. G. Armstrong, Whitworth & Co., Ld., and W. H. Sodeau.
18,937.* Gun Carriages. C. P. E. Schneider and E. Rimailho.
18,947. Air-Gun Targets. A. Mann.
18,995. Ventometer in connection with Rifles. A. McNiel.

* These applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JULY 26—AUGUST 23, 1906.

COMPILED BY HENRY TARRANT.

17,825 (1905). **Case for Containing Cartridges.** J. McArthur, Gannochy, and W. Prain, Montrose. The cartridge carrier described in this patent is an improvement upon that set out in Specification No. 4,818, 1881. A box of metal or leather is fitted with longitudinal divisions which carry clips. The cartridges are arranged in alternate rows of different heights and are held securely by the clips. Accepted July 19, 1906.

20,889 (1905). **Electrical Firing of Ordnance.** L. Hewitt, Chatham. Hitherto it has been possible to short circuit the wires leading to the sounder and safety coil used for indicating that the electric circuits of a firing mechanism are in a state for firing the charge. The safety coil is, by the arrangement dealt with in this patent, fitted round the pistol contacts so that if short circuiting of the sounder wires does take place the charge cannot be fired until the pistol trigger is pulled. The improvements are applied to such mechanism as is dealt with in Patent No. 9,380, 1895. Accepted July 5, 1906.

21,967* (1905). **Ejecting Mechanism for Shot Guns.** W. Baker, Birmingham.

21,688 (1905). **Automatic Pistol Mechanism.** Sir C. H. A. F. L. Ross, Ross-shire. This recoil operated mechanism is illustrated in relation with a pistol. The barrel and breech bolt are locked together when recoiling by means of four links until a cam raises the ends of the links and so unlocks a toggle joint. The stored energy in a spring compressed during this movement carries the breech bolt and barrel forward to the firing position again. Accepted July 26, 1906.

21,176 (1905). **Improvements in Superheating particularly applicable to Torpedo Propelling Engines.** S. U. Hardcastle, London. (This Specification is a Secret Document).

22,344 (1905). **Retaining Projectiles in Boro of High Angle Guns.** Sir W. G. Armstrong, Whitworth & Co., Ld., and Sir A. Noble, Newcastle-on-Tyne. Projectiles have a tendency to run back on to the powder charge when a howitzer is placed at a high angle. To prevent this a groove is cut in the bottom of the bore and the shell is provided at its base with a catch which enters the groove. Accepted July 5, 1906.

24,795 (1905). **Indicator for use with Paper Targets.** A. E. Downing, West Bromwich. The bull of a paper target is cut away, and immediately behind is placed a tube, of the same size as the bull, fitted into a cone-like device. Shots which pass through the tube strike a bell, but shots outside are deflected by the outside surface of the cone into a receptacle. Accepted July 19, 1906.

26,611 (1905). **Rifling of Ordnance.** J. Luciani, Paris. In order to bring the resistance of the projectile into more perfect relationship with the progressive strength of the gases of combustion the rifling at the chamber-end of the barrel is made deep and it diminishes gradually towards a point about half way down the bore. It then remains constant. Accepted July 26, 1906.

27,123 (1905). **Teaching Device for Rifle Shooting.** C. Maxted, Watford. A ring of thin metal is fitted over the foresight of a rifle. From the top of the ring is suspended a pendulum-like pointer. The tip of this pointer must come directly over the centre of the foresight top if the rifle is not canted either to one side or the other of the vertical plane. Accepted July 19, 1906.

3,005 (1906). **Manufacture of Ammonium Nitrate Explosives.** H. C. L. Bloxham, Cape Town, and the Maganite Explosives Syndicate, Ld., Cape Town. This invention is applicable to the manufacture of an explosive in which ammonium carbonite is added to a mixture of ammonium nitrate and nitrobenzene as is set out in Patent No. 7,490, 1904. By the present method the specific gravity and the effects of the explosives are increased by heating and fusing the ammonium nitrate, then adding the ammonium carbonite and afterwards running in melted dinitrobenzene. A mixture of 83 parts of ammonium nitrate, from 0·5 to 2·5 parts of ammonium carbonite and about 17 parts of dinitrobenzene are suitable. Accepted July 26, 1906.

4,069 (1906). **Multipart Small-Arm Bullets.** G. Luger, Germany. The bullet described in this specification consists of two parts arranged one behind the other. The two parts are provided with an interlocking arrangement which holds them together at the outset but does not prevent them separating during flight. Accepted July 5, 1906.

4,126 (1906). **Recoil Operated Small-Arms.** G. Luger, Germany. The action of a spring is transmitted to the toggle links of a recoil operated breech mechanism by means of a bell crank lever. This transmission of the spring power is better than that described in Patent No. 9,040, 1899. Accepted July 26, 1906.

5,259 (1906). **The Covering of Explosive Charges.** C. E. Bichel, Germany. Instead of the cardboard covering heretofore used to enclose compressed charges of such explosives as trinitrotoluol, an elastic fabric of the stockinet kind closely fitting the charges is used. Greater resistance is offered against fracture and disintegration. Accepted August 2, 1906.

6,599 (1906). **Time Fuses for Projectiles.** R. H. Quisling, Norway. A double acting fuse has only one rotatable fuse ring by the setting of which more than two fuse grooves can be timed. The igniting channel is so arranged that ignition of the fuse grooves must always take place at one end of a groove. The igniting pin is given the shape of a pointed projectile and its forward end carries the percussion needle. Accepted July 12, 1906.

7,415 (1906). **Bolt Rifle Mechanism.** Lt.-Col. A. H. Russell, U.S.A. The bolt of a rifle reciprocates longitudinally on a shoe as is usual. It is adapted to rotate on its axis in locking and unlocking and it carries a handle which is pressed forward to close the breech is pulled backward to open very nearly in a straight line. Both the opening and closing and partial rotation for locking are produced by this straight pull. Accepted July 19, 1906.

10,477 (1906). **Time Fuse Setting Device.** Fried. Krupp, A-G., Germany. An improved time setting key is dealt with in this specification. It is provided with a burning time scale adjustable to the scale on the fuse for the purpose of correcting the burning time. It is constructed in a cheaper and simpler manner than keys of this description already in existence. Accepted July 19, 1906.

10,478 (1906). **Projectile Carrier.** Fried. Krupp, A-G., Germany. A projectile clamp is constructed by connecting two semi-circular bands by means of two threaded joints. A handle works upon each of the joints and it depends upon the direction of movement of these handles whether the bands are moved towards or away from one another. Accepted August 2, 1906.

10,927* (1906). **Treatment of Guncotton.** T. Reishoff, Moscow.

10,998 (1906). **Detachable Choke for Gun Barrels.** C. R. Bellamy, and P. J. Dennig, U.S.A. A sleeve with a bayonet joint is designed to slip over the end of a barrel, the foresight block acting as a lock block. Any choke piece may be screwed into the sleeve and engaged with the muzzle of the gun. The choke piece is prevented from turning by a ratchet arrangement. Accepted July 26, 1906.

11,087 (1906). **Telescopic Sight for Rifles.** J. E. Evans-Jackson, London, and The Warner and Swasey Co., U.S.A. A telescopic device having the line of sight deflected four times to shorten it is slidably fitted to the side of the breech of a rifle. It may be shifted longitudinally along the arm. The telescope is pivoted upon the mount and the inclination of its axis may be altered by a micrometer screw arrangement. Accepted July 26, 1906.

12,066 (1906). **Explosive Projectile.** C. D. Abel, London. (Agent for *The Rheinische Metallwaaren und Maschinenfabrik, Germany.*) A double explosion is provided by

arranging that the part of the shell containing the shrapnel shall burst first. The nose of the projectile containing the grenade charge is impelled forward and explodes only after it has travelled some distance beyond the point of the first explosion. Accepted July 26, 1906.

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

SELECTED PATENTS.

TREATMENT OF GUNCOTTON.

10,927 (1906). T. Reishoff, Moscow. Hitherto, the patentee affirms, it has been possible only to secure complete combustion of guncotton by adding nitrates in the form of powders. Without nitrates the guncotton has not sufficient oxygen to ensure conversion of all the carbon to carbonic acid; and even guncotton richest in oxygen is burnt imperfectly and only a small proportion of the carbon is turned into carbonic acid. The greater part is reduced to carbonic oxide in the first instance.

It is said that even with the addition of solid nitrates the evil is not entirely removed. To minimise it, the patentee proposes more intimately to mix the nitrates with each particle of guncotton by reducing the nitrates before combustion with the guncotton to the minutest possible atoms.

The nitrates for this purpose are dissolved in water and the guncotton is saturated with the solution. In order to obtain the greatest quantity of nitrate, as many varieties are used in varying quantities as is possible. Suitable nitrates and the proportions by weight are potassium 4 per cent., barium nitrate 17 per cent., sodium nitrate 17 per cent. and strontium nitrate 12·3 per cent.—making altogether 75 per cent. of nitrates to 25 per cent. of water. The solution contains 40 volumes of water and 60 volumes of nitrates. The force and rapidity of guncotton saturated with this solution are said to be much greater than when the nitrates are in powder form. Further, guncotton so treated cannot become dry by reason of the hygroscopic nature of the ammonium and strontium nitrates, nor, it is claimed, can the water freeze—the strength of the solution preventing this.

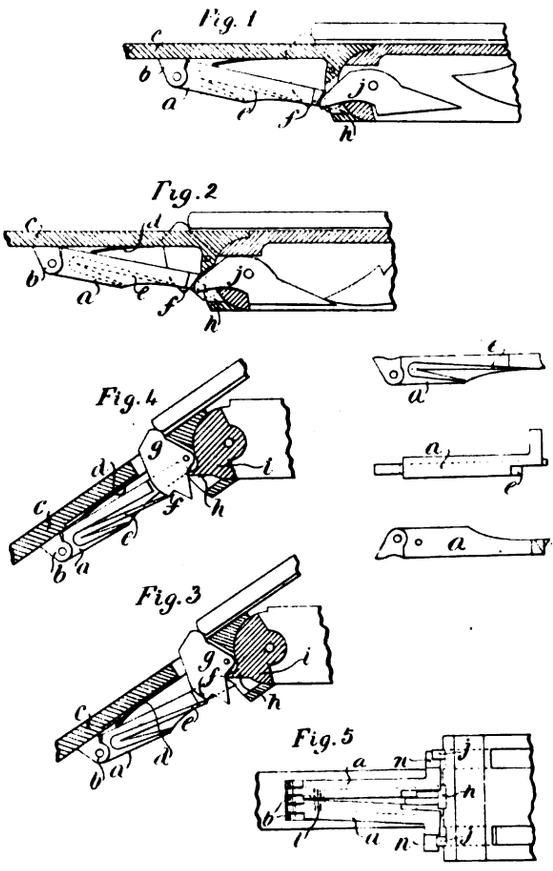
Damp guncotton (40 per cent.) may be treated by applying a 60 per cent. solution of nitrates. To saturate compressed guncotton sufficient strong solution is used to fill up the pores. A good proportion of dry guncotton is needed with compound. To dry guncotton is added 15 to 20 per cent. of a strong solution containing numerous varieties of nitrates. Compounds so prepared may be exploded by a fulminate detonator. The patentee is aware that it has been proposed to use in the manufacture of guncotton one or more nitrates in combination with acids, alcohol ether, and other solvents. But none of them are essential in the process described. Accepted July 26, 1906.

THE "BAKER" EJECTING MECHANISM.

21,967 (1905). W. Baker, Birmingham. The mechanism for ejecting the spent cartridges from the barrels of a break-down gun is modified so that when the gun is closed the "kicker" springs are subject practically to no compression. The springs are mounted in pivoted carriers and are only subjected to full pressure when in the act of ejecting. The closing of the gun is not subject to any spring resistance. Only when the hammers have fallen are the kicker spring carriers taken into the path of a fixed projection protruding from the action body joint to operate the kickers.

The carrier levers *a* are pivoted in the lugs *b* forming part of the fore end iron *c*. The carriers are always pressed downwards by the springs *d* and they are adapted to contain in a recess the kicker or ejector springs *e*. These springs are adapted to operate upon the heels *f* of the kickers *g* which are pivoted on the fore end. A fixed projection *h* protrudes from the body joint piece *i*, and when the hammers are down the carrier ends are brought into engagement with this projection upon opening the gun.

When the gun is closed the ends of the carriers *a* are so far down (Fig. 1) that were the gun to be opened with the hammers still cocked the projection *h* and the carrier ends could not come into contact (Fig. 3). But when the hammers drop the lever *j* is caused to push the carriers slightly upwards as is illustrated in Fig. 2. This movement shortens the distance between the carrier ends and the body joint piece *i* and so takes the ends within range of the projection *h*. When the gun is broken down the projection holds the



ends of the carriers and raises the carriers away from the long arms of the springs *e* which are engaged by the heels *f* of the kickers (Fig. 4). The springs are thus strongly compressed and they finally pass over the heels *f* and give the necessary flick to the kickers to drive the extractors upwards and so throw the spent cartridges from the barrels.

The carriers are arranged also to have side play (Fig. 5) so that when only one barrel is discharged both springs are not compressed when the gun is opened. The carriers are pushed outwards by the spiral springs *l* and only when the hammer of either lock has fallen is the end of the lever *j* allowed to slide over the inclined under end *n* of the carrier *a* and force the inside point of the carrier beneath the projection *h*. If one barrel only is fired the spent case therein only is ejected. If a loaded cartridge is in the second barrel the lock of which is still cocked, it is allowed to remain there when the gun is opened. Modifications of this system of ejecting mechanism are also dealt with in the Specification. Accepted July 5, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Developments of the Short ·22 Cartridge.—Though there is nothing of a magical quality about the dimension ·220 of an inch it seems destined to play a large part in the future of fire-arms. Public opinion at first condemned this as an inappropriate bore of cartridge for the shooting of small game, and yet it to-day forms the favourite missile of the rabbit pot-hunter to say nothing of the sparrow shooter. He realizes as no one else can do the circumstance that there are other things to consider than mere stopping power. Given a sufficient degree of accuracy, the efficiency of the ·22 bullet leaves but little to be desired, whilst offering other advantages such as the minimising of noise and the saving of expense. Just at the present time everyone favours the longest of the three cartridges which fall under the ·22 designation. This arises in a great measure from the circumstance that rifle barrels are constructed to take the long cartridge, and gunnery abhors a vacuum. The air rifle with its calibre of ·177 of an inch demonstrates that we have not arrived at the end of things in the L.R. ·22 rim-fire cartridge. For a start at any rate the short ·22 is worthy of careful consideration. Given a chamber dimensioned to the short cartridge, and the enhanced shooting accuracy obtained will bring its due reward. At the present moment the bullet from the shorter cartridge, when fired from any of the rifles as commonly offered for sale and suited only for the taller members of the family, gives a dispersion greater than the personal error of the shorter. Its chances of success are prejudiced so long as it is well known that the fixed rest results of the alternative cartridge go one better than the most perfect holding of a practised shot. This anomaly can be overcome, and the sub-division of ·22 rifles as well as ·22 cartridges into short and long will represent a step in advance. The next stage of development will be to produce an internally lubricated ·22 cartridge requiring a chamber formed on rational lines, that is the exterior diameter of the case must be greater than that of the bullet by the thickness of the metal forming the mouth of the case. When these things have been accomplished other problems will follow; but sufficient unto the day is an excellent principle to adopt in mapping out a programme of research.

Orders for Private Factories.—Those who have watched the working man's incursion into national affairs must have noticed the difficulty he experiences in taking a view beyond his more immediate interests. Most of us have been accused at one time or another of seeing only our own point of view. This at any rate seems to be the attitude of the many unfortunate workmen who have lost their employment through the recent policy of cutting down expenditure by limiting the production of war munitions. Various other causes have combined to create a state of distress in the Woolwich area which has led to public meetings designed to protest against the policy which has produced such widespread loss of employment. It is, however, in reference to one of the arguments used by speakers at these meetings, rather than to the general aspects of the situation, that we wish to call attention. It has been suggested as a principle to be observed that Government factories should not go short of work so long as there are any orders to be given out. This idea implies that private contractors should receive no orders whatsoever until Woolwich and the other factories are fully occupied. Such a suggestion goes entirely against the entire principle of encouraging private enterprise as a supplementary source of supply, the idea being that in the case of a national emergency there shall exist a number of factories scattered over different parts of the country which would be capable of supplementing Government manufactures. The view has always been held that Woolwich Arsenal is not geographically situated on ideal lines with reference to the possibilities of invasion. Although it lies a long distance from the mouth of the Thames estuary

it is to a certain extent accessible to sea attacks. Such disabilities do not exist in the case of the factories which are situated in Birmingham, Coventry, Sheffield and elsewhere. Hence it is important on national grounds that no policy should be sanctioned which might tend to deprive the nation of the various sources of supplementary supply which form so important an item in our scheme of national defence. The Government authorities are of course in no need of being reminded of the policy which underlies the present division of orders. If times are slack, both the Government and the private contractor draw in their horns as far as possible, each seeking to maintain a skeleton organisation which shall at all times be capable of rapid response to demands for an increased output. In point of fact it would seem as though more satisfactory conditions would arise in respect to the working classes if the Government diminished as far as possible the amount of work turned out in its own factories. A large industrial centre like Birmingham is able without breaking up the workmen's homes to accommodate itself to large fluctuations in various individual branches of manufacture. At Enfield on the other hand it is a question of constant anxiety to keep up something approaching an average rate of production at all times, and so minimise the grave trouble and inconvenience which follow a change, whether for the better or for the worse. When work is scarce the operatives suffer, when the demand for labour increases the officials are hard pressed to get in the necessary extra help, realising that permanent employment cannot be offered as an inducement to move the home.

Our Lecture on Recoil.—The lecture appearing in the present issue is of a kind which promises to be of exceptional value for future reference. A new system of recoil registration is introduced at considerable length; but if it secures anything approaching the universal adoption which its merits seem to foretell, a good many of the readers of this paper will find it useful to know where to refer for a full statement of the position. The whole tendency of modern tests of nitro powders has been to co-ordinate them one with another, so that the practical man can derive the greatest possible amount of information for guiding him in the problems of construction. Recoil more than any item of a gun's behaviour exercises a wonderful influence on construction. That pressure is important goes without saying; but the resisting power of a gun or rifle is determined with reference to the proof charges, and the behaviour of the service cartridge exercises only a secondary influence. Velocity, again, is a factor which exists outside the gun, and does not materially control the design and dimensions. Altogether the test for recoil seems to stand alone as giving the gunmaker real and direct information concerning the arms he is called upon to produce. Although the weight of guns has been mainly determined in the past by evolution, the singular conformity between the average weight existing in practice and the weight necessary to produce a certain standard of recoil value, is an argument not against theory but strongly in its favour. If all the firearms of the past attain a certain behaviour under recoil, capable of demonstration by the simplest experiments and calculations, then it seems certain that in the working out of new guns and rifles for the firing of new combinations of charge, the existence of a recognised relation will greatly simplify the conditions of design, and thereby increase the chances of attaining an early success. Assuming that the prime idea of testing recoil is to regulate the gun to a weight which will make the shooting of a given cartridge physically endurable, then common-sense seems to favour the expressing of recoil values in terms of the appropriate weight of gun to fire them. This principle has been elucidated in the accompanying lecture to young gunmakers, and there seems to be no reason why it should not be extended to cover all classes of weapon in which the recoil is a sufficiently considerable factor to exercise a controlling influence on the weight of the gun.

The W.O.M. Rifle.—The time must by now be very near when the promises of early delivery of the cadet rifle will be fulfilled. The word "cadet" must apparently be abandoned in spite of its singular appropriateness for the purpose. The War Office Miniature Rifle is a title which is bound to suffer decapitation as soon as the public is called upon to use it. Possibly some unknown individual may hit off a phrase as fortunate as the one which describes a certain underground railway as the "twopenny tube." Pending the discovery of a word immediately to become popular, the War Office system of first giving an article an unwieldy title and speaking of it by its initials must be adopted. The letters W.O.M. must, therefore, stand for the word cadet in future references to the new rifle. The immense demand which is anticipated for the cadet rifle seems to be justified by the general desire that shooting may become a recognised department of the elementary curriculum throughout the country. Being quite as enjoyable as gymnastics, and in the opinion of many an even superior substitute for lessons, it is likely that the national principle of extending the acquaintance with arms to all classes will be carried out in its entirety. The movement which has already produced such considerable results, has been carried out in the absence of a rifle recognised as suitable for imparting the exact kind of instruction which is considered desirable. The new miniature bolt rifle—it is difficult at first to use the letters W.O.M.—seems likely to satisfy the long-felt want. Its presence will certainly give an immense impetus to the new movement, and it seems likely that a long time must elapse before production can show itself capable of keeping pace with demand. The new rifle will go a long way towards satisfying the requirements of the user; but it would be strange indeed if experience will not show points of detail in which it can be improved. The rifle will certainly carry out the purposes for which it has been designed; and although gunmakers and others will see openings for improvements it must be understood that the user will not be a critic of mechanical design, being satisfied with a rifle which combines cheapness with high quality, and at the same time enables him to cultivate a class of skill which will in due course entitle him to take rank as a marksman. It will indeed be a great day for English gunmaking when the new rifle comes into use. It will provide a further stimulus to the development of the shooting instinct, an instinct whose development has hitherto been confined to the wealthier members of the community. When everyone in the country has some kind of acquaintance with shooting, the desire to possess fire-arms will not solely affect the W.O.M. rifle, but will extend to other types of weapon, including the shot gun. The only trouble is that the acreage of sporting country is not only limited, but shows signs of diminishing rather than increasing.

RIFLE CLUB AMMUNITION.

The announcement that the Government have made a contract for the manufacture of 8,000,000 rounds of ·22 calibre ammunition may be read side by side with the bold declaration of the King's Norton Metal Company that they have become manufacturers of these cartridges. It is a somewhat extraordinary circumstance that the War Office should have received so little support from manufacturers in their enquiry for home-made ·22 rifle cartridges; but a few questions to the trade have left us in little doubt as to why the whole order was allocated to a single firm, when the more appropriate policy seemed to favour its distribution over several firms by way of a test of relative ability to turn out the right thing. The explanation apparently lies in the inexperience of the War Office when called upon to deal with the manufacture of a type of cartridge on which they have no guidance from precedents, being at the same time unwilling to adopt suggestions from quarters where they would have been readily available. A contract of 8,000,000 rounds of these little cartridges at a price say of ten shillings per thousand would represent a gross value of £4,000, a small enough matter in itself; but one which would bear a very evil complexion with a large proportion of rejects. At first sight it would appear that the ordinary channels of distribution could be made to absorb any surplus cartridges which had failed for trivial reasons to pass the Government inspection; but when the general outline of the specification shows that the cartridges must be delivered boxed in a somewhat expensive fashion, and that the unaccepted surplus would be difficult to get rid of elsewhere, representing in fact a serious loss to the contractor who readily perceives that the price of such cartridges leaves but little margin for the creation of dead stock.

Coming to more precise details the War Office specification binds the contractor somewhat too tightly. It is far too easy in regard to the accuracy test, and is ridiculously severe in respect to missfires. If the Government had itself the benefit of six months experience in the manufacture of ·22 calibre ammunition it would know that the ordinary club shooter's demand that the ammunition shall be capable of making possibles at 25 yards on a half-inch bull is not an unreasonable standard of accuracy to adopt. When this is compared with the humourous notion that a cartridge has passed for accuracy when 95 per cent. of the shots fired fall within a two-inch circle a broad distinction is drawn between Government theory and rifle shooting practice. The Government again lay great stress on the necessity for these little black powder cartridges to fire a long string of shots, we believe 60 in number, without sign of trouble from accumulations of fouling. The miniature rifleman on the other hand knows full well that a box of cartridges may frequently be fired from a rifle with no periodic wiping without apparent loss of accuracy; but he is far too cautious to leave so much to chance, knowing that a piece of string and a whisp of rag represent an easily applied preventative against fouling troubles. The rifle which may one day show comparative insensitiveness to fouling may on another occasion develop a dry hard spot, which will increase with every shot, and very rapidly interfere with the accuracy of the shooting. Having regard to the conditions to be met it would have been far better to adopt a high standard of accuracy, whilst diminishing the conditions of neglect and ill-treatment which seem to be regarded as embodying practical conditions of use. If people insist on firing rifles without intermittent cleaning, the proper remedy lies in the direction of utilising smokeless powder.

It is not, however, so much to the fouling test that attention must be drawn, as to the extraordinary demands for certainty of ignition. Ordinary commercial ammunition will frequently shoot for a considerable number of rounds in an uncleaned rifle, and the standard of accuracy for the last 20 shots, of, say a hundred-series would pass the test of a one-inch circle with flying colours. It is, however, a very different matter to guarantee that practically no missfires shall arise. In rim-fire ammunition the possibility of insuring the presence of composition inside every portion of the circumference of the cartridge rim stands on a very different footing from the far simpler problem of placing enough fulminate in a copper capsule to cause ignition when the striker drives the cap on to an anvil accurately placed below. To place under suspicion an entire delivery of rim-fire ammunition because a single missfire is experienced, is to assume an inspired grade of skill by the manufacturer, and also, be it remembered, by the manufacturer's staff of operatives besides. One re-proof is we believe allowed, but the result turns too much on luck, and makes far too little allowance for the price at which an apparently impossible standard of workmanship is remunerated. A man is not sent to the scaffold for omitting to button his collar, nor is a waiter dismissed because he drops a fork, but the Government does reject a delivery of ammunition for which it pays, say, ten shillings per thousand rounds, if a single instance of missfire is experienced in the first proof and repeated in the second proof. Assuming the usual proportion of one per thousand rounds being expended in proof this condition means that ammunition which is considered good enough when grouping on a two-inch circle at 25 yards is unhesitatingly rejected if one shoot in 500 misses fire.

No lack of willingness to support the Government in an important new development can be alleged against the manufacturers who are all equally anxious to develop a new class of output, but who are debarred from doing so except on sane commercial conditions. One may take it for granted that the alternative policy of entering the open market with ammunition guaranteed to meet the requirements of the shooting man will not only meet with its due reward, but will provide the Government with experience enabling its experts to arrive at a modified specification calculated to produce the article which is required, with a profit to the manufacturer and satisfaction to the user. Gunmakers as well as cartridge manufacturers are getting a wonderfully strong hold on the ·22 rifle and cartridge. The firm of Eley Brothers are understood to have made great strides in the standardisation of their ·22 ammunition output. The firm of Greener, the pioneers of ·22 rifle manufacture in this country, have perfected their system of boring, so that shooters have nothing but praise for the Martini-action rifles which are associated with the name of Greener. The London Small Arms Company have approached the same problem from the point of view of the New War Office miniature rifle, and the Birmingham Small Arms Company are doing the same.

REVIEWS.

Nitro-Explosives (second edition 1906) by P. Gerald Sanford, F.I.C., F.C.S. A work of 300 pages published by Crosby, Lockwood & Son. Price 10s. 6d. net.

The first edition of this book was reviewed in our columns in August 1896. The new edition contains few of the faults then referred to. It has been materially increased in size and brought up to date, making a useful and readable volume. We notice some of the compositions of explosives are not in accord with the latest formulæ adopted e.g., Kynoch's smokeless powder does not now contain dinitro-toluene. The work covers practically the whole field of nitro-explosives, not in great detail, because this would not be possible in one volume, but within the limits implied by 300 pages the subject is well handled. The description of the nitration of glycerine and cellulose includes the new processes of Nathan and Thomson; also the stability tests applied to explosives include not only the latest government tests but also the alternative proposals of Guttmann, Dr. Will and others. Furthermore, the well-known blasting compounds are described, whilst fulminates and fulminating compounds receive quite a detailed amount of attention. Smokeless powders come in for their share of notice, and outside Cordite and the better known powders Axite and the high soluble guncotton powders are mentioned. Fifty pages are devoted to the analysis of explosives and in these pages this edition contains a lot of new matter.

To those who have found the first edition useful, we can recommend this new edition and to the general reader the work is in our opinion a treatise on explosive having many good features. The great feature of Mr. Sanford's writing is a clear grasp of his subject, and the ability to write thereon in a simple and straightforward manner which captivates the reader's attention and facilitates the use of the book for reference purposes.

Blasting (second edition 1906) by Oscar Guttmann. A handbook for the use of Engineers and others engaged in Mining, Quarrying, etc. A book of 178 pages. Published by Chas. Giffin & Co. Price 10s. 6d.

Blasting by Guttmann is a well-known standard work on the subject. Originally published 14 years ago there are naturally important items to bring up to date; all matters in connection with explosives having made great advances during this period.

In this new edition the whole material has been brought up to date especially with regard to rock-drills and explosives. The work includes a very useful table setting out the composition, manufacture, suitable detonator and safe charge of all the more important blasting compounds used in this country and abroad.

As showing the plain and direct spirit in which the author attacks his subject the following on alternative systems of blasting by other means than the use of explosives may be quoted:—"It must be remembered that there is, in practical work, a limit to the production of high pressures, and that the highest pressure practicable is, in the case of rock of medium hardness or even of very tough coal, insufficient, and that the slightest crack, or the commencement of the breaking down, will almost entirely counteract all efforts to keep up the pressure. The sudden development of high pressure, which is an essential in blasting, is well-nigh impossible by these means, as one very important factor—namely heat—is absent. A careful consideration of these and similar proposals will show that there is little prospect of any of them developing into a practical method of working. Some time ago, considerable attention was given to the suggestion of using lime for blasting operations. Cartridges of quicklime were placed into large bore-holes, a perforated tube inserted, and the hole well tamped. Water was then forced through by means of a pump. The swelling caused by the quicklime being slacked detached the coal. The small force thus obtainable from the very beginning limited the use of this method to the winning of coal. Even this limited field, however, was further reduced by the fact that only in hard, unfissured coal, and where the ends were large, could lime cartridges be used. The better yield in lump coal was also partly counterbalanced by its bad appearance, due to the smearing with the lime wash produced, which made it difficult to sell.

Dr. Kosmann suggested a similar process. Sulphuric acid and zinc, in a double chambered bottle, was to be introduced into the bore-hole, and the bottle broken by means of an iron rod. The hydrogen liberated by the reaction between the sulphuric acid and the zinc was supposed to set up sufficient pressure to break down the coal. Some time ago a great stir was made with blasting experiments by means of liquid air. Since it has been possible, chiefly through the work of Hampson in London and Linde in Munich, to make liquid air at a cheap price, it offered great attraction for use as an explosive. It could not be used alone, but had to be mixed with some carbonaceous matter—tar-oils, paraffin wax, and charcoal being used. Experiments on a large scale, which were continued for some time in the Simplon Tunnel, showed, however, that the idea was almost unworkable. The cartridge could not be sealed up, because the slightest rise of temperature created dangerous pressures. They had to be of a very large diameter—four inches or more—otherwise the evaporation of air made them useless. The explosion had to be initiated with a primer of guncotton and a detonator, and in order to obtain a good result the more dangerous tar-oils had to be used. Finally, the preparation of the absorbing mixture and the soaking with liquid air had to be done a few minutes before firing in the heading itself. The whole was thus rendered a dangerous and cumbersome practice. It is no wonder, then, that liquid air did not have a long life as an explosive."

Mr. Guttmann thus goes on to deal with mechanical methods of breaking down coal, and here we are reminded by the excellent illustrations used that the author's publications have always been distinguished by high-class and highly explanatory drawings. This may be attributed in a great measure to his clear grasp of engineering principles and to a trend in his character to things artistic. However much the reader appreciates a clever illustration he seldom realises that much of the artist's enthusiasm has entered into the task of preparation. The chapter on electrical firing offers another instance where most of the latest inventions are carefully reviewed and described. In respect to generators Mr. Guttmann has a good deal to say about magneto machines, but we do not observe any special reference to the dynamo system of winding the magnet coils so as to obviate variations of current due to loss of magnetism.

THE WEBLEY AUTOMATIC POCKET PISTOL.

THE Webley and Scott Company have scored a notable achievement in bringing out a pocket automatic pistol on the interchangeable system of construction as regards the mechanical side of the question. From a commercial point of view the new pistol ranks as a proprietary article whose existence can never be resented by gunmakers as a trespass on their own sphere of business. In time to come we hope to see the firm of Webley the acknowledged and recognised

FIG. 1.—Showing the position of the hands for drawing out the trigger guard.

manufacturers of many special types of arm commanding a large and ready sale, based upon public confidence that each individual sample will behave like its fellows. The present automatic pocket pistol represents more than an isolated piece of invention. The Company's expert, Mr. W. J. Whiting, is probably the most experienced designer of firearms the gun trade can claim to possess. The many types of gun and rifle which emanate from the Weaman

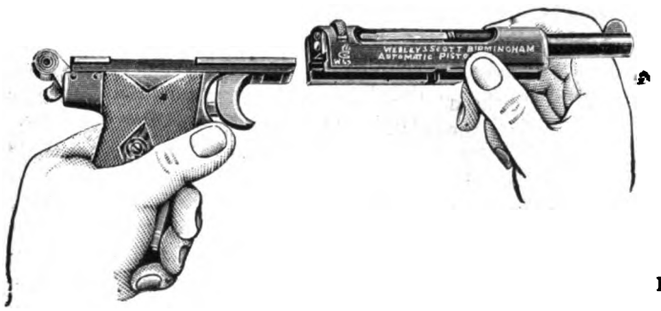

FIG. 2.—When the trigger guard has been removed, the breech block and barrel slide away from the rest of the pistol.

Street factory all owe more or less of their details of construction, or the methods by which the parts are produced, to the designing ability of Mr. Whiting. A long experience in the manufacture of Webley revolvers formed a suitable foundation upon which to attack the problem of automatic loading. The Webley-Fosbery automatic revolver was the first outcome of many years of consistent research and testing of ideas contributed by outsiders as well as by Mr. Whiting himself. Automatic pistols concurrently received a large amount of attention, and model after model was produced, each approaching nearer than its predecessor to the ideal of simplification of parts perfectly co-ordinated with the technical conditions to be met. It is well known that the Company has produced a satisfactory working model of a full-size automatic pistol, but business caution has doubtless indicated the desirability of establishing on a commercial basis for a start a pocket pistol such as may command a general sale, without the delays and modifications which are the usual concomitants of securing its adoption by the home Government or a foreign power.

The new automatic pocket pistol has been designed to take the ·32 Colt automatic cartridge, with its 70-grain metal-covered bullet and smokeless powder charge, imparting a muzzle velocity of 1,050 feet per second. The pistol itself is conceived on very practical lines. Its over-all dimensions, six inches by four-and-a-half inches, hardly convey the idea of compactness which actual handling suggests. The grip is comfortable and substantial, and the amount projecting beyond the shooter's hand when the pistol is held in the firing position seems to amount to very little more than an additional forefinger extended in a pointing fashion. The total weight of the pistol, including the magazine, is 20 ounces, eight cartridges in the magazine accounting for another 2½ ounces. The accompanying illustrations provide an instructive object lesson in the arrangement which has been adopted for taking the pistol apart without the use of tools, improvised or otherwise. The trigger-guard has been made of highly tempered spring steel, thereby enabling it to hold its position by means of the grip arising from its own expansive energy. Fig. 1 shows the way in which the pistol is grasped in the left hand, whilst the forefinger of the right hand pulls the trigger-guard out of its seating by a kind of circular pull. Fig. 2 shows that when the trigger-guard has been removed the barrel and breech block can be slid out clear of the remaining portion of the pistol, which is supported in the

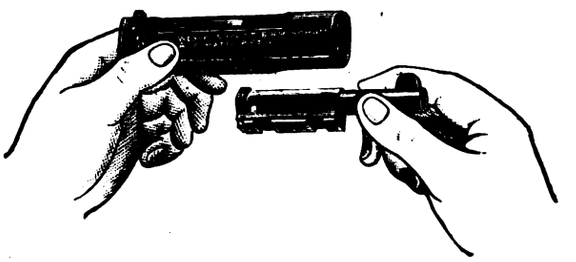

FIG. 3.—The barrel is separated from the breech block piece by drawing the former downwards through a vertically cut slot.

left hand. Fig. 3 shows that the barrel comes apart from the breech block by a simple motion of vertical separation. The barrel can be cleaned, the working parts can be wiped and oiled in an exceedingly short space of time, the pistol being remounted by reversing the above order of operations. Care is necessary to ensure certain surfaces being in coincidence with one another when the trigger-guard is pressed home into place; but as a warning to this effect is set out quite clearly on a label attached to each pistol the owner will have no difficulty in learning once and for all the simple series of operations which enable him to safeguard the smooth working of this most ingenious little weapon.

THE NITRATE INGREDIENTS IN SMOKELESS POWDER.

The following statement concerning the ingredients and manufacture of smokeless sporting powders has recently been widely circulated by the Kynoch Company, and we have considered it appropriate to offer a few remarks thereon :—

"Guncotton is the basis of all 42 and 33 grain nitro-powders, but guncotton in its natural state would detonate instead of burning or igniting, and substances have therefore to be introduced to control its action. The substances generally used are potassium or barium nitrates. These remain behind unconsumed when the cartridge is fired, and sometimes seriously injure the sportsman's eyes. That is "blowback;" once experienced it is never forgotten. The best powders hitherto obtainable contain from 13 per cent. to 20 per cent. by weight of such residue.

Kynoch Limited have invented a process of controlling the guncotton without the use of minerals. They have applied the process to the manufacture of K.S.G. a powder from which the solids remaining after explosion are about ½ per cent. only. This is the only remedy for "blowback." Full details of K.S.G. are embodied in a booklet, for which Kynoch Limited invite applications from all sportsmen. It is sent post free."

It must be understood that we in no way reflect on the usefulness and general good behaviour of the new powder which Messrs. Kynoch have introduced. No information concerning it has reached this office ; but we have every confidence that anything emanating from this firm will be characterised by careful manufacture and the wise selection of a suitable specification. The scientific material which is offered by way of an introduction for the new powder must, however, be regarded as in a great measure a criticism and a condemnation of various powders well-tried and fully established on the market. A journal technically concerned with explosives finds it necessary from time to time to point out fallacious arguments by whomsoever published. Smokeless powders are usually recommended by their makers by certain commonplaces of advertisement phraseology which are customarily interpreted in a broad spirit of toleration. For instance, a powder may according to the description of its maker be absolutely smokeless, free from blowback, insensitive to climatic changes, perfectly regular, hard hitting and so forth. As something must always be reduced to a minimum, recoil is the property to which this special blessing is allocated. There are, however, in the above extract several statements which go further than these claims of general perfection.

Raw guncotton is of course unsuitable for use as a propellant, but when granulated and hardened it is not so, provided a sample is selected with due regard to strength. Guncotton is controlled in the special sense of the term not by nitrate of barium or potassium, but by physical or chemical adjustment, or a combination of the two. The physical treatment consists in the hardening of the grain or otherwise by gelatinisation. Taming by chemical treatment is usually performed by the addition of vaseline or other analagous material. The potassium and barium nitrates of course exercise a certain amount of controlling effect, but they are not present for that purpose, being added only for oxidation. That is to say these substances are rich in oxygen, and thereby supplement the deficiency of the other ingredients in this respect. Many powders contain none of these salts. Amongst their number may be quoted Shot Gun Rifleite, Walsrode, Cooppal No. 2, Ballistite, Mullerite, French T Powder, and so on and so forth. To show that salts are not necessary for controlling purposes a simple experiment can be quoted: A 42-grain powder, giving standard results, was washed so as to remove the whole of the barium and potassium nitrates ordinarily contained in it. The treated powder was then loaded into a sporting cartridge, the charge consisting of 33 grains by weight, which is roughly the amount of material remaining in 42 grains of powder after the salts have been removed. The shot charge weighed 1 1/8 oz. The average pressure for a series of rounds was 2·96 tons in the chamber, and 1·85 tons at 6 ins. The velocity reading was 1,050 ft. per second over the usual 20 yards distance. These results are quite standard, and they appear to provide a complete contradiction of the statement that barium and potassium nitrates are used in powders to tame the natural strength of the guncotton. They appear to have nothing to do with the function ascribed to them as their sole *raison d'être*. If the new Kynoch powder owes its excellence to the diminution of their quantity to one-half per cent., then the above powders which have none at all have still greater merit.

Powder makers, we know, have good reasons for utilising a certain amount of the above salts (usually 10 per cent. in 33-grain powders) in their products. Powders adjusted for the 33-grain charge would certainly be very much easier to manufacture if these salts were omitted. It is in reality one of the most difficult problems in chemical manufacture to make quite certain that 33 grains of a smokeless powder shall at one and the same time exactly fill a 3-dram measure, be hard of grain, and satisfactorily withstand the various tests of ballistic efficiency. The Walsrode system of washing the grains in water would be quite inapplicable to a powder containing soluble salts. Mr. Cocking's patent, published in another column, seems to suggest that a system of water treatment is adopted, that is, of course, assuming that the patent in question relates to the manufacture of the new powder.

Another point seems to be worthy of mention. A certain percentage of these materials is useful in smokeless powders by imparting an alkaline residue to the fouling left in the barrel, whereby deterioration from rusting influences is delayed, if not positively prevented. Powders which contain no such ingredient leave the barrel in a state which makes prompt and thorough cleaning very necessary. If Messrs. Kynoch's new powder gives only ½ per cent. of solids remaining after explosion, combined with the various other properties which have come to be regarded as essential in nitro-explosives, their discovery is of considerable technical importance, and we shall watch its development with sympathy and interest. Past issues of the Kynoch official organ have contained material strongly criticising the opinions on scientific and other matters which have appeared in this and other journals. The present article should give the editor of that journal an opportunity for making clear the position which his firm has taken up ; and we trust that the subject may be dealt with in the friendly spirit which has actuated our own frank but nevertheless amicable criticism.

ROUND THE TRADE.

A good deal of distress is being experienced in the neighbourhood of Woolwich Arsenal by the continued decrease of orders for war munitions.

The Gorst Combined Target Co., Ld., has been formed, with Major R. Lamb, J.P., as chairman, to acquire certain patent rights for target apparatus, and to carry on business therein.

The E.C. Powder Co., Ld., give notice that, owing to the expiration of lease and rebuilding of their old premises at 40, New Broad Street, their London office has been transferred as from the 20th ult. to 20, Bucklerbury, E.C., an address which will be familiar to the older customers of the firm.

The New Explosives Company have recently issued the following circular letter to the trade :—

"As you will see from the enclosed reprint from *Arms and Explosives* of July last, the New Explosives Company have now arranged to take up the manufacture of smokeless powder for shot-guns as well as for all classes of rifles, revolvers and other small arms. These powders are now ready, and we have much pleasure in bringing them to your notice and in recommending them for your adoption, feeling confident that you will find them of the highest quality and quite equal to the best Nitro Powders now on the market. In order to meet the fullest requirements of the trade, the Company are prepared to supply three distinct varieties of smokeless powder for shot-guns, all of them being pure nitrocellulose compounds and containing no nitroglycerine in their composition.

1. *Felixite Smokeless Powder.*—A bulk powder, the charge recommended in a 12-bore cartridge being 42 grains with 1 oz. to 1⅛ oz. of shot. 1 lb. of Felixite will load 166 12-bore cartridges charged with 42 grains each.

2. *Red Star Smokeless Powder.*—A bulk powder, the charge recommended in a 12-bore cartridge being 33 grains with 1 oz. to 1 1/10 oz. of shot. 1 lb. weight of Red Star will load 212 12-bore cartridges charged with 33 grains each.

3. *Shot-gun Neonite.*—A condensed and gelatinised smokeless powder specially made for cone-base cases, the charge recommended in a 12-bore cartridge being 30 grains with 1 oz. to 1⅛ oz. of shot. 1 lb. weight of Neonite will load 233 12-bore cartridges charged with 30 grains each.

These powders can be obtained either in canisters or in loaded cartridges, and on hearing from you we will have much pleasure in forwarding samples for trial.

Nitrocellulose Rifle Powders.—The Company have also commenced the manufacture of pure nitrocellulose rifle powders, which they are issuing under the name of Neonite. They comprise several varieties according to the class of weapon in which they are intended to be used, in particular for sporting, express and military small-bore rifles of ·236 to ·315 bore, and for machine guns of same calibre; also for revolvers, rook and rabbit rifles, and for blank ammunition. They contain no nitroglycerine, and give high velocity with low initial pressure combined with little heating and erosive action. These powders can be obtained either in canisters or in loaded cartridges. The New Explosives Company's factory at Stowmarket ranks with the oldest of its kind in this country, having been originally erected in 1861 under the direction and guidance of the late Sir Frederick Abel, of explosives fame, for the manufacture of guncotton, and it was here that from 1863 to 1865 he carried out his researches on guncotton, resulting in arrangements being made for the production of this material on a manufacturing scale. Since then Stowmarket guncotton has earned for itself a world-wide reputation and has been supplied to practically every foreign arsenal as well as to our own Government. This fact ought to be a sufficient guarantee to the trade that the sporting and rifle powders which the Company are now placing on the market will be found up to the highest standard of excellence and fully equal to any similar explosives that are on the market, especially as guncotton is the base of nearly all smokeless powders now in use."

Messrs. Wakeford, May & Woulfe, a firm who may be described as solicitors-in-chief to the gun trade, have registered as a company W. R. Leeson Ld., the same having been formed to take over the business of this name carried on at Ashford, Kent, and 31, Maddox Street, London.

Mr. P. Louden, manager to Hardy Bros., gunmakers 5, South Street, Edinburgh, was fined £5 for having allowed the registration of his premises for the storage of mixed explosives to lapse, thereby rendering himself liable to the pains and penalties attendant on storing explosives in an unauthorised place.

Lincoln Jeffries & Co., Ld., is the name of a company which has been formed with £1,000 capital to take over the business carried on under that name at 121, Steelhouse Lane, Birmingham. The business has become very known of late years through the energy and enterprise of Mr. Lincoln Jeffries in his successful efforts to make England the home of the air-rifle manufacturing business.

The Minister of Marine has advised the St. Petersburg town authorities that in view of the agitation in favour of removing the navy powder factory from the Smolensk field at the Grebny port, measures are being taken to close the factory at the beginning of 1907. Meantime samples only of smokeless powder are to be made there. Since the explosion last July no shells have been stored on the spot.

The annual report of the Public Control Committee of the London County Council shows that 2,846 premises are registered for the storage of explosives in the county of London, the greater number being for the storage of fireworks. At 22 registered premises the filling of safety cartridges is carried on in rooms specially adapted for the purpose. These premises are of course the subject of frequent inspection by the County Council.

The annual report and balance sheet of the Birmingham Small Arms Co., Ld., for the year ended July 31 last has just been issued. Including the sum of £7,609 brought forward from the previous account, there is an available surplus of £81,721 for distribution. Interim dividends, and the present final distribution, make up a total of £55,358, which covers 10 per cent. dividend and five shillings per share bonus on £304,725 worth of £5 ordinary shares, and five per cent. dividend on £203,150 of preference shares. Of the sum remaining in hand £15,000 is to be carried to the reserve fund making the total £75,000, and leaving £11,363 to be carried forward. The account makes mention of the purchase by the Company of the Sparkbrook factory, the appearance of this item in the balance sheet having caused various alterations in the different items set forth. A portion of the expense of purchase has apparently been met by a mortgage of £50,000 on the new factory. The cash surplus, shown in the previous account, has given place to an item of £8,952 owing to the bank; but the assets have of course gone up in a degree proportionate to the liabilities. The general business position of the Company is well shown by the statement that Government orders for service rifles, though smaller than in the previous year, have kept the gun department fairly well employed during the past year, and the prospect for the current year is satisfactory. The cycle business has been very active, and the new Sparkbrook factory will be employed with the immediate establishment of a motor department. In the course of his speech at the annual meeting the chairman, Sir Hallewell Rogers, referred to the adoption of a miniature rifle by the Government, and its probable effect in opening up a new branch of manufacture. Some unfavourable references were made in the course of the same meeting to the now established internal reserve, but the general trend of the meeting showed that in this, as in other matters, the directors, retain the full confidence of the preponderating bulk of the shareholders. Mr. T. F. Walker has found it necessary, for health reasons, to resign the office of chairman, but he remains a member of the Board. Sir Hallewell Rogers has been appointed chairman in his place, and Mr. Hubert Wallis, the managing director, has been appointed deputy-chairman. Mr. F. D. Docker has been nominated for a place on the Board.

LECTURES TO YOUNG GUNMAKERS.

XXXIX.—RECOIL IN A NEW UNIT OF MEASURE.

In no department of shooting test have experiments been so continuously carried on as in recoil; and certainly in no other instance do final results seem so near achievement. It is difficult to know where to give credit when so many workers have contributed their thoughts and ideas. The late Dr. Walsh did an immense amount of work with the spring recoil gauge, and thereby emphasised the importance of considering cartridges from this point of view. Amongst modern contributions to the elucidation of recoil the names of Mr. Jones and the late Mr. Housman must be associated. It was Mr. Jones who mounted the proof barrel down, at Barwick, on wheels, registering, side by side with every record of velocity, the distance which the gun was driven backwards along the rails which supported the carriage. An attempt was made to standardise the distance of movement with reference to foot-pounds, but the friction varied day by day according to the weather and the condition of the lubricant on the wheels. Relative results were, however, always obtainable; and these afforded a very valuable check on the velocity readings obtained. This gun is still in daily use at the Eley factory; but as a means of registering recoil it is entirely outclassed by the Housman system of a freely suspended gun as heavy as a cannon. The ingenuity of Mr. Housman enabled him to carry out the automatic registration of recoil in respect to every shot fired on a system which left no doubt as to the precision of the measurements obtained. That is to say the readings of recoil were not only true relatively with one another, but they were taken on a system which enabled them to be converted into exact units, whether in terms of energy or velocity.

The Housman system of recoil taking was incorporated into the design of the *Field* proof gun which was adopted by a committee of experts, Mr. Housman among their number, who met at the offices of that paper. The leading manufacturing companies are now possessed of replicas of the original instrument, which was constructed for the *Field* under the supervision of the executive committee which was appointed at the conference above referred to. The Housman system is now expressed by a gun weighing exactly 50 lbs. which is suspended pendulum fashion on four wires having a radius of five feet. The recoil is measured in the number of inches of horizontal movement in a backward direction; and the general experience which has now been gained in the use of these guns make it necessary to write a new chapter in the science of fire-arms. It may appropriately be prefaced by giving the following reproduction of a card which has lately been issued for interpreting the results obtained.

Taking Recoil on the Housman System.

"The table on the face of this card is based upon a pendulum proof gun having a 5-ft. radius of swing, and weighing exactly 50 lbs., this including half the weight of the moving portions of the suspending wires and fittings. It is inapplicable to any other weight of gun or radius of swing.

Frictional resistance may be estimated and allowed for by releasing the gun from rest when held back (say 10 in., as shown on the slide) and measuring the loss after one complete swing. Previous to firing a shot, the slide should be set one-quarter of this distance from the zero marked on the scale, and the index rod on the gun should just touch the slide when so set. The distance for a properly mounted gun has been found to be ·15 of an inch.

To eliminate the friction involved in pushing the slide along the scale, the slide should be set at a point on the scale representing about 1 in. less than the recoil anticipated.

Recoil in Velocity and Energy Units.

It has been customary in the past to register recoil in ft.-lbs. units with reference to a conventional weight of gun, usually 7 lbs. Even when the reading is expressed in the correct energy of recoil for a precise weight of gun, a given ft.-lbs. value of recoil can only be regarded as tolerable or intolerable with reference to the particular weight of gun under consideration. Thus 30 ft.-lbs. might be quite endurable in the case of a gun weighing 7 lbs., whereas it would be inadmissible if produced in a 6¼ lb. gun.

Experience has in fact shown that the energy of a gun's movement in recoil is not a reliable medium for expressing the shooter's sensations. The amount of distress he experiences is more correctly denoted by the *rate* of movement, the actual weight set in motion being of only secondary importance.

The accompanying table of recoil shows the velocity of movement for every reading of recoil with reference to four weights of gun, viz. 6¼, 6½, 6¾, and 7 lbs.

Experience will sooner or later show that a recoil velocity of 16·5 f.s. or thereabouts may be regarded as standard for all sporting cartridges. With a given distance of recoil for a cartridge tested, the minimum weight of gun suited to that cartridge will be determined by the column which contains the nearest value to 16·5 f.s. Thus for an average recoil of 10·50 in. the reading will be :—

Weight of gun.	7 *lbs.*	6¾ *lbs.*	6½ *lbs.*	6¼ *lbs.*
Velocity of Recoil.	15·93 *f.s.*	16·51 *f.s.*	17·16 *f.s.*	17·48 *f.s.*

so showing that such cartridges should not be shot in a gun weighing less than 6¾ lbs.

By adopting this process of measurement it will be possible, when reporting to the general public, to abandon the use of scientific units of recoil, and to state the result in the form of the best weight of gun for the cartridge tested. Those shooters who are unduly sensitive to recoil, will of course interpret the weight determined by experiment with due reference to their special requirements. Others, again, of more powerful physique will be able to use a combination of gun and cartridge, giving a comparatively high recoil.

The accompanying tables and explanatory matter are issued under the authority of the following subscribers :—

Users of the Field Proof Gun :—Cogswell & Harrison, Ld., Eley Bros., Ld., Curtis's & Harvey, Ld., New Explosives Co., Ld., Schultze Gunpowder Co., Ld. Manufacturers of the Field Proof Gun :—Webley & Scott, Ld. First Users of the Housman System :—Kynoch. Ld."

For the convenience of those who wish to compare the old and the new methods of computation a foot-pounds table is herewith appended :—

TABLE OF RECOIL ENERGY FOR GUN WEIGHING 7 LBS.

Backward Travel.	Recoil.	Backward Travel.	Recoil.
inches.	*ft.-lbs.*	*inches.*	*ft.-lbs.*
6·0	8·95	10·2	25·97
7·0	12·19	10·4	27·00
8·0	15·94	10·6	28·06
8·2	16·75	10·8	29·14
8·4	17·58	11·0	30·25
8·6	18·43	11·2	31·38
8·8	19·30	11·4	32·53
9·0	20·19	11·6	33·69
9·2	21·10	11·8	34·87
9·4	22·03	12·0	36·07
9·6	22·98	13·0	42·43
9·8	23·96	14·0	49·30
10·0	24·96	...	...

(Extract ends.)

It is not here intended to reprint the table of values referred to as appearing on the face of the card, of which the above is the explanatory matter, but rather to show that now recoil testing has been placed upon a definite basis the values given on the card can be greatly simplified.

The whole question really turns on the adoption of some suitable basis of recoil velocity by which to judge the measurements or records obtained. The ordinary card of values shows the velocity of recoil for various definite weights of gun. If the velocity corresponding with a normal recoil is once and for all fixed, the changing value becomes the weight of the gun. That is to say the recoil of any cartridge can be specified with reference to the appropriate weight of gun for firing it. As all shooters are not alike some kind of latitude must be allowed; but this seems to be amply provided for by the assumption that a full recoil arises in the presence of a gun four ounces lighter than the table value, whilst eight ounces difference implies a heavy recoil. In a similar fashion shooters who desire a moderate recoil should have their guns to weigh four ounces heavier than the table specifies—an eight ounce margin in the same direction giving low recoil conditions. These assumptions are all based upon the possibility of arriving at some definite velocity of recoil which may be accepted as governing practical conditions. There is no great margin for variation of opinion in this respect, for the simple reason that certain average weights of gun are recognised in the trade as suitable for cartridges containing certain charges. Practical variations amount to a very few ounces in either direction. In fact the whole difficulty turns upon the relative desirability of 16·0 f.s. and 16·5 f.s. as the basis recoil velocity for judging the relation of guns and cartridges with reference to their physical effects on the shooter. Two tables are accordingly here appended, which have been based on the above alternative standards of recoil velocity.

FIELD PROOF GUN.—TABLE FOR CONVERTING DISTANCE OF RECOIL MOVEMENT INTO APPROPRIATE WEIGHT OF GUN FOR AN ASSUMED STANDARD RECOIL VELOCITY OF 16·0 F.-S.

Distance of Recoil.	Appropriate Weight of Gun.	Distance of Recoil.	Appropriate Weight of Gun.	Distance of Recoil.	Appropriate Weight of Gun.	Distance of Recoil.	Appropriate Weight of Gun.
8·00—8·06	5 lbs. 5 oz.	9·02— 9·08	6 lbs. 0 oz.	10·04—10·12	6 lbs. 11 oz.	11·06—11·14	7 lbs. 6 oz.
8·08—8·16	6	9·10— 9·18	1	10·14—10·22	12	11·16—11·22	7
8·18—8·24	7	9·20— 9·28	2	10·24—10·30	13	11·24—11·32	8
8·26—8·34	8	9·30— 9·36	3	10·32—10·40	14	11·34—11·42	9
8·36—8·44	9	9·38— 9·46	4	10·42—10·48	15	11·44—11·50	10
8·46—8·52	10	9·48— 9·56	5	10·50—10·58	7 lbs. 0 oz.	11·52—11·60	11
8·54—8·62	11	9·58— 9·64	6	10·60—10·68	1	11·62—11·70	12
8·64—8·72	12	9·66— 9·74	7	10·70—10·76	2	11·72—11·78	13
8·74—8 80	13	9·76— 9·84	8	10·78—10·86	3	11·80—11·88	14
8·82—8·90	14	9·86— 9·92	9	10·88—10·94	4	11·90—11·98	15
8·92—9·00	15	9·94—10·02	10	10·96—11·04	5		

A SIMILAR TABLE FOR AN ASSUMED STANDARD RECOIL VELOCITY OF 16·5 F.-S.

Distance of Recoil.	Appropriate Weight of Gun.	Distance of Recoil.	Appropriate Weight of Gun.	Distance of Recoil.	Appropriate Weight of Gun.	Distance of Recoil.	Appropriate Weight of Gun.
8·04—8·12	5 lbs. 0 oz.	9·00— 9·08	5 lbs. 10 oz.	10·04—10·12	6 lbs. 5 oz.	11·00—11·06	6 lbs. 15 oz.
8·14—8·22	1	9·10— 9·16	11	10·14—10·22	6	11·08—11·16	7 lbs. 0 oz.
8·24—8·32	2	9·18— 9·26	12	10·24—10·30	7	11·18—11·26	1
8·34—8·40	3	9·28— 9·36	13	10·32—10·40	8	11·28—11·36	2
8·42—8·50	4	9·38— 9·46	14	10·42—10·50	9	11·38—11·44	3
8·52—8·60	5	9·48— 9·54	15	10·52—10·60	10	11·46—11·54	4
8·62—8·70	6	9·56— 9·64	6 lbs. 0 oz.	10·62—10·68	11	11·56—11·64	5
8·72—8·78	7	9·66— 9·74	1	10·70—10·78	12	11·66—11·74	6
8·80—8·88	8	9·76— 9·84	2	10·80—10·88	13	11·76—11·82	7
8·90—8·98	9	9·86— 9·92	3	10·90—10·98	14	11·84—11·92	8
		9·94—10·02	4			11·94—12·02	9

While these tables will be of great assistance to experimentalists for the every-day work of testing, and will help the young gunmaker to appreciate the meaning of published results, they need to be supplemented by statistics of actual shooting test in order to illustrate their true inwardness. A very valuable table showing the behaviour of various combinations of charge in 12-bore cartridges was published in the *Field* of October 28th last year. This table gave the recoil movement for a comprehensive variety of charges. The velocity accorded to each combination of powder and shot was obtained by practical experiment; and one may, therefore, suppose that here and there exceptional records may be found in which the behaviour experienced may be slightly out of harmony with ordinary experience. This remark applies for instance to the very high velocity obtained with 42 grains of smokeless powder, and one ounce of shot. However, the table does not stand or fall by a single result. Generally it expresses the behaviour of the powders specified; and subsequent results have confirmed the figures previously given. A further table is accordingly presented which embodies the *Field* results of last autumn, interpreted by means of the two previous tables which now appear in print for the first time.

It will at once be apparent that the table which is true for an assumed standard recoil velocity of 16·0 f.s. exactly fits in with the every-day experience of the past 20 years. Using 42 grains of Schultze and 1⅛ oz. of shot a velocity of 1,063 feet-per-second is obtained as the mean over 20 yards. This cartridge produces a travel of 10·53 inches on the *Field* proof gun. The appropriate weight of gun to fire this cartridge is exactly 7 lbs., which fully confirms the general experience that recoil is found to be rather high when this charge is used in the ordinary game gun having a weight of 6¾ lbs. In such instances 1 1/16 oz. is the favourite charge, and this produces a recoil movement which suggests 6 lbs. 13 oz. as the appropriate weight of gun. Turning now to E.C. charges the favourite load of 36 grains and one ounce, giving a very high velocity, coincides with a gun weight of 6 lbs. 11 oz., again the 6¾ lbs. weight commonly adopted by the trade. 33 grains and 1 1/16 oz. of shot has always been recognised as a low recoil cartridge. 6 lbs. 5 oz. is the table value for the weight of gun from which this charge may be fired to give a normal sensation of recoil. A 6½ lbs. gun gives three ounces margin, and would, therefore, recoil to a moderate extent. Guns weighing anything from 6 lbs. 9 oz. to 6 lbs. 12 oz. would exactly meet the requirements of shooters desiring a low recoil combination. Turning again to Schultze we find the popular load of 40 grains and one ounce gives a very moderate recoil, which is expressed by a gun weight of 6 lbs. 7 oz. In fact taking the entire column on the 16·0 f.s. basis the whole of the smokeless powder charges specified conform very closely with practical every-day experience.

Table showing the Behaviour of Various Sporting Charges with Reference to the Appropriate Weight of Gun for Firing them.

Powder.	Grains of Powder and Ounces of Shot.	Mean Velocity over 20 yards.	Distance of Recoil Movement in inches.	Weight of Gun for 16·0 f.s. Velocity of Recoil.	Weight of Gun for 16·5 f.s. Velocity of Recoil.
BLACK	88 × 1⅛	1094	11·88	7 lbs. 15 ozs.	7 lbs. 8 ozs.
,, ...	84 × 1⅛	1069	11·48	7 10	7 4
,, ...	80 × 1⅛	1042	11·20	7 7	7 1
SCHULTZE	44 × 1⅛	1096	10·90	7 4	6 14
,, ...	42 × 1⅛	1063	10·54	7 0	6 10
,, ...	42 × 1 1/16	1092	10·30	6 13	6 7
,, ...	42 × 1	1135	10·24	6 13	6 7
,, ...	40 × 1⅛	1012	10·14	6 12	6 6
E.C.	35 × 1⅛	1062	10·10	6 11	6 5
,, ...	36 × 1	1140	10·08	6 11	6 5
SCHULTZE	40 × 1 1/16	1060	9·88	6 9	6 3
E.C.	33 × 1⅛	1032	9·70	6 7	6 1
SCHULTZE	40 × 1	1076	9·68	6 7	6 1
E.C.	33 × 1 1/16	1063	9·56	6 5	6 0
,, ...	33 × 1	1076	9·50	6 5	5 15
,, ...	31 × 1⅛	999	9·38	6 4	5 14
RECOILITE	30 × 1⅝	1052	8·80	5 13	5 8

With black powder cartridges on the other hand the three values specified appear to need some justification. Everyone knows that in the old days of black powder the shooter was taught to regard high recoil as a proof of efficiency in the cartridge; and according to the figures given the shooter received full measure. Shot guns were of course heavier in those days than they are now. Seven pounds was certainly a normal weight, to judge by the circumstance that all the old tables of recoil were based upon a fixed weight of gun of this value. The table values for standard black powder cartridges run about half-a-pound heavier than the guns actually weighed: therefore the recoils registered with a black powder charge and a seven-pound gun would rank as high according to modern estimates of what recoil ought to be. In times gone by when game was less plentiful, and the shooting methods employed involved fewer opportunities for a constant succession of shots, a standard of recoil which would be

regarded today as excessive may have been quite endurable with the old heavy guns, coupled with fewer shots fired per day, the opportunities for shots presenting themselves at more regular intervals allowing a longer period between times for recuperation.

Having said so much in favour of the 16·0 f.s. column of recoil values, the alternative figure may be dismissed in a very few words. The only argument in favour of assuming the higher recoil velocity is that it brings the calculated appropriate weight for the black powder charges nearer to our present conception of what they ought to be; but this argument will not stand against the common experience that a gun weighing seven pounds is distinctly punishing to the shooter when used with black powder charges. The same column entirely loses touch with modern conditions in respect to low-recoil charges with reference to present day weights of gun. While it is quite feasible for instance to suppose that a 6¼ lb. gun gives a reasonable amount of recoil when firing 33 grains and one ounce of shot, the same cannot be said for the alternative 6 lbs. 1 oz. weight of gun. With such a gun, complaints would arise with reference to the amount of recoil experienced.

With low recoil cartridges so much in vogue the gunmaker can adopt either of two courses. He can reduce the weight of the gun by a given number of ounces, and so diminish to that extent the burden to be carried through the day. As an alternative he can leave the weight of the gun unaltered, giving the shooter the benefit, say, two hundred times a day of a greatly diminished recoil. The latter course seems to be the one most generally adopted; and there are practical reasons in its favour, in so far that the shooter is not tied down by the light weight of his gun to a particular group of low recoil charges.

In the case of the Holland "Recoilite" cartridge which contains a ⅛oz. charge of shot the very low recoil values could have been utilised for bringing the weight of the gun down to 5 lb. 13 oz. Instead of going to so extreme a weight Messrs. Holland, when constructing a gun to display in the best way possible the good qualities of this cartridge gave the gun a weight running slightly in excess of 6¼ lbs. That is to say the specification of the cartridge provided a margin for reducing the gun weight by an entire pound. It was, however, reduced half this amount, and shooters gain the double advantage of reduced recoil and a diminished weight of gun. The resulting rule seems to be that a margin of gun weight in excess of the table value is useful up to half-a-pound in giving low recoil; but beyond this point normally constituted persons derive no further benefit from the reduction of recoil. Any further margin still remaining may be utilised by diminishing the weight of the gun.

If the reader has patiently followed the somewhat detailed exposition of the new treatment of recoil measurements, it should be apparent to him that we are entering a new period in the statement of gun experiments. The old foot-pounds unit conveyed no mental conception whatsoever as to whether the recoil registered was high or low for the shooter's own particular weight of gun. The foot-seconds velocity for a variety of weights of gun is only useful in so far that it affords a good general index to the amount of the recoil when considered with reference to some standard rate of movement. The ordinary table must, therefore, stand on the firm basis that no assumptions are involved in the values it specifies. The supplementary tables which have here been given are merely an attempt to anticipate the time when a standard rate of recoil will be generally agreed upon, so making velocity a fixed quantity and leaving the weight of the gun as the sole variant. The position may be summarised in the following fashion:—

The foot-pounds unit of recoil is valueless as a measure of the shooter's physical sensations, because the number of foot-pounds of recoil which can be comfortably borne varies according to the weight of the gun.

The foot-seconds velocity unit of recoil is a true index of the shooter's physical sensation, because all guns from the heaviest to the lightest attain the shooter's own standard of recoil when a given velocity of movement has been reached.

The weight of gun unit of recoil is the logical outcome of a correct means for stating the velocity, because the weight of the gun is a tangible quantity, and every gunmaker or shooter having recoil measurements supplied in this form can interpret them with reference to any given gun by comparing its actual weight with the table value of gun weight into which the inches readings are transposed.

THE PYROMETER IN MANUFACTURING ESTABISHMENTS.

THE Cambridge Scientific Instrument Company of Cambridge have sent us their list No. 39 of 62 pages entitled "Technical Thermometry." This title might in some quarters cause misapprehension. The catalogue does not relate to mercurial or spirit thermometers but electrical and optical pyrometers, instruments designed to register or record the temperature of inaccessible places, too hot for the ordinary thermometer.

The pamphlet differs in many respects from an ordinary catalogue. Although the prices of the instruments and parts are set in detail the descriptive matter includes so much of the underlying principles involved, and the application of pyrometers to special purposes, that it forms a useful appendix to the standard works on the subject. A more correct title to our mind would be: Pyrometry as applied to the arts and manufactures.

The manufacturer will find described the special application of pyrometers to various manufacturing operations, and thus assist him in any prospective installation. On the other hand the science student will meet with the variations of standard forms, devised for his special demand. A not unimportant feature of the work comprises the various tables which are included in its pages. Special mention should be made of the table by Dr. Harker, of the National Physical Laboratory, showing the boiling and melting points of various metals and other substances. The values in this table differ materially from those generally accepted, because the usual text-books have not yet assimilated the results of the latest researches.

Pyrometry has now become established in all first-class steel-works, and in many tool-shops. No longer does the manufacturer rely on the eye of the workman to determine the narrow margin of temperature essential in the operations of annealing and hardening. In the early days, and in the application of pyrometry this is only a few years ago, the

workman looked with suspicion and great annoyance on the instrument located in the office which indicated irregular firing of the furnaces placed in his charge and not unfrequently did the instrument suffer in consequence. Nowadays the workman is beginning to regard the pyrometer more as a help than as a policeman to keep a record of his shortcomings. To give further encouragement to this change of front Mr. Robert S. Whipple has suggested a system of bonus to workmen in charge of furnaces, when the temperature is kept within prescribed limits. This is an excellent idea, and would pay the manufacturer in coal consumption and quality of output. The scheme is explained fully in the catalogue.

It would take us beyond the limits of this notice to describe the instruments, or the application of the same to technology. Pyrometers are applicable to all manufactures where heat is a process, and those interested in such industries should apply for a copy of this catalogue.

It is reported from Russia that experiments have been made at the gun factory, Polygon, with a new system of shell, the invention of a mining engineer. It is a little difficult to make out the exact purpose of the new system of construction, but it appears mainly to relate to means for controlling the manner and direction of distribution of the fragments projected from a shrapnel shell.

The annual report and balance sheet of Sir W. G. Armstrong, Whitworth & Co., Ld., shows a profit of £607,186 on the year's operations, including £84,033 brought forward. This allows for the payment of three shillings per share dividend on the ordinary shares, which, with the payment of £14,120 on the preference shares, will absorb £503,317, leaving a balance of £103,869. The accounts of the Company will be closed for balance taking purposes on the 31st December next, the period to be covered being six months. This step has been found necessary in view of the various inconveniences attaching to the principle of closing the financial year on the 30th June.

APPLICATIONS FOR PATENTS.

AUGUST 27—SEPTEMBER 22, 1906.

19,136.* Means for Preventing Accidental Discharge of Firearms. C. Lewes.
19,169. Adjustable Backsight for Rifles. G. W. Bonson and W. Bonson.
19,215. Apparatus for increasing the Density of Fusible Explosives. C. E. Bichel.
19,240. Ordnance Breech Mechanism. Sir W. G. Armstrong, Whitworth & Co., Ld., and C. H. Murray.
19,288.* Single-trigger Mechanism. O. W. Brenizer.
19,408.* Explosives. C. Duttenhofer.
19,441. Ordnance Mountain Equipments. W. Beardmore & Co., Ld., and A. Banks.
19,579. Means for Directing the Firing of Guns on Ships. T. Gilbert Russell.
19,622. Apparatus for Teaching Rifle Shooting. H. M. N. Milton.
19,641.* Cartridge Feeds for Automatic Firearms. A. G. Bloxam.
19,688.* Cartridge Belts. W. Lindsey.
19,689.* Cartridge Belts. W. Lindsey.
19,706. Projectiles. S. O. Cowper-Coles.
19,707. Ordnance. A. F. Petch and R. Redpath.
19,791.* Explosives. O. Silberrad.
19,858. Sighting Gear for Ordnance. A. F. Petch and F. W. H. Shepherd.
19,928. Ammunition Hoists. A. F. Petch, R. H. Carpmael and W. Osborne.
19,932. Browning Guns. C. Dencker.
19,954.* Magazine Firearms. K. A. Bräuning. (Date of Application in France, Sept. 7, 1905).
20,049. Hoisting Apparatus for Turret Guns. A. T. Dawson and J. Horne.
20,053. Breech Loading Ordnance. A. T. Dawson and G. T. Buckham.
20,126.* Small-arms. T. C. Johnson. (Date of Application in the United States, May 7, 1906).
20,146. Detonator Shield and Fuse Clincher. J. F. Barber.
20,166. Projectiles. J. A. Nisbet.
20,365. Apparatus for Thawing Explosives. J. P. Jones.
20,376. Bullets. A. Bessel.
20,382.* Sword-Pistol. A. Kühnen.
20,475. Signalling Apparatus. G. Hecht and P. Arens.
20,528. Sporting Guns. F. W. Isaac.
20,531.* Hand Protector for Gun Barrels. W. C. Alves.
20,544. Ordnance Sighting. C. R. B. Owen and W. J. Griffiths.
20,634.* Cartridge Holders. C. J. Ross.
20,675.* Automatic Firearms. F. R. C. von Stechow.
20,691.* Ordnance Trigger Mechanism. Fried. Krupp, A.-G. (Date of Application in Germany, January 17, 1906).
20,692.* Elevation Apparatus for Ordnance. Fried. Krupp, A.-G. (Date of Application in Germany, January 10, 1906).
20,744. Air Rifles. L. Jeffries and G. F. Urry.
20,786. Shooting Glove. D. S. Ashworth.
20,889.* Explosives. C. G. Luis and J. C. Williamson.
21,080. Repeating Rifles. K. Vondruska.
21,098.* Automatic Guns. Hotchkiss Ordnance Co., Ld.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

AUGUST 30—SEPTEMBER 20, 1906.

COMPILED BY HENRY TARRANT.

16,946 (1905). **Transport of Cartridges.** W. P. Wise, London (Agent for *W. Lindsey, U.S.A.*) A satchel is constructed to contain a number of bandoliers loaded with cartridges ready to be served out to the wearers. The triangular fastening is constructed so that the bandoliers may be folded to pack flat. The loaded satchels may be transported on the backs of animals. Accepted August 16, 1906.

21,779* (1905). **The Manufacture of "Bulk" Smokeless Powders.** A. T. Cocking and Kynoch, Ld., Birmingham.

25,222 (1905). **Breakdown Air Guns.** A. H. Hill, Handsworth, and W. F. Williams, Aston Manor. The parts of a breakdown air gun are arranged beneath the spring compression cylinder, so that an efficient pistol grip may be constructed on the stock. A part is also arranged to act as a valve in order that the air compressed by the plunger may be stored up and released only at a certain point. A sudden, instead of a gradual, push is in this way imparted to the pellet. Accepted August 16, 1906.

25,781 (1905). **Ammonium Nitrate Explosives.** G. Reschke, Hamburg. The patentee has discovered that ammonium nitrate explosives can have an admixture of more than 120 per cent of carbon compounds beyond the calculated amount which is ordinarily found necessary for freeing the explosive gases of carbonic oxide and hydrogen. The addition of such a quantity necessitates grinding much smaller quantities of the explosive at one time, but a great degree of safety against fire-damp and coal dust is said to be obtained. Accepted August 30, 1906.

460 (1906). **Construction of Projectiles.** — Jones, Bersham, Wales. A projectile is constructed in two parts, one screwing into the other. This arrangement allows of easy manipulation so far as loading the shell is concerned, and of an increase of the total length of the shell for alteration of ballistics and explosive power. Accepted August 23, 1906.

2,753 (1906). **Correcting the Sighting of Ordnance.** Professor S. Czapski, Germany. A telescopic appliance consisting of two separate portions—one for the breech and the other for the muzzle—is inserted in the bore of a gun. The line of sight coincides with the axis of the bore. The adjustment of the ordinary sights may be tested by the aid of this device. Accepted August 23, 1906.

4,389 (1906). **Machine Gun Mechanism.** Baron A. O. von Augezd, Vienna, Austria. Machine gun breech mechanism of the types set out in patents Nos. 23,271 (1899), 16,939 (1890), and 7,137 (1892) is modified with the object of rendering it more safe and reliable in operation. It is also constructed to enable single cartridges to be fired by hand, or a given series to be discharged at will. Accepted August 23, 1906.

4,389A (1906). **Automatic Small Arms.** Baron A. O. von Augezd, Vienna, Austria. In order to regulate the exact time for unlocking the breech block of an automatic small arm the gases of combustion are conducted from the barrel through a passage some inches in front of the chamber, and thence through a helical passage to the cylinder holding the plunger designed to regulate the movement of the breech block. Accepted August 16, 1906.

9,267 (1906). **Barrel Recoil Ordnance.** Fried. Krupp, A-G., Germany. The air running out gear of barrel recoil ordnance composed of a compressor and compressed air reservoir is combined with a fluid pressure brake. The patentees arrange the reservoir to contain the recoil brake and the compressor within itself. Accepted August 23, 1906.

9,947 (1906). **Sighting Telescopes.** Fried. Krupp, A-G., Germany. Regarding sighting telescopes having several sighting marks as described in patent No. 23,458 (1904), the patentees surround the bush carrying the sighting marks with a chamber of the casing of the telescope so that only a portion of its jacket is exposed. Manipulation is not interfered with. Accepted August 16, 1906.

10,209 (1906). **Support for Small Arms.** J. Livtschak, Russia. A double-legged support elastically attached to the barrel of a rifle is arranged so that when released from the folded position beneath the rifle the legs diverge and form an angle one with the other. The rifle may be twisted about on the elastic attachment after the manner of a universal joint. Accepted August 16, 1906.

11,092* (1906). **Bolt Rifle Trigger Mechanism.** A. and C. Francotte, Belgium.

12,474* (1906). **Single-Trigger Mechanism.** J. D. Russ, F. F. McIntosh, and A. J. Lyons, U.S.A.

12,716 (1906). **Ammonium Nitrate Explosives.** B. G. Reschke, Germany. In order to render the gases of combustion of ammonium nitrate explosives harmless in dangerous mines, a certain proportion of fennel with or without wood pulp is incorporated into the explosive. An example of one compound is 81·8 per cent. ammonium nitrate, 6·6 per cent. fennel, 5·6 per cent. wood pulp, 1·0 per cent. dinitrobenzol, and 5·0 per cent. copper oxalate. Accepted August 30, 1906.

12,807 (1906). **Shrapnel Shell.** L. Reidel, U.S.A. The patentee is aware of patents Nos. 865 (1902), 25,327 (1894), but he states they do not deal with the sort of shell he describes, which consists of two sections having a threaded connection. The bottom section contains the smaller projectiles and a tube of explosive, whilst the top part holds a longitudinally sliding firing stem. Accepted August 30, 1906.

13,849 (1906). **Barrel Recoil Ordnance.** Rheinische Metallwaaren und Maschinenfabrik, Germany. The idea dealt with in this specification is particularly applicable to guns which have to be dismounted for transport. A loosely mounted disc is inserted between a flange on the brake cylinder and the end of the spring that returns the gun after recoil. When the brake cylinder is removed the spring is retained by the disc in the cradle. Accepted August 30, 1906.

14,316 (1906). **Percussion Fuse.** Fried. Krupp, A-G., Germany. The needle and primer of this percussion fuse are arranged so that they are held in a position of absolute safety until the projectile impacts. The primer bearing part, by the sudden stoppage of the rotatory motion of the projectile, is turned in its screw socket by a loosely mounted part which continues to revolve until the primer is brought into contact with the firing pin. The same movement opens a passage and gives access to the explosive charge. Accepted August 23, 1906.

14,634 (1906). **Cartridge Belts.** J. Y. Johnson, London (Agent for *W. Wesley, Russia*). Pockets adapted to contain cartridges are provided with eyelets through which a piece of stiff wire is passed to allow its hooked ends to catch top and bottom of the belt, and so retain the pouch in position. Accepted August 30, 1906.

14,762 (1906). **Shrapnel Fuse Setting Device.** Fried. Krupp, A-G., Germany. The fuse of shrapnel shell for high angle gun is set by means of a device provided with a number of scales corresponding with the weight of propellant used. Accepted August 30, 1906.

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

SELECTED PATENTS.

"BULK" SMOKELESS POWDER.

21,779 (1905). A. T. Cocking and Kynoch Ld, Birmingham. The production of a nitrocellulose powder of such density that the space occupied by a given weight is great in relation to its explosive power is described in this patent. When the charge is measured by bulk the same measure may be used as is necessary for making up charges of black powder.

Patent No. 15,053, 1904, contained a description of a method of preparing such a powder, but it has been found that a better grain may be made and a certain amount of waste may be avoided which was caused by removing the unsuitable part of the old grain. The patentees are aware that it has been proposed to destroy the fibrous nature and to purify nitrocellulose by treating it with solvents diluted with some inert liquid such as a mixture of nitrobenzene and alcohol, the fibres being swollen and disintegrated by this method; but they propose to form a bulk powder by causing the grains to revolve one over the other at the same time thoroughly wetting them with a liquid which will act as a solvent only for a portion of the nitrocellulose and gelatinising only part of the grains while revolving with a mixture of benzene and alcohol or methylated spirit. The gelatinisation is stopped by pouring hot water over the grains. The density of the finished grains depends upon the period of treatment and the temperature of the water used.

To form a sporting powder 32 grains of which should occupy the unit measure of three drams of black powder the wet pulverised nitrocellulose is granulated. The grains are dried and revolved and whilst revolving they are thoroughly wetted with a mixture of benzene and alcohol. Any such liquid may be used providing it is not a complete solvent for the particular nitrocellulose under treatment, but in the case of benzene and alcohol the patentees prefer to mix them on the proportion which will act as a solvent for 30 per cent. of the nitrocellulose. About 120 lbs. of the liquid mixture are added to 100 lbs. of grains of nitrocellulose and it has been found that five minutes treatment gives a suitable density. The grains are poured into about 250 lbs. of water at 85° C. and the mass is agitated. The water replaces the solvent and stops gelatinisation. An increased temperature of the water is found to decrease the density of the grain. The liquid is separated from the powder by the aid of a centrifugal machine the moisture being reduced until only 25 per cent. remains.

About 2½ per cent. of nitrate of potassium is either sprayed on to the wet powder grains or is incorporated with the nitrocellulose before granulation to obtain a solid residue after combustion. The combustion may also be moderated by spraying the wet grains with a solution of vaseline in benzene or other solvent. Accepted August 23, 1906.

SINGLE-TRIGGER MECHANISM.

12,474 (1906). J. D. Russ, F. F. McIntosh, and A. J. Lyons, U.S.A. The drawings attached to this specification do not give a very clear idea of the details of the mechanism. The principle follows that usual in some single-trigger systems, but the mode of operation is somewhat different. A limb is pivoted on the trigger

plate at the rear end of the trigger blade so that it may be swung laterally from beneath one sear tail to a position beneath the other. Whichever sear tail it happens to be beneath is the one which will be lifted when the trigger is first pulled. This part acts also as a sort of interceptor to stop the involuntary pull discharging the second barrel. The involuntary pull as is well known is an inevitable result of the recoil of the first discharge. The second deliberate pull lifts another part which has been allowed during the first movements to slide beneath the sear tails.

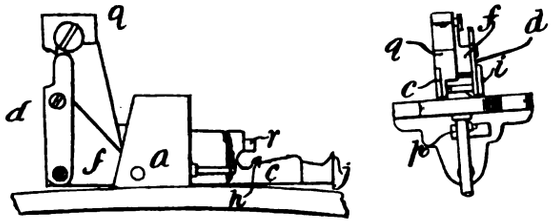


Fig. 2

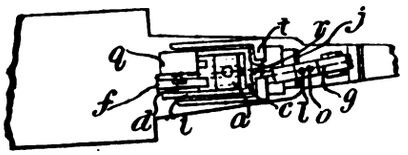
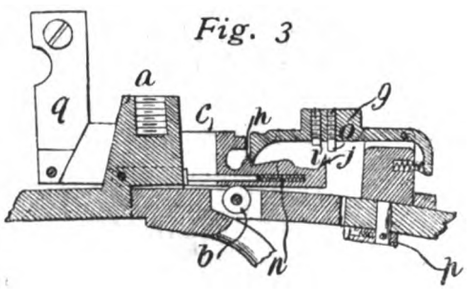


Fig. 3



The drawings may not give a very detailed idea of the parts but we think our readers will be able to inform themselves generally with the help of the text as to the general nature of the system. The trigger is mounted much in the usual manner in the fixed post *a*. It is provided with the roller *b* designed to facilitate the backward and forward movements of the slideable member *c* which is more or less the shaped like a tuning fork. Its legs lay either side of the post *a*. To the forward end of the left-hand leg the setting lever *d* is pivoted. This setting lever is also pivoted at its upper end to the pivoted bracket *f* and a part operated by the top lever of the gun in breaking down to reload is caused to push the top of the setting lever *d* rearward and so draw the bottom forward and with it the bifurcated sliding part *c*. The last named is held in the forward position by the tip of the swinging detent *g* which engages the shoulder *h* on the rear end of the sliding part *i*.

The detent *g* may be made to assume a position beneath either sear tail *t* and if on pulling the trigger it is beneath the left-hand sear as is illustrated in Fig. 2 the corresponding barrel will be discharged. The sliding part and detent are lifted together but the ontact during the movement of the point *j* on the end of the sliding part, and the pin *l* on the detent, lifts the point of the detent out of engagement with the shoulder *h* and the spring *n* is allowed to force the sliding part rearwards. The rearward movement is very quickly arrested by the slightly longer pin *o* which catches the point *j*. The involuntary pull takes place during this engagement and after it has passed the sliding part drops far enough to release it from the pin *o*; and it resumes its rearward travel until its legs take up a position beneath the sear tails. The next trigger pull lifts the legs and discharges the second barrel.

The thumbpiece *p* is adapted to turn the detent *g* over from one sear to another; the part *q* is attached to the right-hand leg of the sliding part *c* and is adapted to take up side play of the legs; and the wing *r* is adapted to prevent the sliding part moving rearwards if the trigger is pulled when the detent is harmlessly situated midway between the two sears. Accepted August 23, 1906.

BOLT RIFLE TRIGGER MECHANISM.

11,092 (1906). A. and C. Francotte (Auguste Francotte & Co.), Belgium. The trigger mechanism described in this patent is designed mainly for rifles of the bolt type and special care has been exercised in producing a construction at once simple and economical so far as manufacturing cost is concerned. The different limbs are all attached to the trigger plate and the whole arrangement may be removed from the rifle by taking out one pin.

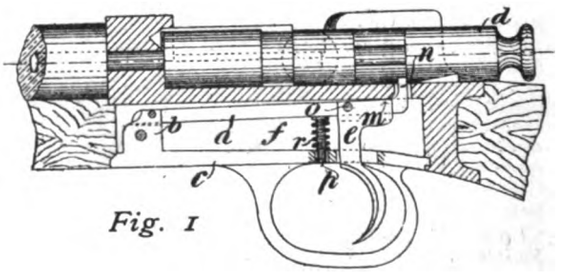


Fig. 1

Fig. 2

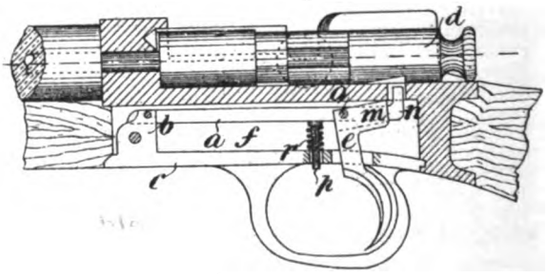
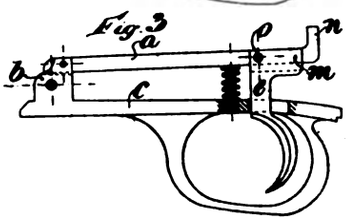


Fig. 3



The sear *a* is pivoted in the projection *b* standing up from the front end of the trigger plate *c*. At its rear end the sear has the tail *n* which is always pressed upward by the spring *r* working on the pin *p* attached to the plate *b*. The trigger blade *c* is forked at its top and the pivot *o* holds the sear between the forks. The back part of the trigger blade bears against the top of the box *f* (Fig. 1) which holds the whole arrangement When the trigger is pulled the pivot *o* pulls the sear down and takes its tail *n* out of bent (Fig. 2); so releasing the bolt *d* and firing the cartridge in the barrel. Accepted August 9, 1906.

Arms & Explosives

A TECHNICAL AND TRADE JOURNAL.

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CONTENTS.

CURRENT TOPICS.

Cartridge Prices.—Great as was the outcry ten years ago against the price cutting which had even then deprived the cartridge business of what was regarded as a fair trading profit, one can now almost look back with envy on the state of affairs which then existed. Competition has since become steadily more acute, and things are hardly likely to improve now that the wholesale manufacturers no longer agree on prices, a fresh element of discord being thus added. The retailer is unlikely to gain by the war of wholesale prices which is now imminent. The pressure will be felt in every quarter, and such small profit as the retailer can still reserve for himself is likely to be diminished by the squeezing tendencies going on all around. Powder makers can hardly expect to be omitted from the list of those invited to fall in with the prevailing demands for cheapness; and if the weaker links of the chain begin to give way, powder, like cartridges, may tend to find a lower level. Unpleasant as the situation may appear there is really nothing in present tendencies which the public mind would describe other than as healthy competition. Prices go down, quality improves, everyone does more work for less money, and the consumer gets the benefit. When other people's businesses are suffering from the invigorating influences of healthy competition, the onlooker rejoices that he is better served than ever before; but when one's own trade suffers from healthy competition it is natural to wish that human nature could be re-constituted so that the policy of live and let live occupied a front position amongst the easily cultivated virtues. An unfortunate complication of the present state of business is the extraordinary rise in the cost of raw materials. Market prices for every kind of metal are on the up-grade, and as the movement results from increased consumption and inelastic sources of supply the present condition of affairs can only be ameliorated by the greater evil of a slackening of industrial activity. Generally speaking, everyone must live, and the present fight may arrive at some sort of a settlement when manufacturers and distributors have discovered the precise limits of the living wage. As before mentioned the whole process is included in the phrase healthy competition; but the process of evolution is on all fours with one's sentiments towards a cold bath on a frosty morning, invigorating perhaps but nevertheless to be dreaded.

Metrics at Last.—According to the daily press the Kynoch Company, tired of waiting for decimal reform from above, have decided to adopt the metric system for general use throughout their business. The object is to simplify clerical and other transactions with metric countries, and it is expected that the reform will pay for itself in lessened labour. This is evidently more than a mere decision to print metric sizes and weights in parallel columns in catalogues and other printed matter. Such a thing is already done in many businesses, but what is now contemplated seems likely to go some distance further. How much further it is difficult to say. Standardised cartridge sizes cannot be altered beyond the allowable limits of manufacturing toleration, and as regards internal arrangements, machinery, gauges and tools can hardly be altered except by easy stages as renewals are needed. Trade papers like our own must not lag behind the enterprise of its constituents, hence we are prepared when next noticing a new Kynoch cartridge to deal with it somewhat on the following lines:—Besides their other well-known specialities in proprietary cartridges, of which Shadrax, Meshax and Abednigax are the most popular, Messrs. Kynoch have introduced one to be known as the Decemax. It is loaded with 2·27 grammes of the new smokeless powder recently introduced by this firm, which by the way is guaranteed not tamed with Barium or Potassium nitrate. Appearance and get-up having been specially studied in the new cartridge

the brass head has been made nearly 22 mm. deep. The usual 12-bore load will comprise the above 2·27 grammes of powder and 30·12 grammes of No. 6 shot. Over the powder is the usual 2·117 mm. waterproof card wad. For the above shot charge an 11·112 mm. felt would ordinarily be used, but in the new cartridge one of 1·587 mm. greater thickness has been employed, so that the felt wad becomes 12·7 mm. thick. Over this, instead of the usual 2·117 mm. card, a rather thinner one of 1·27 mm. is employed. The over-shot wad is the usual 1·587 mm. For the present the new cartridge will be made in the 63·499 mm. length only. Later on a 69·849 mm. case may be introduced. . . . To express round-number English sizes in reasonably round-number metric sizes necessitates a very careful examination of practical conditions. It must, therefore, be understood that the surplus decimals above used are not given with the idea of adding complication to a description in any event bewildering, but merely to safeguard accuracy pending a working list of metric sizes. It seems a pity that so disgracefully simple a description as 12-bore should be allowed to exist any longer. It is based on the pound weight, and our decimal or duo-decimal enthusiasts should have provided us long before this with a metric equivalent as difficult to remember as the average telephone number, and above all things with a decimal point in the middle of whatever series of figures is adopted.

Our Lecture on Air-Guns.—The present instalment of the series of Lectures to Young Gunmakers represents an interesting example of the kind of mental gymnastics which can be performed in reference to almost any mechanical problem. The first-rate results which have been obtained with the modern air-gun have been attained by practical men regardless of the theories involved. The theorist is not, however, displaced by such a process, in so far that the measurements he can make provide the practical inventor with *data* upon which fresh advances can be made. To know that the present air-gun, efficient as it seems to be, transmits to the bullet less than half the energy stored up in the spring suggests that improvements are still possible, having for object the attainment of a higher grade of efficiency than has so far been achieved. The entire problem resolves itself into a consideration of the best means for conveying to the air-gun slug the compressed air at the very moment when its tension has reached the particular limit promising the greatest application of propulsive force to the bullet. Whether or not further possibilities of enhancing the efficiency of the air-rifle have been exhausted, it is nevertheless interesting to know just what takes place inside the mechanism, and how the forces set in operation are harnessed to carry out the work they are set to do. For the time being the lecture must be allowed to stand on its merits as an interesting exposition of he theory underlying the behaviour of a simple piece o mechanism.

London's Miniature Rifle Meeting.—The fact that the National Rifle Association has decided to hold a miniature rifle meeting in London at the end of the present month affords welcome evidence of renewed activity. It is quite essential to the continued success of the miniature rifle club organisation that an annual meeting, preferably at a fixed date, should take place in London. Too long an interval has been allowed to elapse since the last gathering at Olympia, and it is, therefore, satisfactory to observe that the idea of holding provincial meetings at different centres has taken a secondary position beside the all-important need for metropolitan gatherings, preferably as annual functions. The forthcoming meeting will present several features of exceptional interest, notably in regard to the use of miniature rifles, military in model so far as regards the design of the sights and such other details of construction as influence the conditions mainly affecting the marksman. It is impossible to speak with precision concerning the intended arrangements until the actual programme and conditions are available; but it seems reasonable to suppose that the National Rifle Association, having sanctioned a group of arms which are classified as falling within military conditions, will allow shooters unfettered selection within these limits, not necessarily in the hope that each sub division will give an equal chance to the competitor, but rather for the purpose of establishing the question of relative efficiency on a target shooting test. The aperture-sighted rifle, which of course occupies the position of easy first as regards accuracy, will naturally be allocated a very third-rate place on the programme. Their show will probably be limited to certain of the sixpenny sweepstake unlimited entry competitions. The policy embodied in this decision complies with the known intention of the National Rifle Association to encourage only those rifles which are a colourable imitation of the military pattern. When rifles falling within the last-named category were almost non-existent the policy adopted gave rise to feelings of grievance by gunmakers and others desirous of doing business with rifle shooters; but now that the new specification of what the N.R.A. regard as military rifles has been widely published, gunmakers have had ample opportunity for complying with the requirements laid down. Therefore whilst the N.R.A. has but little amended its previous policy, the surrounding circumstances have sufficiently changed to remove any sense of grievance which gunmakers may have nourished in the past.

The Shooting Season.—Something in the nature of a slump has arisen in connection with the demand for sporting cartridges. The prolonged autumn has left the trees well covered with foliage, and has naturally delayed the commencement of the more active operations of pheasant shooting. Cartridges are of course being sent in considerable quantities to all places where pheasant coverts abound; but there is not quite that evidence of stocks thinned out by early partridge shooting which denotes a satisfactory shooting season. Whatever may be the total consumption ultimately attained, the exceptional rise in the price of certain materials used by cartridge loaders will do a great deal to diminish the amount of profit made. Few large purchasers were, for instance, sufficiently far-sighted to buy shot in advance of the present rise in price. Hence, fixed selling rates for cartridges have been complicated by the suddenly increased dearness of a component which is mostly purchased day by day as demand occasions. Pheasant shooting prospects being less influenced by seasons than is possible with naturally reared birds such as the partridge, one may look to the mild autumn to bring the birds known to exist into first-class shooting condition. Disease has been rare, and a good stock of healthy well plumaged birds will help materially in establishing the present shooting season on something approaching an average footing.

AUTOMATIC SHOT GUNS.

We have had in this country a matter of two or three years experience of the Browning automatic shot gun, and it is impossible to resist the conclusion that this weapon has made staunch friends in quarters where it has received a practical trial. If only the inventive ability of the English gun trade could be applied to the perfecting of this model of arm a very important step would be achieved in the direction of being prepared for its more active competition with the existing double-barrel system of construction. The automatic shot-gun is made on a system which by no means reproduces the British gunmaking traditions of fine workmanship and good appearance. So many patents have been taken out and have since been abandoned with reference to automatically operated firearms that the field is sufficiently open for independent inventive power to be exercised. An automatic gun certainly needs more assistance from the machine room than is the case with an ordinary double-barrel gun. On the other hand its working parts have been conceived on a simpler basis of operation, so that the actual outlay involved in the machining of the various parts can compare favourably with the "repeat" work put into a double-barrel gun. If some leading gunmaker with the needful facilities for research, and a sufficiently well-equipped factory for dealing on a large scale with the model produced, would get to work on an automatic gun it should not be long before the British gun trade would be able to satisfy the growing demand for an inexpensive type of single-barrel gun capable of firing a succession of cartridges without the trouble of reloading between times. The attitude of passive resistance cannot in the nature of things be successful if the automatic system of construction proves sound in principle and effective in use. That it satisfies both these conditions we feel firmly convinced, and we would go further and say that it will be only a matter of time before the automatic shot gun is in sufficiently general use to displace a material proportion of the purchases of the older types of weapon which have been brought to such a high state of perfection through a long period of evolution.

It is frequently regretted by the gunmaker that there are no fresh fields to conquer in the design of new mechanism calculated to increase the efficiency of the shot gun. The guns of twenty years ago are in regular use to-day, and their owners have no temptation to discard what may be old as measured by years but is comparatively new and modern so far as design is concerned. The complaint that there is in sight no obvious improvement in the double-barrel shot-gun of a kind which will render existing weapons obsolete, deals very inadequately with the question when there is hovering in the immediate vicinity an entirely new construction of weapon whose potentialities are unlimited so far as one can judge. The actual model of gun on the market seems to shoot in a perfectly satisfactory manner. It constitutes a five-barrel single-trigger gun, and a shooter armed with it can hold his own in any company, with the single exception perhaps of where guns are used in pairs with an assistant to load. Even then, it is not certain that the automatic gun would come out second in a carefully adjudicated contest. The double gun necessitates a change of weapons every two shots, and great skill must be developed to ensure the needful rapidity of motion to take two arriving and two going-away birds out of a pack of grouse or a covey of driven partridges. The Browning automatic gun would give the shooter five shots without a change of guns, this surely representing a sufficiency of shots for any ordinary rush of birds. Another gun in reserve would allow for a further five shots; and it does not seem unreasonable to suppose that with a little practice a competent loader should be able to keep his master as well if not better supplied as under present conditions. This on the face of it seems to cover the true position of the automatic gun judged with entire freedom from prejudice or interested motives. An argument which was once very effectively used in connection with the automatic gun was put in the form of a question. The enquirer wished to know what chance an ordinary double-barrel gun would have had in a world already armed with automatic shot guns, to the perfecting of whose details generations of skilled gunmakers had applied their best thought and attention. The question seems really to need no answer. On first principles a single-barrel gun is better than a double-barrel for the simple reason that for a fraction of the cost of a pair of barrels the single tube can be made straighter, thicker, and yet with a lighter balance than any pair of tubes in existence.

The policy underlying the present article is not to boom a foreign production but an English one, or to be strictly accurate, what we hope will in time be a speciality of the English industry. Invention by committee is hardly likely to afford a satisfactory solution of so difficult a problem as is presented by the design of an automatic gun, but there is no reason why one or more firms acting independently should not take the lead by working out a new automatic shot gun with every detail conceived and laid out to harmonise simplicity of machine manufacture with the conditions of workmanship, balance and general shape which will closely conform to a perfect outline. The profile of the existing double-barrel shot-gun is of course an inappropriate model to adopt for a weapon working on a totally different principle. In the shot-gun, as in other pieces of constructive design, utility came first and outline afterwards. The essentials of automatic operation must be thought out before an attempt is made to give to the entire structure a pleasing formation, artistic in outline, of easy balance and generally satisfying the practical requirements of the shooter. The problem is not one which the average busy gunmaker will take up at the outset with any great enthusiasm and yet from certain points of view there is more money in its successful solution than in many of the intricate little designing jobs which are carried out year after year having in view the production of a new kind of sporting or other rifle. The most disheartening aspect of the gunmaker's business is that when he has applied unremitting care and attention to the working out of a new class of weapon, the orders for the same will hardly run into dozens, whereas in any other department of manufacture something as good and as original would rapidly attain a demand running into hundreds and thousands per annum. In the successful accomplishment of the automatic shot-gun problem there is at any rate ample prospect of a satisfactary reward for the energy and enterprise which produce it. In Mr. Lincoln Jeffries we have a shining example of a gunmaker in an apparently small way of business who initiated a new design of gun on a small scale at the outset, but who can now show an output in thousands, without robbing any of his competitors in the home trade of a single farthing's worth of business.

A SERIES OF WILDFOWL SHOT SIZES.

In a Lecture to Young Gunmakers which appeared some years ago a careful summary was given of the small manipulations and processes which are necessary for obtaining the standard diameters and other statistics of the various sizes of pellet used in game charges. In writing on the subject of wildfowl charges the *Field* has lately published some statistics concerning the larger sizes of shot which are of sufficient interest to justify their reproduction in our own paper. The Curtis's and Harvey *Shooter's Year Book* was the initiatory source of the new development. The larger shot sizes are very variously quoted by the different makers, so much so in fact as to leave one in doubt as to what size is really meant when a certain designation is mentioned. One maker's catalogue of sizes differs very materially from that of another, and even in actual deliveries the agreement between the size marked and the sample supplied is only approximate. This state of chaos has afforded our contemporary the opportunity of adopting the round-number series of sizes which were first put forward in the little pocket diary already quoted.

We accordingly present a table showing the total number of pellets in a charge, and another table showing the proportion of the total pellets which would be counted in a 30in. circle firing at 40 yards with a full choke gun :—

TOTAL PELLETS IN CHARGE.

Charge in oz.	Size of Pellet.				
	B	1	2	3	4
2	160	200	240	280	344
1⅞	150	188	225	263	323
1¾	140	175	210	245	301
1⅝	130	163	195	228	280
1½	120	150	180	210	258
1⅜	110	138	165	193	237
1¼	100	125	150	175	215
ONE	80	100	120	140	172

FULL-CHOKE PATTERNS.

Charge in oz.	Size of Pellet.				
	B	1	2	3	4
2	120	150	180	210	258
1⅞	113	140	169	196	242
1¾	105	131	158	183	226
1⅝	98	121	146	170	210
1½	90	112	135	158	194
1⅜	83	102	124	144	177
1¼	75	93	113	131	161

The chief justification of the above table consists in the circumstance that for shot sizes larger than No. 3 the round-figure equivalents adopted represent a good working average as between one maker's sizes and those of another. If bags of shot are ordered by the loader with reference to the number of pellets to the ounce the shot maker will find no difficulty in supplying something so near the round-number figures shown in the above table that the useful tabulated matter given above can be applied with a margin of error so small as to be negligible.

Another table, which is now given, contains certain statistics relating to the individual pellets in the series which could only be arrived at after a fixed series of sizes had been adopted :—

STATISTICS for the Mean Values of Wildfowl Pellets, adopted from the previous Table, No. 6 size having been added for comparison.

Nominal size.	Pellets per oz.	Weight per pellet.	Relative Weight.	Diameter.
A	50	8·75grs.	314	·179in.
BBB	60	7·29grs.	287	·169in.
BB	70	6·25grs.	246	·160in.
B	80	5·22grs.	206	·153in.
1	100	4·38grs.	172	·141in.
2	120	3·65grs.	144	·133in.
3	140	3·13grs.	123	·127in.
4	172	2·54grs.	100	·120in.
6	270	1·62grs.	64	·102in.

It will be seen that the range of pellets above dealt with goes as high as size A for which 50 pellets per ounce is the assumed size. This exactly agrees with Walkers Parker's list of sizes. Shot size BBB becomes 60 pellets per ounce as against 64 for the Newcastle chilled scale. BB shot is taken at 70 pellets per ounce, this representing a fair average between Walkers Parker at 58 and Newcastle at 76. B shot at 80 pellets per ounce hits off a similar midway point between 75 and 88 respectively for the two makers already quoted. No. 1 shot enjoys the advantage of the very round-number value of 100 pellets per ounce, the Newcastle size being 104 pellets and Walkers Parker 82. Shot size No. 2 is given at 120 pellets per ounce, as against 122 for Newcastle and 112 for Walkers Parker. The differences above noted may seem in some instances rather more than would give an opportunity for getting exactly what was required from the maker whose published list is in greatest divergence, but on the principle that demand produces supply there is no reason why a little sorting and special selection should not give the conscientious loader exactly what he requires.

The column of relative weights shown in the above table gives a very useful indication of how one pellet compares with another. The diameter is of course the most instructive value ; because an exact knowledge in this particular makes it possible to estimate from Bashforth's tables a relative striking power of the pellet at every distance which it may seem desirable to consider. The relative velocity and penetration of a certain size of shot as compared with another exercises a certain amount of influence on the selection of appropriate loads for special purposes, and it is only by the power to work from diameter to remaining velocity that a satisfactory series of properly graduated charges can be worked out. The following relations are for instance of great interest in so far that they display in a simple form the relative characteristics of the different shot sizes which have been tabulated above, all as fired from cartridges giving the standard velocity of 1050 feet per second :—

1 oz. of No. 6 shot gives 421 ft.-lbs. striking energy at 40 yds.
„ No. 4 shot gives the same energy at ... 44 „
„ No. 3 „ „ „ „ „ „ ... 48 „
„ No. 2 „ „ „ „ „ „ ... 50 „
„ No. 1 „ „ „ „ „ „ ... 52 „
„ B „ „ „ „ „ „ ... 54 „

INDIAN ARMS ACT REGULATIONS.

THE latest announcement by the Indian Government has produced a serious upheaval in the trade, and gunmakers and others are endeavouring, with little greater prospect of ultimate success than attended their opposition to the Pistols Act, to secure some relaxation of the recent prohibitory rules. The Indian Government seems to be decided that no rifle shall enter the country which can by any conceivable process of rechambering be rendered suitable for firing cartridges of military type. For this reason practically all rifles of ·450 and ·303 calibre have been peremptorily forbidden entry into the country. A special proviso appears in the original document, as reproduced in another column, which relieves from the effect of the new order rifles already in the country which have been legally imported. Furthermore, the wholesale prohibition of ammunition for ·450 rifles has been relaxed, so far as reasonable quantities are concerned, for use in such rifles. The brunt of the inconvenience seems to fall on the gunmaker possessing stock which falls within the prohibited category.

Sportsmen will naturally be prejudiced against rifles which are exceptionally subject to red tape regulations: hence a probable depreciation in their value. At a time when the attitude of the Indian Government is peculiarly liable to criticism by those interested in the sale of sporting rifles, it will be interesting to recall the parallel case of some years ago when the restrictions were first made more onerous. What then formed the subject for bitter complaint turned out subsequently to be a blessing in disguise, in so far that the prohibition of private importations of rifles firing military cartridges enhanced the demand for other rifles of a kind mostly produced by the gunmaker. The success these arms achieved in India quickly became known in other countries; and it can hardly be denied that the modern high-power cordite express partly arose out of the martyrdom to which the military rifle was subjected. The service rifle, for the time being used by the troops, seems likely to be the most used game shooting rifle amongst British sportsmen. Official legislation which tends to check this secondary employment for the service rifle will not abolish the pursuit of big game, it will merely cause another class of arm to be used in its place, and more profit is made by selling non-service pattern rifles than others that have service characteristics.

It may be urged that in taking this view of the situation the wish has become father to the thought. It nevertheless seems feasible to suppose that, with the repression of the ·450 as a sporting rifle, a slightly different calibre of rifle will be designed to take its place which will rapidly become a world-wide favourite. Everyone recognises that express rifle ammunition has suffered from subservience to the black powder models of cartridge upon which their design was based. If the Gunmakers' Association could act with Messrs. Eley and Kynoch in the production of a new sporting express cartridge lying well outside the limits of the Indian Government's nervous apprehensions a valuable access of new business would doubtless follow in due course. A cartridge with a perfectly dimensioned case, fired in a correctly shaped chamber would go a long way towards ensuring for the shooter complete immunity from the irritating minor mishaps which arise under present conditions of working.

LIGHTNING PROTECTION FOR EXPLOSIVES BUILDINGS.

THE reports of H.M. Inspectors of Explosives must frequently enchain the attention of the reader not only on account of their technical importance but as models of clear and lucid writing and examples of how simple science becomes when well set out by a writer who understands his subject. No report better deserves special praise than that of Major Cooper-Key on the Sedgwick explosion last June. He had an interesting set of circumstances to review, and the work accomplished as now set out in published form reminds one more of an interesting lecture than a departmental report. Fortunately for the journalistic profession there are other outlets for literary productions than newspaper articles.

On the 23rd of June last a severe thunderstorm passed over the Sedgwick Gunpowder Factory in Westmoreland, and the cake press house and four incorporating mills exploded. An examination of such evidence as was available suggested that there must have been at least three separate strokes from the same lightning flash. Here, therefore, to use Major Cooper-Key's own words, we have the somewhat rare phenomenon of a divided flash striking simultaneously two unprotected objects nearly 100 yards apart, while at the same moment a third object, the press house, 40 yards from the nearer of the other two and protected by conductors (although as will be shown, very imperfectly) was separately exploded either directly or indirectly by a portion of the same flash. Major Cooper-Key then proceeds at some length to summarise so much as is known or can be inferred concerning the behaviour and tendencies of lightning phenomena. He distinguishes with great care between the double functions of conductors, first their office of gently and progressively conveying away the electrical difference of potential which reaches the breaking point when a flash occurs, and secondly their utility as conductors for leading through safe channels the flash which has at last broken loose. Whilst earnestly recommending a perusal of the original document (No. CLXXIX.) we still desire to enrich our own pages by quoting *in extenso* the concluding portion of the report, wherein it gives specific instructions concerning the most protective treatment which can be adopted towards securing immunity from lightning flashes. Generally speaking the advice is based upon a careful study of Major Cardew's "cage" system. To quote Major Cooper-Key:—Much has been written on lightning conductors in general, but little on their special application to magazines, whereas it is clear that a faulty joint, or the accidental existence of an alternative path, which might be of little or no moment in the case of a cathedral or other public building, which might have disastrous results in the case of a powder magazine.

On the other hand, however, methods of protection may be adopted in the case of "danger" buildings, which from their unsightliness would be inadmissible on buildings with any architectural pretentions. But, unfortunately, though given a perfectly free hand, unrestricted by artistic requirements or by considerations of expense, it is almost impossible even for an expert to provide complete immunity. The contingencies to be met are so many, and the character and behaviour of the oscillatory current so elusive and difficult to forecast, that largely to reduce the risk seems to be the

utmost that can be achieved. Thus, at the Modderfontein Dynamite Factory in the Transvaal, where, with one exception, the system of lightning protection is that recommended by Major Cardew, with the addition of an underground horizontal conductor, at least two cases are recorded of lightning flashes penetrating the outer defences and discharging in one case in a tank in the final washing house, and in the other in the nitrating house, fortunately causing no serious damage in either case. In each instance the lightning seems to have struck a pipe outside the protected area and followed it into the building, showing the importance of earthing thoroughly all pipes and gutters outside a danger building, and insulating them as thoroughly from the actual walls and machinery inside. Galvanized-iron structures offer perhaps the best protection against lightning, provided the walls are well earthed, and that, in addition to the iron sheets, at least one continuous conductor is fitted as a protection against bad connections and oxidation between the sheets.

Two or more well-earthed conductors should be raised as high as practicable on poles standing a yard or two away from the actual building, or on the screening mounds if these are provided. These should be connected near their upper terminals by means of barbed-wire cables. The finials should consist of as many points as possible, and all joints should be made thoroughly good mechanically and soldered in addition. If the conductors are actually in contact with the building there is an increased risk of a portion of the flash seeking an alternative path through some metal inside the building with disastrous results, many, if not most, building materials being better conductors than dry air, and moreover sharp bends are not so easily avoided as when separate poles are used. Internal masses of metal should be thoroughly well connected to each other and to earth, and should be situated at as great a distance as practicable from the conductors. All external metals, such as rain gutters, lead flashing, iron door plates, &c., should be connected to the conductors or otherwise thoroughly earthed.

The principles underlying the above would appear to be accepted by all the chief modern authorities, but there are now one or two vexed questions to be considered in regard to which expert opinion is by no means unanimous. Should the conductor be of copper or of iron? Owing to its high conductivity the uninitiated would at once reply in favour of copper and for a considerable time this metal has held the field. Sir Oliver Lodge maintains on the other hand that this very conductivity is a defect instead of an advantage on account of the suddenness with which the electric energy is thus dissipated, whereas iron from its self-inductive properties and consequent loss of conductivity absorbs the energy gradually, so to speak, and dissipates it with far less tendency to dangerous effects, such as surging and side-flash.

But there is a good deal to be said on the other side Owing to its higher resistance and the consequent increase of heating effect, a rod or cable of iron must be of such dimensions as to furnish about two and a half times the surface required in the case of copper. This necessitates about six times the weight, so that if 6 oz. per foot run is considered sufficient where copper is used, 2¼ lbs. of iron per foot run would have to be substituted, the result being that in cost of material alone the advantage would be with copper. To this must be added the increased difficulty of fixing and connecting large rods, their comparative inadaptability to the shape of the building, and the liability of iron to rust unless galvanized or periodically painted—not an easy matter on a high building. On the other hand iron does not offer the temptation of copper to thieves and marauders.

Briefly then, although iron may be electrically preferable to copper, the balance of advantage in the case of high and complicated structures where repairs and renewals are difficult is perhaps in favour of copper, and particularly copper *tape*, but in connection with such simple buildings as magazines and other "danger buildings" the reverse seems to be the case, especially as in mining and quarrying districts where magazines and "stores" generally abound there should be little difficulty or expense in providing old iron rods, haulage and winding cables, and such like excellent material for conductors.

The mere establishment, however, of the most elaborate and efficient system of protection is of little value unless steps are taken to maintain it in good condition, and this can only be done by periodical testing. For this purpose the earth plate should on no account be disturbed but use should be made of a subsidiary earth formed by sinking an iron rod in damp ground close by, or by attachment to a gas or water pipe. This should be done by an expert every spring before the commencement of the thunderstorm season, and the resistance found should not exceed 15 ohms—in Government magazines the maximum allowed is 2 ohms—part of this being due of course to the wires and subsidiary earth. But, unfortunately, this is only a test of the continuity of the conductor and the efficiency of the earth plate, and is no indication of the correctness of the general design, such as the presence or otherwise of alternative paths to earth, the existence of sharp bends, or of a deficiency of metal. The test may indeed be actually misleading. It may for instance show a practically infinite resistance on account of a break in the conductor which, in the absence of an attractive alternative path, would offer little or no impediment to a lightning flash, whereas a sharp bend shewing no resistance on the testing instruments might well cause a disastrous short circuit. On an experimental scale the mere existence of a defective joint does not appear noticeably to decrease the efficiency of the conductor.

It is not uncommon to hear it stated that a faulty conductor is worse than none, but a good deal would seem to depend on the degree of faultiness. It has been argued, with a good show of reason, that every large building covered as it must be with rain gutters, flashing, vanes, gas pipes, etc., presents many faulty conductors to the lightning flash, and that the addition of another which, however bad, must be less faulty than these others cannot but have a beneficial effect. In the case of a large building this may be true enough, as a considerable number of prominent features such as gable ends and chimney stacks must always be present, but in the case of a magazine of simple construction the deliberate provision of a conductor which from its material, prominence, and shape, has been experimentally shown to offer a special attraction at any rate to the ordinary, as opposed to the "overflow," lightning discharge, would appear to be a mistake unless the utmost care be taken to ensure that the path to earth through this conductor is as perfect and unobstructed as possible, and that there are in the immediate vicinity no other paths which, though faulty, might be sufficiently attractive to act as conduits for at least a portion of the current.

ROUND THE TRADE.

His many friends will deeply regret to hear that Mr. Reginald Woulfe is the victim of a serious attack of illness, and that, though his condition is somewhat improved, it will at the best be some time before he can be pronounced convalescent.

We have received a letter from Mr. W. R. Leeson calling attention to the unfortunate misprint in our last issue by which his London address was given as 31, Maddox Street, instead of 31, George Street, where he has been installed for some time.

A serious dispute arose in the middle of last month between the management and certain of the employees at the Eley factory. The difference arose out of reduction in the piece-work prices for cartridge manufacture. A *modus vivendi* was fortunately secured without delay, the two parties having agreed to submit their differences to arbitration.

The Birmingham Small Arms Co., Ld., has lately appointed Mr. J. Scott Duckers as the specially retained chief of a new legal department which has been established for directing and supplying information to the various professional advisers of the Company, and relieving departmental heads of matters in which legal difficulties are likely to arise. Mr. Duckers is well known as a specialist in commercial law.

It is understood that the new edition of the *Text Book of Gunnery*, whose publication has been so long delayed, will be issued in two parts, Part I. being due at about the turn of the year, whilst Part II. can hardly be published for twelve months to come. The tables will appear in the first part, and there will be no great encouragement to purchase Part II., unless it contains some of the new matter derived from the researches of the Ordnance Committee.

The *Financial Times* reports that a meeting of the Morris Tube Company was held last month at which admission was refused to representatives of the press by resolution of the shareholders. The *Financier and Bullionist* writing a few days earlier discusses without arriving at a definite conclusion what it describes as an abrupt slump in the price of these shares. It concludes its analysis of the Company's future prospects by referring to the known and generally acknowledged success of the ingenious Morris tube for rifle practice.

In the Mining Department of the Ministry of the Trade and Industry a special committee has been appointed for testing explosives with a view to their admission into Russia for mining purposes. The committee is engaged in testing various explosives of both home and foreign manufacture and no explosive can be admitted into the Russian Empire unless tested by the committee for mining purposes. The open-air trials take place usually at the freestone quarries of Count Kaiserling near Sablino on the Nikolaieffsk railway and the laboratory tests are made at the laboratory of the Mining Institute.

Captain Desborough, in reporting on the fire at Messrs. Bickford Smith's factory last April, attributes its origin to the fall of a steel knife igniting some powder dust on the floor, the presence of a steel instrument in the room being a breach of the special rules governing the operations carried on in the spinning room where the accident occurred. An examination of the conditions of work carried on in the building has convinced Captain Desborough that a bronze knife cannot be kept sharp enough for the work of the spinning room, the result having been that the workpeople introduced surreptitiously a steel knife. This gives rise to an interesting piece of advice to manufacturers, viz., that when manufacturing conditions make a bronze instrument inappropriate for the work to be carried on the management should acquaint themselves with the fact and make formal application for permission to use a steel knife, the same to be permitted in due course, subject to all possible precautions to minimise danger. Capt. Desborough pays a deservedly high tribute to Messrs. Bickford Smith's management of their factory, the accident last April being the first of a fatal character for 75 years.

The War Office has issued invitations to manufacturers to submit a modification of the service cartridge, the same to contain a brass bullet of a certain weight, and having a velocity very little short of 3,000 f.s.

Inspector Dymond, in his report to the General Purposes Committee of the Exeter City Council, dealing with registered premises for the storage of mixed explosives, mentions the discovery of a kind of firework called the electric sparker which dealers claimed was not an explosive, but which H.M. Inspectors regard as such under its better known title of aluminium torches.

Arms and ammunition are included amongst the items which have been subjected to the new ten per cent. increase of import duty for New Zealand. The idea said to be underlying the new tariff rates was the arrangement of preferential treatment for the mother country, but in its working out it seems to be little more than a general rise of duties to benefit the home producers in New Zealand.

We recently enjoyed the opportunity of a long chat with Mr. Robert B. Pollitt, who is enjoying a well deserved rest after some six or so years of herculean labour at the De Beers dynamite factory. Although sphinx-like in his attitude towards the important work with which he has been connected, one cannot but judge from his general conversation that the De Beers venture into explosives manufacture has proved a complete success.

The large amount of discussion which has arisen in connection with the organisation of a soap combine has a special interest for manufacturers of blasting and other explosives, glycerine, the chief by-product of soap, being an important ingredient in all explosives having a nitroglycerine base. It was as an answer to a ring which had been formed in the glycerine market that Messrs. Kynoch instituted a soap and candle works, so as to enjoy a home-made supply of glycerine.

Writing upon the concussion caused by gun fire on board ship the *Western Morning News* says:—"We have yet to learn the precise effect of the blasts upon the officers stationed in the conning tower, but it a captain were half-stunned by concussion he would not be able to keep a cool head, or be able to control his ship during a prolonged action. Scientific men will, perhaps, have to find some means of tempering these concussions. We know, however, that concussion is not felt nearly so much inside the conning tower as in other parts of a ship. Deafness must be expected to increase afloat with the augmentation of armaments, and naval surgeons should be required to experiment further with various appliances for lessening the effects of concussion upon the drums of the ears of guns' crews. Cotton wool is said to retain its popularity with many, although in using this substance it is necessary to avoid inserting a hard wad into the ear."

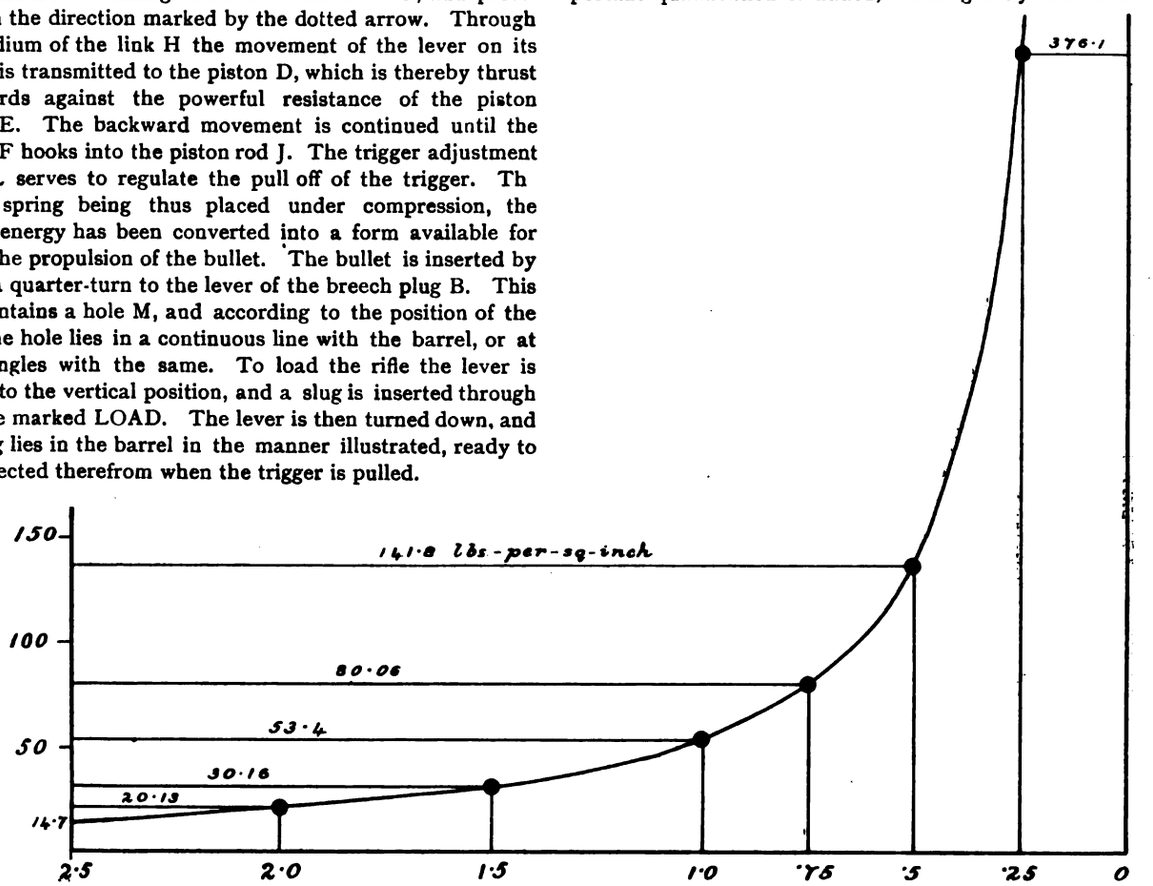
The following is the text of a notice recently sent round to newspapers and others interested:—The National Rifle Association will hold a miniature Bisley rifle meeting in London, from the 26th to 30th November, 1906, in the drill hall of the London Rifle Brigade, Bunhill Row, City, kindly lent by Colonel Lord Bingham, commanding. There will be stationary, moving, and disappearing competitions and 25 and 50 yards; squadded individual competitions, unlimited entry competitions and team competitions. The shooting will commence at 4 p.m. and continue up to 10 p.m. each day. Prizes have been kindly presented by:—The Birmingham Small Arms Co. Ld., Messrs. Elkington & Co., Mr. W. W. Greener, The London Small Arms Co. Ld., The Morris Aiming Tube & Ammunition Co., The Re-Loading Miniature Ammunition Co., and the money prizes exceed £100. The squadded competitions are open to military rifles, but in the unlimited entry competitions there are competitions for any miniature rifle. Competitors must either be members of the National Rifle Association or of associations or rifle clubs affiliated thereto. Entries for squadded and team competitions will close on November 17th. The full programme will be sent when ready, to each club secretary free, and to others who now forward 3d. (including postage) to the Secretary of the N.R.A., Bisley Camp, Brookwood, Surrey.

LECTURES TO YOUNG GUNMAKERS.

XL.—SOME SCIENTIFIC PARTICULARS OF THE AIR-RIFLE.

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

THE opportunity to make use of the very excellent sectional illustration of the B.S.A. air-rifle which accompanies this article, affords an excuse for showing that a scientific analysis of its action introduces many interesting questions. In order that the various references to constructional details may be fully understood the following description of the mechanism illustrated is provided :—The rifle is set ready for shooting by freeing from its retaining catch the hand-lever G, and pressing it in the direction marked by the dotted arrow. Through the medium of the link H the movement of the lever on its pivot I is transmitted to the piston D, which is thereby thrust backwards against the powerful resistance of the piston spring E. The backward movement is continued until the trigger F hooks into the piston rod J. The trigger adjustment screw L serves to regulate the pull off of the trigger. Th piston spring being thus placed under compression, the human energy has been converted into a form available for use in the propulsion of the bullet. The bullet is inserted by giving a quarter-turn to the lever of the breech plug B. This plug contains a hole M, and according to the position of the lever the hole lies in a continuous line with the barrel, or at right angles with the same. To load the rifle the lever is turned to the vertical position, and a slug is inserted through the hole marked LOAD. The lever is then turned down, and the slug lies in the barrel in the manner illustrated, ready to be projected therefrom when the trigger is pulled.



CURVE SHOWING THE RISE OF AIR PRESSURE DURING THE FORWARD TRAVEL OF THE PISTON.

The air-gun, or air-rifle as it must now be called since the bullet is spun by rifling, thus becomes no more and no less than a glorified pop-gun. The noise which the cork makes in the pop-gun arises from venting the air at the high pressure it must attain before it can overcome the frictional grip of the cork, and so expel it from the muzzle of this noisy little toy. In the case of the pop-gun the compressed air is vented at the moment of its highest compression, the idea being to make as much noise as possible. With the air-gun on the other hand the compressed air is utilised by causing it to expand against the base of the lead slug, so giving the latter a velocity, and converting a large portion of the energy represented by the compressed air into motion imparted to the bullet. The scientific aspects of the question are much more profound than a casual examination would seem to suggest. Boyle's law of air compression assumes that the tension of the gases is inversely proportional to the space into which they are compressed. This implies that if a given volume of air at atmospheric pressure is compressed into half the space it ordinarily occupies the pressure has doubled as a result. In point of fact this is not strictly true unless a very important qualification is added, which greatly influences the consideration of the mechanism and behaviour of the air-rifle. The action of compressing air raises its temperature to an extent obvious to those who have noticed the extraordinary heat which is developed at the nozzle of a bicycle inflating pump when vigourously used. The air is delivered into its chamber, whether an enclosed cylinder or a pneumatic tyre does not matter, at a materially elevated temperature; and so long as this heat is retained the pressure is far greater than Boyle's law would indicate. Boyle's law may thus be held to apply only to compressed air which has remained in a state of compression for a sufficient period to allow the surplus heat to pass away. That this heat has actually passed away from the air is well shown by allowing highly compressed air to escape from confinement, this experiment demon-

strating, by the appearance of ice flakes in the air or the sensation of extreme cold in the blast, that just as compression is accompanied by heating, so cooling takes place during expansion.

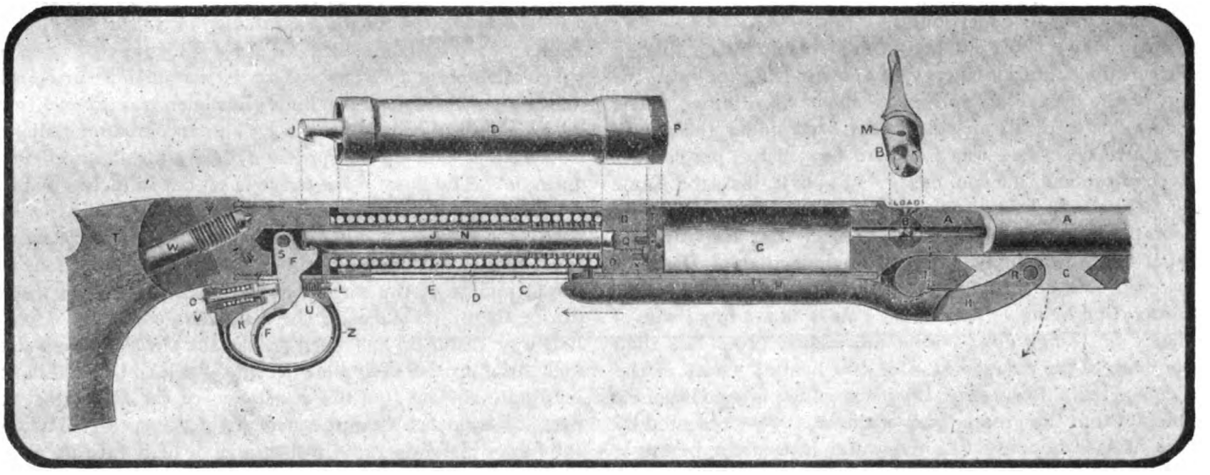
Two forms of curve have accordingly been worked out for showing the relation which exists when air is compressed between pressure and volume, Boyle's curve assuming that the surplus temperature developed during the process has been dissipated, and the adiabatic curve that no heat has escaped. The latter curve obviously applies to the modern spring air-gun, because the compressed air performs its functions before sufficient time has elapsed for the surplus heat to be lost, whereas Boyle's law expresses the action of the old-fashioned pump air-guns, where the air is compressed perhaps one day and discharged in shooting the next day, or for that matter six months later. A few minutes suffice for the dissipation of a material amount of the heat produced. Some even must escape in the course of a few seconds or even a portion of a second by reason of the cool metal surfaces

the efficiency of the air-rifle considered as a power engine. The third and most theoretical aspect of the air-rifle is embodied in an analysis of the conditions which exist during the actual travel of the piston. This portion of the subject will be treated in a somewhat sketchy fashion, as the underlying principles could only be explained by assuming the reader to possess a somewhat extensive knowledge of certain branches of physical science.

The actual measurement of the energy of a spiral spring acting under known conditions can be very easily accomplished. The following *data* are necessary for making the experiment :—

Length of spring, after firing, when the spring occupies its greatest length in the gun ... = 6·4 in.
Length of spring when fully compressed for firing = 3·9 in.

Therefore the distance from face of piston to cylinder head, when in the cocked position ready for firing ... ... = 2·5 in.



which adjoin it; but in the case of the air-rifle compression takes place as nearly as possible in the hundredth part of a second, a time during which any heat lost may be disregarded, or at any rate be classified with friction and other sources of wasted energy.

The examination of what takes place in the action of an air-rifle may be divided into two elementary sections and a third section which is more abstrusely scientific. One of elementary sections comprises the progressive increase of pressure which occurs during the forward movement of the piston, assuming all the while that the bullet has sufficient grip against the walls of the chamber to prevent any material escape of air. The curve showing this rise of pressure will be explained later on. The other simple aspect of air-rifle science is based upon a careful measurement of the energy developed by the spring during its various stages of compression. This can be set out in curve form with great exactitude, and the total energy stored up in the compressed spring, and available for use, can be clearly shown. The known muzzle velocity of the air-gun pellet can then be converted into energy, so as to establish a comparison with the energy put into the spring, the relation between the two representing

The difference between the first two measurements corresponds with the last measurement, which can, however, be separately ascertained. Obviously the energy of the air-rifle spring is represented by the amount of expansive force it exercises when changing from the initial length of 3·9 in. to its final length of 6·4 in. It is not of course so convenient to measure the strength of a spring during the process of expansion as during the reverse action of compression. To make the actual experiment an ordinary air-gun spring should be fitted with a rod which comfortably fits the core and forms a sliding guide for the same. At the upper end of the rod a cross-pin or nut can be fixed to prevent the rod from being pulled through the spring. The lower end of the rod can be bent into the shape of a hook, to which weights can be attached. The whole arrangement can be mounted in the jaws of a vice so as to leave the rod free to compress the spring as weights are hung on to the hook beneath.

The accompanying diagram shows companion sets of measurements which were taken with a new and an old spring respectively, the latter having slightly weakened in use. The actual observations with each spring are duly set out, and fairly consistent curves result. A mean value between the

two extremes was then taken, the same being expressed by a straight line, from which an exact series of measurements has been obtained. The average force of the spring is obviously that denoted by the horizontal line at 96·5 lbs. intersecting the middle curve at its half-way elevation. This gives the mean force of the spring over its 2½ in. of travel in the gun as 96·5 lbs. The foot-pounds energy is this mean force multiplied by ·208 of a foot, the equivalent for 2·5 ins. That is to say the average strength of the spring over 2½ in. of travel = 96·5 lbs. multiplied by ·208 ft. = 20·0 ft.-lbs. for the complete distance of travel. It is thus irrefutably established that a spring of the average strength arrived at from the measurements made represents when set an energy of 20·0 ft.-lbs., the same being utilised in discharge for compressing the air, propelling the bullet, overcoming friction, and in 'fact doing the various things which take place in practice, including possibly a hammer blow by the piston against the cylinder head when lack of grease in the working parts allows too much air to escape. More recent issues of the B.S.A. air rifle may have been fitted with stronger and more durable springs, but the figures here given are sufficient for explaining the principles in operation.

One can take a short cut to the final result by comparing the ascertained muzzle energy of the air-gun slug with the energy of the propelling spring as above ascertained. The muzzle velocity of an air-rifle bullet fired under the conditions above described was found to be 516 feet per second. This represents a muzzle energy of 5·9 ft.-lbs., the same being arrived at by squaring the velocity, multiplying by 10-7000-ths. the weight of the pellet in lbs. and dividing by 64·4. It accordingly becomes obvious that of the 20·0 ft.-lbs. put into the spring the bullet receives 5·9 ft.-lbs., the proportion being 29 per cent. This is not a low grade of efficiency as things go. The steam engine gives less than 10 per cent. of the energy value of the heating effect of the coal consumed, a lowness of efficiency which is accounted for by the fact that the greater part of the energy represented by coal is utilised in converting the water into steam before it can be employed, the heat used being subsequently lost by allowing the steam to escape through the exhaust. In the case of the air-rifle it is impracticable to make the barrel of such length that the bullet shall not leave the muzzle till the air has been expanded to atmospheric density. There are various other losses on the way, all of which diminish the net amount of energy transmitted to the bullet. A further portion of the energy in an air-rifle has of course been utilised in giving the bullet a spin around its central axis, velocity taking account solely of forward motion. The energy of smokeless propellants has been worked out on a similar basis to the above by chemical calculations; and it is interesting to know that air-gun results do not compare unfavourably.

Regarding the tension of the air vented from the muzzle this can be calculated with a fair amount of reliability if certain assumptions are permitted.

The diameter of the bore is ·177 of an inch.

The area of the bore thus becomes ·0246 of a sq. in.

The diameter of the plunger or piston is 1·1 inch.

The area of the piston face is ·95 sq. in.

If it is assumed that the plunger compresses the 2½ in. column of air to one-quarter of an inch before the bullet commences to move we have a wad of compressed air possessing a cubical capacity of ·24 cubic inches (·95 × ·25). If then the bullet commences to move and the wad of compressed air is driven into the barrel as the bullet gives way, the pressure on the base of the bullet may remain undiminished for a travel of about ten inches (·24 ÷ ·0246). Following that the air will expand for the remaining 9 in. or so of travel till the bullet reaches the muzzle, and what pressure remains will be lost when the bullet emerges from the muzzle, as also will any spring energy which had been unemployed in compressing the air and driving it into the barrel. Roughly speaking it is reasonable to assume that the 10-grain slug of the air-rifle may receive an average thrust from the compressed air behind it at the rate of about 100 lbs. per square inch. This would just about represent the pressure necessary to impart the ascertained velocity to the air-gun slug. It would represent too complex a task to endeavour to classify all the different sources of wasted energy and to give them relative values. The fact remains that the air-gun slug receives approximately 30 per cent. of the energy imparted to the spring.

Another aspect of the subject relates to the amount of compression which the 2½ in. column of air undergoes during the travel of the piston, assuming as we must that the bullet does not commence to move till it is acted upon by a given amount of pressure. This is assumed to arise when the air enclosed in the cylinder has been compressed from a 2½ in. length of column to ¼ in. The accompanying diagram shows a curve of air compression derived from a well-known formula. The base of the curve is set out in inches of piston travel, and the vertical scale represents pounds-per-square-inch of pressure. Compression begins at the atmospheric level of 14·7 lbs. per square inch, and it will be obvious from the formation of the curve that the pressure rises very slowly during the initial stages of the piston's movement. After the half-way distance has been passed the curve shows a strong inclination to rise at a more abrupt angle. Up to this point it is quite obvious that the resistance of the air against compression is far less than the strength of the spring. Therefore the heavy piston is rapidly attaining a high rate of motion, the unutilised energy being accumulated as momentum of the piston. As the continued compression of the air causes more resistance, the piston begins to utilise its accumulated store of energy by adding to the pressure of the spring the blow effect of its own momentum. All these things are taking place in a very short period of time. Consequently if all the working parts of the air-rifle are designed with a view to exclude as far as possible all sources of air escape except as regards the forward motion of the bullet, the air ultimately receives in compression the entire force of the spring, whether delivered by direct pressure or as accumulated momentum. It is in fact the violent blow with which the piston reaches the end of its course which enables a pressure of 375 lbs. of compressed air to be reached supposing the bullet remains stationary up to this point. The surplus energy of the piston is employed in holding the air up to its work, thereby forcing it into the barrel, and giving the pellet a forward impulse which can be compared in suddenness only with the rapid evolution of gas which arises when a charge of gunpowder is ignited. With an air pressure of 375 lbs. per square inch the force acting on the bullet is ·0246 of this amount because the area of the bore is the fraction of a square inch. The answer is 9·2 lbs.; it is quite conceivable, and actual measurements sustain the view that the friction of the bullet enables it to

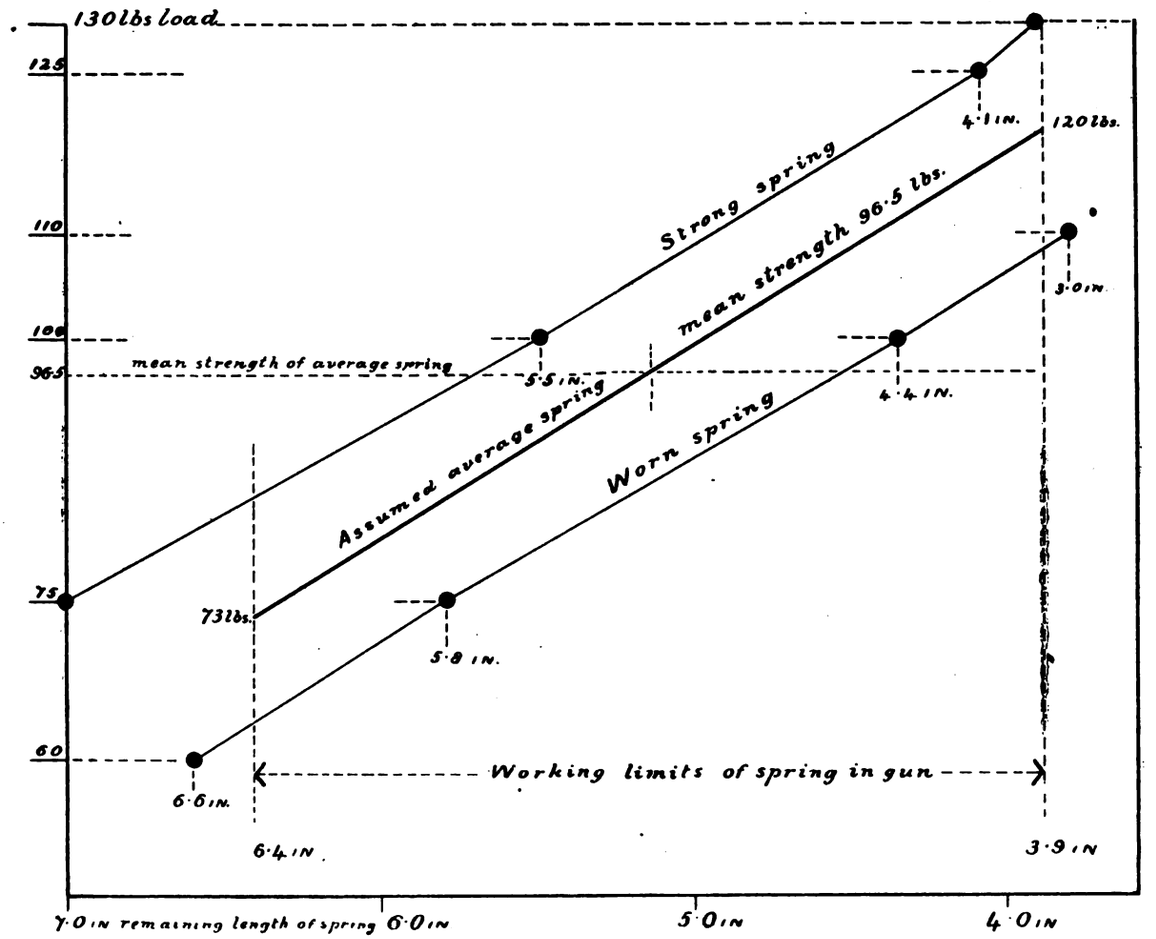


DIAGRAM SHOWING THE RELATION OF LOAD AND DECREMENT IN A NEW AND A WORN AIR-RIFLE SPRING ALSO OF AN AVERAGE SPRING, WHOSE MEAN FORCE OVER 2·5 IN. OF TRAVEL IS SHOWN TO BE 96·5 LBS.

hold back the air till about the corresponding limit of pressure is reached.

More abstruse calculations show that the piston attains its maximum velocity of movement when about half-an-inch from the end of its course, the rate being 32 ft. per second. Thereafter it falls if no air escapes, so that ¼ in. from the cylinder base the pace has dropped four feet. If no air escapes the piston will come to rest at rather less than ⅛ of an inch from the end of its course, the whole of the spring's energy having then been expended in air compression. The pressure of a 2½ in. column of air compressed to ⅛ of an inch is 1019 lbs. per square inch. If compressed a further 16th of an inch it becomes 2732 lbs. per square inch, or more than a ton. Another interesting value which is obtained by calculation is that when the piston or plunger has compressed the air to one quarter of an inch it has expended 18·2 ft.-lbs. of its total energy. Of this amount only 12·35 ft.-lbs. have been expended in compressing the air, and the remainder is accounted for by the momentum of the piston. It is impossible to trace in theory the whole of the energy contained in the spring, even the assumption of the ¼ in. limit of compression leaves a good deal of energy unused, and of the air compression which results only a part is shown in bullet velocity.

THE INDIAN ARMS NOTICE.

THE following letter as issued by the Home Department of India to Governments and administrations, is reprinted from *The Englishman* of Calcutta:—

SIR,—In continuation of the Home Department letter, dated 20th November, 1902, I am directed to forward for information, a copy of a notification, dated the 11th September, 1906, making certain amendments in the rules issued under the Indian Arms Act II. (? Act XI.) of 1878, from which it will be seen that the Government of India have now decided in supersession of all previous orders on the subject, to prohibit, subject to narrowly defined exceptions, the importation of all rifles of ·450 and ·300 bores, irrespective of the size of their chamber and action, and consequently of all ammunition which can be fired from such weapons: the exceptions are (*a*) in the case of ·303 rifles, single-barrelled weapons, sighted to over 1,000 yards, imported *bonâ fide* for match shooting purposes, and brought on to the equipment list of the regiment or corps to which the importer belongs, by the persons mentioned, and subject to the condition laid down in Home Department notification No. 1892, date the 14th May, 1903; and (*b*) in the case of ammunition, such reasonable amount as is required for use with weapons of the

prohibited bores which are already in the lawful possession of persons in this country.

I am to request that this change in the rules may be made widely known to the public and to dealers in arms and ammunition. The change now made in the rules will be embodied in the revised rules under the Arms Act, which will shortly be issued.

The notification runs: In exercise of the powers conferred by Sections 17 and 27 of the Indian Arms Act (II. of 1878) the Governor-General in Council is pleased to direct that the following further amendments shall be made in the notification of the Government of India in the Home Department, dated the 6th March, 1879, as amended by subsequent notifications.

PARAGRAPH I. *For the words* "if rifles of ·303 bore or rifles of ·450 bore of the Martini-Henry pattern, if such rifles have been imported into British India subsequently to the 20th February, 1901, without the special sanction of the Government of India, balled ammunition which can be fired from rifles of the bores and pattern aforesaid" *substitute the words* "rifles of ·303 and ·450 bore, and balled ammunition which can be fired from such rifles."

At the end of the first clause of paragraph I. after the words "carry or possess," *add the following proviso:* "Provided also that no prohibition or direction contained in Sections 13, 14, 15 or 16 of the Indian Arms Act, 1878, shall apply to persons in possession of rifles of ·303 bore or ·450 bores which have been lawfully imported into India before the date of this notification."

PARAGRAPH 6. *Note to rule 5, for the words* "any rifles of ·303 bore or rifles of ·450 bore of the Martini-Henry pattern" *substitute the words* "rifles of ·303 or ·450 bore."

Special attention may be drawn to the fact that the Ashton and Speed's patent for the W.O. Miniature Rifle is referred to under "Selected Patents," the same having just been published. The patent dates from Dec. 6, 1905, being about a week after the War Office was in possession of the rifles submitted by the trade.

Our contemporary *South Africa* has in a single issue discovered two new explosives, the one hailing from the Cape and the other from Mexico. The first is Manganite; the second is Potassimite. To these must be added Hymalayite, the invention of a Portugese priest, the priest and the explosive being jointly discovered by the *Daily Mail*. It seems that the first experiments which were made at Frankfort, Pa., produced such startling results that the Secretary for War would not give permission for further trials unless Padre Hymalaya would accept responsibility for any damage done. Padre Hymalaya refused handsome offers for his explosive in America, returning to Portugal, where he placed it at his country's service.

A great point is made in the arguments put forward on behalf of the Woolwich workpeople that Government manufacture is carried on at more economical prices than when the same work is performed by private contractors. This argument assumes that the whole cost of War Office output is set forth in the published accounts. In point of fact it is well known that the factory accounts do not charge against the cost of output many of the administration, experimental and capital charges which must form a part of the manufacturing expense, however the items may be treated in the system of book-keeping adopted. In comparing the relative bustle and activity of private and Government factories the skilled observer is at least forced to adopt the conclusion that Government factory methods would not pay dividends.

APPLICATIONS FOR PATENTS.

SEPTEMBER 24—OCTOBER 20, 1906.

21,107. Steel Targets A. E. Downing and J. Trow.
21,238. Air-Guns. T. Noble.
21,240.* Explosive. R. Weyel.
21,324. Air-Rifles. L. Jeffries and G. F. Urry.
21,462. Telemeters. C. von Hofe.
21,525. Target. T. C. Ferrand and E. H. Coggins.
21,551. Aiming Apparatus. W. R. Clark and F. W. W. Baker.
21,557.* Ordnance. Fried. Krupp, A.-G (Date of application in Germany, January 27, 1906).
21,566.* Automatic Shooting Apparatus. H. Niedecken.
21,615. Projectile Fuses. H. V. Cuthbert-Keeson.
21,885. Sighting Devices for Firearms. T. Gilbert-Russell.
22,438. Prevention of Report of Rifles. E. K. Kloehs.
22,505. Projectile. G. H. Hoxie.
22,565. Wind Gauges for Small-Arms. King's Norton Metal Co., Ld., T. A. Baylis, E. Whitworth, C. H. Watson and F. W. W. Baker.
22,672. Moving Targets. J. Graham.
22,783. Drying Guncotton and Nitrocellulose. K. B. Quinan.
22,830. Automatic Pistols. F. T. Murray and J. Carter.
22,831. Air-Guns. L. Jeffries and G. F. Urry.
22,861. Automatic Firearms. J. Eastwick and I. A. Timmis.
22,877. Range Finder. D. W. McLean.
23,101. Gun Barrels. T. K. North.
23,139. Rifle Gunnery Practice. F. Mitchell.
23,304. Gun Sighting. A. T. Williams.

* These applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

SEPTEMBER 27—OCTOBER 18, 1906.

COMPILED BY HENRY TARRANT.

22,131 (1905). **Trigger Operated Mechanism for Rifles.** H. Danner, Austria. Through the medium of a series of levers and cams the breech bolt of a rifle is automatically moved backwards and forwards by the movement of one member of a four armed trigger through an angle of 90°. The spent cartridge is ejected by this action and a fresh one is taken from a circular magazine and pushed into the chamber. Accepted September 6, 1906.

22,348 (1905). **Explosive Projectile.** Major M. C. Mansell. This safety device, designed to prevent premature firing of the main charge, is adapted to operate in connection with a fuse attached to the nose of a projectile. A sliding door arrangement is interposed between the base of the fuse, and these doors are forced open against the pressure of springs by centrifugal force set up by the rotation of the shell when discharged. A bolt holds them in the open position and on impact the flash is allowed to pass into the shell. Accepted September 13, 1906.

22,607 (1905). **Time and Percussion Fuses.** F. Beale, India. The rotation of one time ring of a double action fuse is adapted to remove or return two safety levers which prevent ignition when in a locking position. When the ring is set the levers are removed; when it is turned in the reverse direction the safeties are replaced. A shutter may also be arranged to close or open the magazine hole of the fuse. Accepted September 6, 1906.

24,778 (1905). **Cartridge Turnover Chuck.** A. J. Rudd, Ipswich. The chuck of an ordinary sporting cartridge turnover machine is provided with two pins which regulate the shape of the turnover—whether it be round or square. The patentee so shapes the recesses in these pins which operate on the turnover that a compromise is produced. The inside of the turnover is square, and the outside round. Accepted September 6, 1906.

25,403* (1905). **Miniature Rifle Mechanism.** H. T. Ashton and J. J. Speed, Enfield.

25,656 (1905). **Automatic Pistol Mechanism.** The Mars Automatic Pistol Syndicate, Ld., and C. Brown, Birmingham. The

automatic pistol mechanism described in Patent No. 14,777, 1900 (granted to H. W. G. Fairfax), is modified in several respects. The lifting of the cartridges from the magazine, the trigger and sear mechanism, and the method of preventing premature liberation of the bolt if the trigger be pulled when the barrel is not home have been improved. Accepted September 27, 1906.

6 (1906). **Balanced Target Apparatus.** C. Reid, Dublin. Two targets are pivoted to opposite ends of a single set of four levers One target is raised into position by lowering the other, but no trench is needed to accommodate the bottom one. To counteract forward pitch a guiding rod is made to move backwards in the lower axle. Accepted September 13, 1906.

262 (1906). **Air Gun Construction.** W. S. Armstrong, Leeds. A pump cylinder and piston are accommodated in the stock of the gun and are attached to an underlying lever. The whole is drawn downwards away from the stock to allow the piston during the return movement to compress the air in the cylinder into a chamber. The charge is released from the chamber when the trigger is pulled. Accepted September 27, 1906.

1,737 (1906). **Adapting Service Rifles for Miniature Ammunition.** A breech adaptor is constructed with a chamber for a low power "miniature" cartridge. The adaptors loaded with cartridges are fed up from the ordinary magazine into the chamber of the barrel. The small bullet is discharged from the adaptor into a rifled tube in the barrel. A rod is attached to the bayonet stud for pushing the small cartridges from the adaptor and for cleaning the latter out. Accepted September 20, 1906.

1,844 (1906). **Gas Tight Joints.** Col. H. C. L. Holden, F.R.S., Woolwich. To prevent escape of gas at the breech of ordnance the abutting ends are formed with a series of concentric ribs. The ribs of one series fit accurately into the grooves between the ribs of the other. Accepted September 13, 1906.

2,586 (1906). **Breech Mechanism for Small Arms.** H. T. Ashton, London. (This Patent Specification is a Secret Document).

5,098 (1906). **Rimless Cartridge Extracting Mechanism.** L. B. Taylor, Birmingham. Combined with the segmental head of the rifle cartridge extractor is a sliding catch or lip having the same curvature as the annular groove of a rimless cartridge. This lip engages the groove and pulls the cartridge case from the barrel when the extractor is operated. Accepted September 27, 1906.

8,604 (1906). **Smokeless Powder.** R. F. G. Robrecht, Germany. A smokeless powder is described in this specification consisting of suitable vegetable fibres (Söhn hemp) nitrated in a mixture of three parts of sulphuric acid and one part of nitric acid. For 12 hours this mixture is kept in a revolving apparatus at a temperature of 25° Cent. After washing it is dissolved in English (concentrated) sulphuric acid, precipitated by water, dried and crushed. Accepted September 27, 1906.

10,211 (1906). **Barrel Recoil Ordnance.** Rheinische Metallwaaren und Mf., Germany. Ordnance of the barrel recoil type is provided with a chamber into which fluid under pressure may be introduced or removed. When it is introduced the gun is run into the firing position and when it is discharged the gun is moved backwards so that its weight is more evenly distributed over the four wheels. Accepted September 20, 1906.

11,093 (1906). **Martini-Francotte Rifle Mechanism.** C. Francotte, Belgium. The trigger guard and plate carrying the lock mechanism are secured in the "breech box" by either one of three methods in principle the same. They consist of a spring actuated hook device locking over a projection in the body. Accepted September 6, 1906.

11,446 (1906). **Bicycle as Gun Carriage.** H. Stracke, Germany. An ordinary rifle is mounted with its barrel between two sets of parallel pillars—one supporting the handle-bar; the other the saddle. The mounts are arranged to allow the gun to oscillate under recoil and the back support is moveable vertically to allow the elevation to be modified. Accepted September 20, 1906.

15,236* (1906). **Small Arm Lock Mechanism.** Société Anonyme Fabrique Nationale d'Armes de Guerre, Belgium.

16,950 (1906). **Telemeter Construction.** Carl Zeiss, Germany. Coincident telemeters (consisting essentially of two telescopes having a common ocular) are modified to obtain more exact measurements. Two images of the object, one inverted, are brought into a position where they lie symmetrical to a boundary line between them. Accepted September 20, 1906.

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

SELECTED PATENTS.

SMALL ARM LOCK MECHANISM.

15,236 (1906). The Société Anonyme Fabrique Nationale d'Armes de Guerre, Belgium. Usually the hammer of a sporting gun or rifle lock is cocked by a lever which is rocked during the breakdown movement of the barrels. The mechanism described in this specification consists of four parts only—the main and trigger springs, the trigger, and hammer all mounted on the trigger plate—and the mainspring itself is forced upwards, carrying the hammer to its cocked position.

The mainspring *a* rests upon the trigger plate *d*. The free end of one arm bears on the inclined surface *b*, and the other rests in a

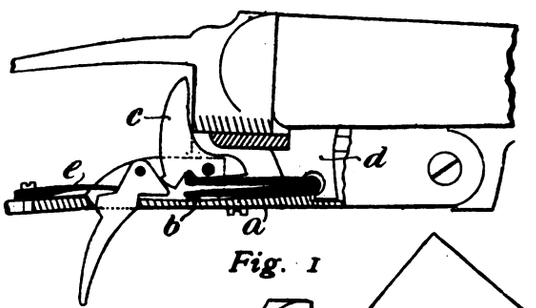


Fig. 1

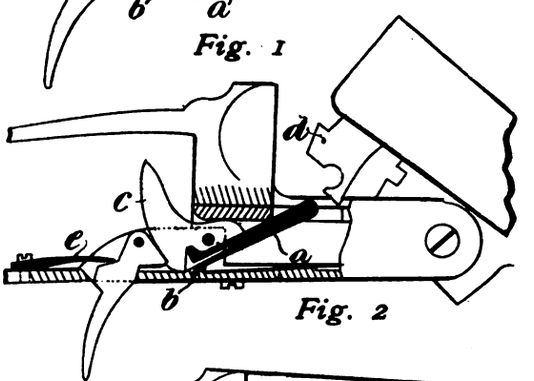


Fig. 2

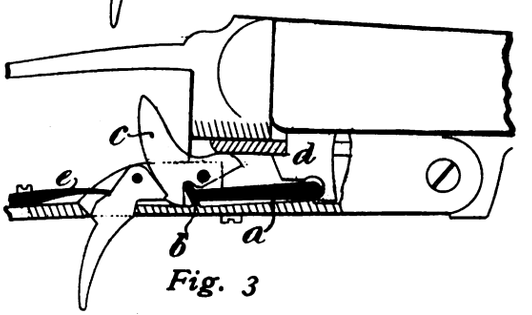


Fig. 3

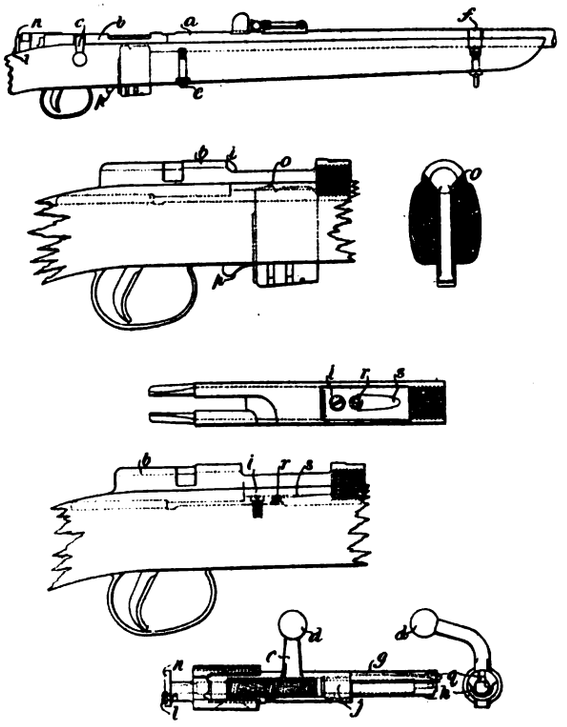
slot in the bottom of the hammer *c*. The bend of the spring is mounted freely in the lump *d* of the barrel. The trigger is pivoted in an upstanding extension of the trigger plate and its nose is adapted to act as a sear. The trigger is always pressed forward by the spring *e*.

When the barrels are dropped down to open the gun the lump *d* carries the mainspring upwards (Fig. 2), and forces the hammer round on its pivot. The free end of the lower arm of the main-

spring passes over the inclined projection *b*, and the spring is held in its raised position until the barrels are returned to the closed position. The end of the free arm is forced over the projection *b* again and the hammer is held in the cocked position by the engagement of the nose of the trigger in the bent. (Fig. 3). When the trigger is pulled this engagement ceases and the spring drives the hammer forward to discharge the cartridge. (Fig. 1). If the trigger is pulled when the gun is open nothing can happen. To dismount the mechanism the mainspring and the trigger plate screw only have to be removed. Accepted September 27, 1906.

MINIATURE RIFLE CONSTRUCTION.

25,403 (1905). H. T. Ashton and J. Speed, Enfield Lock. The rifle described in this specification is that which is now known as the "War Office Miniature Rifle." It is constructed for miniature ammunition, and its parts are designed as nearly as possible to be manipulated in a fashion similar to those of the service arm. The bolt is especially made of large diameter in proportion to the diameter of the cartridge used. and the underside of its head is so cut away that the axis of the bolt practically coincides with the



axis of the cartridge. The striker is also of large dimensions and extends from end to end of the bolt. The rifle is illustrated with a magazine and also as a single loader.

From the illustrations appended it will be seen that the general construction of the rifle is somewhat on the lines of the service rifle. The barrel *a* screws into or is made solid with the breech piece *b* in which the bolt *c* is adapted to work. The bolt is moved backwards or forwards in the slideway in the usual manner by the arm *d*, cocking being effected as the bolt is returned to close the breech. The stock consists of one piece of wood and is secured to the barrel by the screw *e* which may be removed with the aid of a coin and by the end of the sling swivel which screws into a projection from the ring *f* surrounding the barrel.

In order that the external dimensions of the bolt *c* and bolt head *g* may be maintained as large as possible in proportion to the cartridge used the underside of the head is cut away as at *h* so that the cross section corresponds with that of the cartridge trough *i*. This arrangement brings the axis of the bolt practically into line with the axis of the cartridge and the cartridge may be pushed straight into the chamber without relying on any but the slight guiding given by the rounded nose of the bullet. The head is screwed into the bolt body so that when the arm *d* is turned up to unlock the bolt the body rotates and leaves the head stationary so far as rotary movement is concerned. The striker *j* extends from end to end of the bolt and is arranged in a similar manner to that of the service rifle. It is adapted to strike rim fire ammunition and is necessarily situated eccentrically. When the keeper screw *l* is removed to allow the head to be turned to remove it from the body the striker also is turned and its rear is unscrewed from the cocking piece *n*. The whole of the parts of the bolt are thus separated.

The magazine is formed of sheet metal and carries inwardly projecting lips *o* which hold the cartridges from being forced out by the spring beneath. The front of the top is bevelled off to allow the bullet of each cartridge to rise and enter the chamber. The topmost cartridge lies as in the trough *i* with its axis almost in a line with the axis of the bolt so that when the bolt is pushed forward the cartridge is carried from the magazine and in as direct a line as possible into the chamber. The magazine is inserted either from the top in a manner similar to forcing cartridges from a clip into the magazine of a service rifle or from beneath. It is held by the spring clip *p*.

The spent cartridge is extracted from the chamber by the extractor *q* and is ejected by being tipped up by the rim of the next cartridge in the magazine or in the case of a single loader by the pin head *r* lying at the end of the ejector groove *s*.

As doubts have been expressed concerning the possibility of there being anything of a patentable nature in this rifle mechanism the claims are now given in full, subject to the understanding that the reference letters apply to the original drawings in the specification and not to the accompanying reproductions therefrom.

1. In a rifle the combination with a bolt of large diameter in proportion to the diameter of the cartridge used of a reduced or cut away portion as at A^3 in the head of the bolt substantially as and for the purpose described.

2. In a rifle for use with miniature ammunition the combination with a barrel of the necessary small bore of a bolt of comparatively large external dimensions having its head cut away on the underside as at A^3 substantially as and for the purpose described.

3. In a rifle for firing miniature ammunition the combination with a bolt of large diameter in proportion to the diameter of the cartridge used and having its head cut away on the underside as at A^3 of a striker also of large dimensions in proportion to the diameter of the cartridge used and extending from end to end through the bolt substantially as described.

4. In a rifle for firing miniature ammunition the combination with a bolt having its head cut away on the underside as at A^3 of an ammunition trough such as B^1 and a magazine substantially as described.

5. In a rifle for firing miniature ammunition the combination with a bolt of large diameter in proportion to the diameter of the cartridge used of a hopper shaped ammunition trough such as B^1 and a correspondingly shaped head for the bolt whose main axis lies in a position to approximately coincide with the axis of the cartridge when within the trough substantially as described.

6. The combination and arrangement of parts forming the complete bolt and striker for a rifle firing miniature ammunition substantially as described and illustrated in Figures 6 and 7 of the accompanying drawings.

7. The combination and arrangement of parts constituting the complete rifle for firing miniature ammunition substantially as described and illustrated in the accompanying drawings.—Accepted September 13, 1906.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

Sunday Rifle Shooting.—It seems but a very few years ago that Mr. C. F. Lowe caused a pained feeling of surprise when he got up at a general meeting of the National Rifle Association to propose that rifle shooting should become a recognised Sunday pursuit. Sir Henry Fletcher presided over the meeting in question, and, as a large landowner in Sussex, metaphorically the father of his flock, and one morally obliged to set a good example, it was not surprising to find that he dismissed the idea with silent contempt. A good deal has happened since then, and the large rifle shooting fraternity, whose sport is restricted by long railway journeys have looked with envy on the golfer, the up-river man and the yachtsman proceeding in sporting attire to enjoy an unbroken day at their favourite recreations. Bisley Camp is an ideal lounging place for the unattached batchelor, so much so that many of its frequenters avoid the rush home on Saturday night and stay over Sunday, talking shooting as a substitute for actual work at the ranges. The pressure on the ever-reducing range accommodation throughout the country is daily increasing; and although Saturday afternoon brings all classes of riflemen to the firing line, those in charge of the official statistics realise that the Saturday afternoon shooter is as a rule the favoured individual whose business hours are elastic. General Mackinnon, whose speech at a recent banquet is mentioned elsewhere in another connection, boldly advocated the idea of Sunday shooting as a remedy for existing difficulties, and as morally and ethically justified, whether regarded on the grounds that a day so spent is none the less holy, or that Sunday is better spent that way than in aimless wanderings around. He pictured the idea of a volunteer detachment attending church parade, then having dinner at mess, and afterwards proceeding to the ranges to qualify as good citizen soldiers. The precedent which justifies such a picture is an old law authorising the practice of archery on Sunday. But precedent or no precedent, public opinion may not immediately be ripe for such a bold innovation. A large proportion of the community would vote in its favour if the principle of the referendum could be adopted, but in matters affecting the moral susceptibilities of the public mind the objecting minority must be generously considered. The change is nevertheless likely to come about by private initiative. Small rifle clubs where the members are in the habit of looking after their own requirements, may announce club shooting on Sunday afternoons with the same immunity from interference which most golf clubs and a few tennis clubs have experienced. In a few years time prejudice might be so far broken down as to clear the way for official action in the same direction. In fairness to General Mackinnon it should be noted that he expressly qualified his remarks by saying that they were uttered as personal opinion only, and had no reference to his official position as Director of Auxiliary Forces.

The Vicissitudes of the Soap Trade.—One of the most extraordinary incidents of commercial history has just come to a close. Everyone is acquainted with the recent attempt to combine the soap trade. If human nature were differently constituted combination would be a good thing. Unnecessary expenses would be avoided, and the overlapping of work which competition produces would be saved. But many industries have grown up around the competing system on which commerce is based. The enormous growth, for instance, of the advertising trade is a case in point, and the whole newspaper world depends upon the maintenance of a state of healthy competition. When, therefore, the soap combination announced that one of the benefits of the new organisation would be to limit wasteful advertising, the newspaper

world at once headed a determined attack on the new combine, and some of the cleverest writers of the day exercised their talent in showing the public that the whole scheme had for its ultimate end the plundering of their pockets. The public mind is easily aroused against anything in the nature of tyranny and oppression; and as a result an open boycott was declared against soap trust productions. Many and varied were the forms of attack adopted. One of the most telling was the doubtless exaggerated accounts of the enormous profits made by the soap industry. Existing concerns outside the trust found such a suddenly increased demand for their goods that large extensions of works were put in hand. If fresh capital was required the newspapers advised the public to subscribe with an emphasis and air of conviction which thousands of pounds of expenditure could not influence for an ordinary industrial promotion. With ever diminishing sales, and with daily evidences of enormous masses of new capital coming into the business panic seized the authors of the combine, and its dissolution was announced on the 24th ult. The explosives trade is vitally interested in the status of the soap business, in so far that the market for glycerine seriously influences the cost of raw materials for making explosives. Messrs. Kynoch some years ago retaliated against a corner in the glycerine market by entering the soap and candle trade. The recent agitation has encouraged them to go a step further; and they have raised £215,000 in view of the unexpected opportunities in the soap trade. By an extraordinary coincidence the subscription list for the new debenture issue, closed on the very day when the soap trust arrangements were cancelled. A wealthy and enterprising firm will, doubtless, find no difficulty in employing in the interests of its shareholders, such a sum of money. A quarter of a million more or less is a mere bagatelle in large commercial enterprises, and soap might still prove a good horse to back. Public suspicion, once aroused, is hard to allay, and Macchiavellian designs will for some time to come be attributed to the firms whose friendly understanding has been scotched.

Tests with the "Montagu."—All attempts having failed to salve the *Montagu* the hulk will be put to the ignominious but scientifically interesting use of a target for gunnery experiments. The Admiralty take every available opportunity of testing armour-piercing artillery on targets bearing a semblance to the real article. Just as gunmakers try sporting bullets on joints of beef, so the Admiralty gains useful experience by supplementing the ordinary armour-plate trials by launching their shots at an actual vessel. The *Montagu* offers an exceptional opportunity for testing modern shells against modern armour properly located in the sides of a battleship. The plate once pierced the destructive effects produced in the interior of the hull can be exactly determined. Ordinary range tests with shells and armour are a measure of penetration only. Consequently explosive charges are not much used, because their effects are not produced in presence of normal conditions. With the *Montagu* on the other hand the internal structure of the vessel is intact, and the exact consequences of a shot can be noted. More than this the influence of the angle of impact can only be very approximately established by experimental tests with individual plates bolted into framework on the butts. Artillery experiments are so enormously expensive that practically speaking only one or two firms outside the Government can afford to conduct them on a measurable scale. Here in the *Montagu* we have ready to hand the material for an experiment which could not be conducted by even the richest of nations, unless the apparatus, in the form of a modern battleship, derelict and staged ready for the experiments, were available free of cost. Such knowledge as can be derived from the tests to be made will of course be guarded as a State secret; but the information will be available where wanted, and the public must be satisfied to know that even in death the lost *Montagu* is an asset of some importance.

The Indian Arms Order.—Gunmakers who engage in the rifle trade continue to be seriously perturbed by the new order which makes the ·450 calibre obsolete for sporting arms. Big game shooters are mostly found amongst officers of the British Army, and although India does not represent the whole world it is at any rate the largest area in military occupation, and wherever an officer may be quartered to-day his next appointment may be in this dependency. A strong prejudice must accordingly be understood to operate against the sale of ·450 sporting rifles, and, however, sympathetically one may regard the efforts which are being made to secure a relaxation of the stringent order which has been promulgated, it is difficult to see how the official mind can be stirred. The order was deliberately made, and doubtless with due regard to the monetary inconveniences it would produce. The whole burden may be said to fall on the trade, but private owners of the prescribed rifles will be badly hit as well, since once out of India the privileges accorded to their rifles will cease to be effective. Whatever steps it is deemed desirable to take in endeavouring to secure an amelioration of the new restrictions, parallel with those steps should be the attempt to replace the ·450 cartridge with one outside the new rule, but ballistically its equal if not its superior. It should not surpass the ingenuity of gunmakers to design a ·460 or ·465 bore which might even be capable of transposition into existing ·450's. Several technical difficulties exist, and the process of conversion might not be applicable to existing arms, but if only a part of the existing stock of partly finish goods could be so liquidated some alleviation would be experienced. As a set-off against the losses incurred some extra trade in converting or re-barrelling existing private rifles might be secured as a set-off. Certainly recent researches in the science of express ammunition point towards great changes in the future, and the new ·465 cartridge might be made so as to embody an instalment of those changes. A slightly enlarged bore, with a cartridge head of practically the present size, might be incorporated with the idea of a lower pressure, a light Spitzer bullet and a 2,500 to 3,000 f.-s. velocity. Loaded with M.D.S. cordite or its equivalent such a cartridge might make a great stir in the sporting world. The trade is now drawn together for the purpose of facing the common difficulty. If a part of its policy could be made constructive, then for the first time in the history of sporting rifles a cartridge could be evolved of absolutely standardized dimensions. It might be urged that to propose such an idea is to talk in the realm of the clouds, but if this is so the sooner it comes to earth the better; for such a cartridge though on paper now might soon become a solid fact.

TWO KNIGHTHOODS.

THE pleasing information that Colonel F. L. Nathan, R.A., and Colonel F. W. J. Barker, R.A., have received knighthoods was conveyed in reading the list of birthday honours on the 9th ult. Both recipients of the honour are curiously associated with the history of cordite. It will be remembered that Colonel Barker delivered the historical lecture on "Modern Gunpowder and Cordite" before the Royal Artillery Institution on January 23rd, 1893, which formed the pivot around which the cordite controversy waged. Colonel Barker had at the time retired from active connection with explosives being then responsible for the operations carried on at the Sparkbrook Rifle Factory. His term of service was continually renewed in recognition of the efficiency of his administration. Major Tisdall was at last appointed his successor, and was fetched post haste from India to take up his new duties. Meantime the factory had been sold by the War Office, and the present birthday honour is a fitting recognition of the many and busy years during which Sir Francis Barker has served his country.

In regard to Sir Frederick Nathan the honour is even more appropriately bestowed. That is to say it is given during his period of active service, many years in fact before his retirement can possibly be due. One would like to see more instances where the honour of knighthood is conferred during actual employment. Colonel Nathan, we mean of course Sir Frederick, is one of those rare individuals whose work is his hobby and whose hobby is his work. He retires to rest at an exceptionally early hour each night, in order the better to meet the strain of his many responsibilities; and acute as have been the periods of anxiety through which he has passed when the new baby cordite was giving unexpected trouble, he of all others was the one who maintained a calm and consistent demeanour, dealing with each day's work as it arose, without reference to distractions which would have barred attention to routine matters by ordinarily constituted individuals. Of late years things have run quite smoothly, and the gallant Colonel has devoted much of his time to improving the processes of manufacture adopted in Waltham Abbey, particulars of which have appeared in recent issues of this paper. To those who have been privileged to inspect the arrangements of his factory, an object lesson has been given in the science of perfect organisation. The stores contain a sufficient variety of materials to start a new colony in a strange country. Every item is classified and booked in and out of the stores, so that its history is complete from the time it enters the factory till it is used up or discarded as no longer serviceable. At the present time Sir Frederick Nathan is engaged on a special mission to India for the purpose of investigating an unaccountable mishap which has arisen, and personal congratulations must await his return. Considering the number of eminent workers who have devoted the best years of their life to the manufacturing and inspectional work of the War Office it seems a pity that more honours are not available. Service in the factories and arsenals is quite as wearing as the active control of troops. In many instances it is more dangerous, and it certainly requires brain power of a special order. To become a manufacturer at a moment's notice with no more technical training than the artillery or engineer officer receives certainly needs great adaptability.

THE NEW W.O.M. RIFLE.

The issue of the new War Office miniature rifle in machine-made form marks an epoch in the history of gunmaking of considerable importance. A service practice rifle, not made in Government factories, but Government viewed and marked, indeed represents a plum for those gunmakers having machinery to tackle the manufacturing problem. General W. H. Mackinnon, the Director of Auxiliary Forces, speaking at a recent public dinner, stated that the War Office received more notices of existing rifle ranges being closed than new ones opened. He emphasised the unfortunate coincidence of ever-diminishing range accommodation at a time when the great and increasing power of the modern rifle made long-range practice more and more necessary. Though not a complete remedy in itself, the general extension of miniature range practice will do a great deal to perfect the soldier's early education in the use of firearms under conditions which render restrictions of space of little account. Much of the instruction which is at present carried on with full-power rifles and ammunition can readily be replaced by useful tuition nearer home. The skilled shot at the Miniature Rifle Club is a more proficient marksman than the ordinary soldier. He may have had no education at full length military ranges, but this gap in his training could be readily filled in view of the sound foundation afforded by his short-distance training. On first principles miniature rifle practice is bound to come to the front, and an immense impetus will be given to sales, far beyond anything which recent advances indicate.

General Mackinnon was also responsible for the very cheering news that great as are the grounds for congratulation respecting the fine military organisation in the Colonies, the most satisfactory feature of all is the fine state of efficiency of the different Cadet Corps. Australia has for years been known as the largest buyer of military model Cadet rifles firing small ammunition, and these weapons have been used by the Corps for musketry training. When a comparison is made with our own Church Lads and other Brigades which are armed with carbines cut across the breech with a saw to demonstrate their worthlessness as rifles, the home country is proved backward in the extreme. All this is bound to be altered at any early date, and the new W.O. miniature rifle is the obvious successor to the purely "drill" rifle now used or rather carried. A Colonial Conference will be held next year to discuss various questions of policy with regard to bringing the outlying sections of the Empire into closer touch than at present with the mother country on matters military. It seems likely in such circumstances that some arrangement may be made for adopting the W.O. miniature rifle as the Cadet arm of the Colonies the same as it now is of the home country. Here again is a fresh source of trade activity, and one which has the great advantage of being more patriotic than, for instance, the arming of savage nations with weapons of precision. Government action, if it has restricted the sales of arms in quarters where they might be turned against our own troops, has at least in the matter of the new Cadet rifle opened up a fresh source of demand where the larger the trade done, the greater is the benefit which the nation derives. There may be difficulties during the first few months but the new rifle will soon be weaned, and a prosperous future is assured.

CORRESPONDENCE.

·22 CAL. INTERNALLY LUBRICATED CARTRIDGES.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—In your October issue *re* ·22 cal. cartridges, you say "The next stage of development will be to produce an internally ·22 lubricated cartridge requiring a chamber, etc.," but such a cartridge is already made, viz., the ·22-7½-45 for Winchester Repeating Rifle (model 1890). This cartridge is fairly accurate and sure fire with black powder, but it is just a fraction short of the ordinary ·22 long rifle outside lubricated cartridge for fine target work.

Why this is so it is difficult to understand, but personally I think it is because there is too much powder (viz., 7½ grains) for the weight of bullet, 45 grains.

In a rim-fire cartridge there is so much power in the priming composition that this makes an appreciable increase in the velocity, which makes the ammunition all right for sporting purposes, but not so good for target work. It would be interesting to know exactly how many grains of black powder the priming composition of a ·22 cal. rim-fire shell is equal to. If you reckon it is equal to say, 2 grains, then, with the charge of 7½ grains, you have equal to 9½ grains of powder to the 45 grains of lead, which is too much.

If you take the ·450 cal. as an example, the best target load was 85 grains (and 3 grains for four of E.C. powder) and 500 grains lead. If you reduce this proportionately to the ·22 you get 9 grains (composed of 7 grains powder and 2 grains force of priming) and 50 grains lead. To sum up, I should say the ·22-7½-45 shell would shoot all right if it were loaded with 7 grains powder and a 50 grain bullet, the rifle being properly chambered and rifled with a twist of one turn in 16 ins. The diameter of the barrel should be ·220 and ·004 ins. depth of rifling, the diameter of the bullet ·227 in. The bullet *not* to be crimped in shell, but only firmly seated on to the powder. Ordinary ·22 cal. rim-fire rifles with twists of one in 16 in. or 17 in. could be re-chambered to shoot the above cartridge, which would be clean to handle, and could be extracted unfired from the rifle without leaving the bullet in the chamber, which the present ·22 long rifle cartridge does. Of course this inside lubricated *·22-7-50* cartridge would be rather more expensive than the ordinary ·22, and would also be more powerful than necessary for short ranges (up to 50 yards), but it would be a very good cartridge for clubs with ranges of 100 up to 200 yards, and very much cheaper than centre-fire ones.

Re the War Office Miniature Rifle. This seems to have been rifled too deep, viz. *·006.* If it is bored ·220 inches, this makes it ·232 in. diameter to the bottom of the grooves. I understand the present ·22 cal. R.F. ammunition has a bullet of ·226 in. to ·227 in. diameter, so it looks as if there would have to be *upsettage* of the bullet to fill the grooves to the bottom, which is not a good principle, especially for small bore rifles.

C. H. MANN.

Bradford, Nov. 14, 1906.

[Our correspondent's suggestion deals with a matter which is receiving attention from manufacturers. An objection to the cartridge he mentions is the extra amount of metal used in its manufacture. The whole idea should of course be to remedy existing difficulties without enhancing cost. It is an understood thing that the present ·22 rim-fire cartridge is one of the most difficult of all the problems with which the ammunition manufacturer is faced. It has been proposed that the War Office should recognise the existence of these difficulties, and co-operate in the production of a truly English cartridge, constructed primarily for giving efficient results under rifle club conditions of shooting. At the present moment Enfield is wasting its time in endeavouring to make a magazine action for a cartridge of which the bullet can be pulled out by the finger and thumb.—ED.]

CHAMBER OF COMMERCE.

GUN AND AMMUNITION TRADE SECTION.

A MEETING of the Gun and Ammunition Trade Section of the London Chamber of Commerce was held on the 30th ult., Mr. Edgar Harrison presiding. There were also present Messrs. Martin Pulvermann, William Darlow, Henry A. A. Thorn and others.

The minutes of the meeting of the 30th June were read and confirmed.

The Chairman said that the principal business of the meeting was to consider the important change in rules of the Indian Arms Act respecting sporting rifles in certain and specific calibres, whereby they would be practically prohibited from importation into India.

Considerable discussion took place on this matter, when the following resolutions were passed:—

Indian Arms Act.—"That representations be made to the proper authorities to make an exception in certain of the proposed rules, viz., C: For single high velocity rifles of sporting pattern. D: For double sporting rifles of high velocity cartridges."

"That the India Office be asked to receive a deputation on the question of the importation of low-priced repeating rifles, and further, that the Indian Chambers of Commerce be communicated with, and also the Foreign Office at Calcutta."

In addition to this it was also agreed to endeavour to secure the support of the Indian Chambers of Commerce.

Deputation in regard to the Amendment of the Gun Licences Act.—The Chairman reported the action taken by the Special Committee in regard to this matter, which was regarded as satisfactory. It was, however, decided to spare no efforts to secure the inclusion of the clause in the Act which the Committee recommend, viz.: a clause authorising rifles to be carried without a licence when used for target practice, the matter to be reconsidered at a future meeting.

Condition of the Trade.—It was reported that the Special Committee on this matter would shortly issue its report to the Section.

London Court of Arbitration.—The Section concurred as to the principle of appointing arbitrators for the trade, but left the selection of arbitrators to a future meeting. The Court of Arbitration is organised jointly by the Corporation of London and the London Chamber of Commerce, and all Trade Sections are requested to appoint arbitrators for their particular trade to act in cases of disputes arising in such trades.

A vote of thanks to the Chairman terminated the meeting.

THE DISPERSION OF SHOT CHARGES.

AN interesting review of experiments for examining the gradual spread of shot pellets as they pass along the range has recently been published, and a few remarks thereon may serve to throw light on a subject of some considerable practical importance in gun experiments. Briefly stated the idea consists in measuring at various distances the size of circle which contains the same number of pellets as are contained in a 30 in. circle at 40 yards. The firing of a large number of shots under such conditions showed for instance that the pellets of a full choke pattern occupy the area enclosed by a circle of five inches diameter at 10 yards. A seven-inch circle on the other hand is required in the case of a cylinder gun to hold the pellets which are contained in the 30 in. circle at 40 yards. The whole series of values can be set out in table fashion thus:—

	10	15	20	25	30	35	40 yds.
Cylinder Gun	7·0 in.	9·8 in.	13·0 in.	16·3 in.	20·3 in.	25·0 in.	30 in.
Half Choke..	6·0 ,,	8·8 ,,	12·0 ,,	15·5 ,,	19·6 ,,	24·5 ,,	30 ,,
Full Choke,.	5·0 ,,	7·8 ,,	11·0 ,,	14·7 ,,	19·0 ,,	24·0 ,,	30 ,,

These figures at once make it clear that the pellets composing a charge of shot do not travel in anything approaching a straight line, but that the rate at which they move away from their common centre is in a greater ratio than is directly proportional to the forward movement. It does not follow that the individual pellets follow a curved path. It is possible on the other hand that they do. Slight surface irregularities and a slight spin would easily impart a bias to the pellets, giving them a mode of travel which may be likened to the eccentric behaviour one notices in the game of bowls. Another explanation of a dispersion of the pellets greater than would be represented by a straight-line course is the possibility that the gas blast from the muzzle, and the possible interference of the wadding may give the various pellets constituting the charge a variety of different lines of flight, the angle of divergence of each pellet varying in accordance with the disturbing forces which have acted upon it. Whatever may be the precise explanation the fact remains that the above measurements show that the central and the most consistently flying cluster of pellets opens out or spreads trumpet fashion, so that there is a greater relative spread at the longer distances than measurements at short ranges would suggest. However that may be the fact remains that the shot gun experimentalist is now possessed of a curve showing the average dispersion of each of the three main borings of gun. The full-choke, which is the closest shooting at the longer distances, is not only closer shooting at the short distances, but the degree of extra concentration of the pellets is far more pronounced than with cylinder guns.

So far as the experiments already conducted have been able to show a series of patterns measured say on the basis of an 11-in. circle at 20 yards for a full-choke gun give within experimental limits the same average result as would be expected shooting the same gun under the normal 40 yards conditions. Moreover the variations from round to round in the number of the pellets counted would not be markedly different from the variations experienced under the ordinary conditions of a pattern test. More than this those who have enjoyed considerable experience in judging the behaviour of guns, as displayed by the patterns produced at 40 yards, can find no difference in the general style and character of the arrangement of the pellets when comparing the perforations produced in a cardboard sheet shooting at short ranges with the visual effect produced by an actual pattern taken under ordinary conditions. Cartridges and guns which give patchy distribution under the full distance test similarly misbehave themselves at the reduced ranges. Patterns themselves vary so much from day to day, from powder to powder and from shot to shot that no one would be justified in making capital out of minor divergences between a short distance test and one conducted at longer ranges. The general tendency is well expressed in the table of values already given, and gunmakers will certainly find the 20 yards test for choke guns and the 15 yards test for cylinders a valuable addition to their methods of test. The advantage of the short distance pattern is that it can be taken on carboard sheets in a form which readily lends itself to permanent storage. To supplement the records supplied to a shooter concerning the 40 yards behaviour of his gun on a whitewashed plate with a series of cards showing the absolute result which has been obtained at the half-way distance should certainly secure added appreciation for a well-made gun. As a means of illustrating in the showroom the relative effect produced by variations of charge the two-foot square sheet has many striking merits. A rabbit cartridge, with its 172 pellets of No. 4 shot, would make a splendid showing against a larger charge of smaller shot; the one being obviously suited to the purpose in view, the other quite unsuitable. The use of the cardboard sheet does not constitute a discovery, seldom as it is used. On the other hand the power to scribe a reduction of the 30 in. circle true for the lesser distance at which the shooting is done certainly represents a new idea. As already explained the size of circle varies with the boring of the gun used. To be able to say here is the actual 15 or 20 yards pattern: here is a circle which is proportional with the rest of the pattern to 30 inches at 40 yards is to place the shooter in immediate possession of facts which cannot be conveyed by mere verbal description.

Great as is the information which can be derived from the personal examination of gun patterns, taken not only at 40 yards but at other distances, the record is unfortunately of a kind which can never be adequately expressed on paper. Such impression as is conveyed to the mind by the examination of targets is either forgotten or remains stored up in the mind as a memory impression or vague instinct. At shorter distances where the enlarged splashes on the whitewashed plate are so close together as to overlap and form solid bunches the useful visual effect disappears. With cardboard, or better still with cheap strawboard sheets faced with white paper, the shot pellets make clean perforations of their own size. Hence the card target of reasonable dimensions commences to be most useful when the whitewashed plate shows little more than an unmeaning jumble of marks. An incidental use of the dispersion table above given is that the values can be sub-divided for every yard of range, so showing the serious influence which is produced when pattern tests are conducted at other distances than those laid down. For instance 38 yards seems near enough to 40 for practical use, but with a full-choke gun the circle should have a diameter reduced to 27½ inches, and everyone knows that such a difference must exercise an important influence on the records obtained.

WEAVER'S MILITARY EXPLOSIVES.

THE author of this book, Major Erasmus M. Weaver, late instructor in charge of the department of artillery, chemistry, and explosives at the Artillery School, Fort Monroe, U.S.A., rightly concluded that no single work of recent publication gives just the general knowledge of modern explosives which officers and others indirectly associated with these substances desire to possess. Major Weaver undertook a very big job when he decided to acquaint himself first of all with every scrap of written information, and then bring his own knowledge to bear on the material so collected, with a view to compiling an elementary and yet detailed volume of instruction. The successful accomplishment of his task depended quite as much on the power of clear exposition as on having adequately prepared the ground beforehand. Whilst the second condition is fully assured by the important position Major Weaver for some time held, the first is mainly a gift, so that it is really pleasant to be able to record that by means of the book now before us the untrained reader can obtain a clear grasp of explosives chemistry mostly because of Major Weaver's logical mind and happy flow of language. His description of the general properties of the ingredients used in explosives manufacture is of the kind which impresses material points on the lay mind, so giving the officer, the business manager and even the clerk a working knowledge of explosive substances and ingredients which he may never previously have been able to acquire. This is high praise to accord to a new volume when the literature of explosives seems already so well represented. But whether Major Weaver's summary of explosives from their chemical aspect is regarded by the test of quality of matter, typographical arrangement or due sequence of treatment the verdict must remain the same, that it is an ideal book for beginners whose ordinary occupation in life is such that they never wish to get much beyond the preliminary stage of education.

Whilst fully appreciating the merits of Hodgkinson's "Notes on Explosives," and Wisser's "Explosives Materials," it must be recognised that the information in these pocket books is too much of the "note" order to challenge comparison with the more ample treatment which Major Weaver has adopted. The book is published in America by John Wiley and Sons, of New York, and in London by Chapman and Hall, Ld. The only criticism we should feel inclined to put forward is regret that so high a price as 12s. 6d. net has been considered appropriate for the book, which, as a printing job, is at least far less expensive than "Modern Sporting Gunnery," also reviewed in this issue, the latter being published at 7s. 6d. net.

Part I. deals with chemical principles, such as the forms of matter, the distinction between their physical and chemical condition, fundamental laws and so forth. Part II. describes the substances used in the manufacture of explosives, the various nitrates being first of all considered, then follow the chlorates, sulphur, charcoal, organic compounds, the benzine series, alcohols, ethers, etc. The general remarks on explosives, to which Part III. is devoted, briefly distinguish between explosion, detonation and fulmination. The progressive explosives are covered by Part IV., where one learns to appreciate the properties which cause a propulsive as distinguished from a rending effect. Detonating explosives are next treated with reference to the disruptive effects produced. The remaining portions of the book which cover "service tests of explosives," "storage of explosives," "handling high explosives" and "demolitions" are more appropriate for the American than the English reader. Some rather interesting notions are to be derived from the laboratory notes, which are of course quite elementary, being only intended for those who have not received a chemical training.

MODERN SPORTING GUNNERY.

IN Mr. Henry Sharp we have one of the few writers who by past experience and associations is fully capable of grasping the procedure of experimental shooting tests at the same time being gifted with the capacity to form interesting conclusions and to set them out in a taking written form. It is, therefore, with a pleased expectation that one takes up a book from his pen, so ambitious in scheme as the above title indicates. Hitherto he has been known mainly as a writer on wildfowl subjects; but the grasp he has always shown of the technical aspects of the subject which he has specially made his own leads one to assume that whatever he puts on paper will have been well grasped and carefully digested beforehand. In the present instance any doubt that the reader might at first feel as to whether he has been able to acquire first-hand information of sufficient interest and value to justify so ambitious a programme as the writing of a technical treatise is at once set aside by the statement contained in the preface that the whole of the resources of the Westley Richards factory have been placed at his disposal as a hunting ground for information and as a means of experimental research. The Kynoch Company seems in a similar fashion to have conferred on him a freeman's privileges. When to this is added an obvious grasp of current writings on gun and ammunition questions it must at least be recognised that a good substratum has been secured in which to seat the foundations of a literary production.

The quality of the material put into the book is fully equal to the value of the sources of information which have been tapped. The book in no way lacks merit through being mainly written around the productions of a single firm. Greener's book is accepted as authoritative and correct, in spite of the fact that the name of Greener seems to crop up in the history of firearms with much the same persistency as that of Westley Richards in the volume now under review. Lancaster's "Art of Shooting" is similarly pre-eminent in its class, although written by a gunmaker. The explanation is of course that firms who engage in book writing have a natural leaning towards treating the developments which they themselves have engineered. The ingenuity of successive generations of workers in the Westley Richards interest has left a permanent monument in the world of sport. One can accordingly read every line of Mr. Sharp's book, fully realising that any interested element which may have inspired the remarks made is fully disclosed, and, therefore, stands justified. A reader of ordinary intelligence will not have the slightest difficulty in distinguishing between views and facts. The former he can interpret as he thinks fit, the latter he will find well laid out and eminently to the point.

ROUND THE TRADE.

We learn that Capt. J. H. Hardcastle, late R.A., has been appointed to a position on the Kynoch Staff, and that his duties will include work on the *Kynoch Journal*, and special researches. He has our very best wishes for his success, and we look forward with pleasure to the resumption of the valuable technical work which lapsed for a time with the death of Mr. Housman.

The rifle club movement has produced several new writers on shooting subjects, but certainly amongst these Mr. E. J. D. Newitt, of the Southfields Rifle Club, and the Society of Miniature Rifle Clubs, is the most learnedly scientific and interesting. His article on "the Optics of Rifle shooting" in *Fry's Magazine* is certainly well worth reading, even by those who consider they well understand the subject dealt with.

Sir Andrew Noble, K.C.B., F.R.S., has published, in the form of a guinea book, a collection of his essays and lectures written and delivered from the years 1858 to 1899. Students of ballistics have oftentimes found cause to regret the inaccessibility of these important papers and their collection into book form will not only aid historical research but will create a monument to the labours of one who has done so much for the scientific and commercial advance of ordnance manufacture in this country.

In answer to a question in the House of Commons the Secretary of Foreign Affairs stated that the Government is not responsible for the regulations of the Suez Canal Company. He was, however, informed that steamers carrying explosives are not prohibited from passing through the Suez Canal, but that the Company reserves the right to take such precautions as are usual in all ports. The authorities take no action unless their attention is drawn to a particular ship as having explosives in her cargo. Such vessels may be berthed at special points and when under transit may fly a special signal, both by day and night. He concluded with a general statement that the Company will obviously take adequate precautions for protecting its property, and duly safeguarding the lives of passengers.

It is very regrettable to notice that two instances have recently occurred in which trusted servants of large concerns in the ammunition trade have been charged with theft in respect to the goods passing through their hands. Such things are bound to happen in any class of trade where the goods are in general demand and purchases are made in small quantities of high intrinsic value. The guarantee principle which works so well with clerical assistants and collectors might be extended in the case of those having the handling of cartridges. If abstractions from the shooter's own store of cartridges are included in the general total, the sporting cartridge is probably the most stolen commodity in the universe. To propound a remedy is difficult, because the victim is seldom conscious of his loss.

The Kynoch Company have issued a prospectus for £100,000 of 4 per cent. debentures. As the debenture capital cannot exceed half the issued capital of the Company, 12,500 £10 ordinary shares have been issued at par, and £1 per share appears to have been paid thereon. The authorised capital of the Company, amounting to £1,000,000 sterling, has thus been completely issued, and the present debentures cover the authorised borrowing capacity of the Company. The new money has been called up by reason of what is described as the unexpected opportunities in the soap trade, but no special undertaking is given that the whole of the money received shall be allocated to that purpose. The prospectus contains a list of the Company's property, which includes 160 odd acres in the neighbourhood of Birmingham, and other areas in Essex, Ireland and elsewhere, making a total of just under 2,000 acres, and the Company estimate the all-round value of this land at £250 per acre. The Essex estate comprises the largest holding, viz., 1,263 acres. On the above basis of valuation it is shown that the Company's freehold land very nearly covers the half-million of debentures, leaving the buildings, machinery and appliances as extra security.

Mr. Cecil Mack, whose courteous treatment of visitors at Eley's Bisley marquee during recent years always produced so favourable an impression, is making an extended trip to the East on behalf of this firm.

In case a wrong impression should have been given by the notification of Messrs. Farmiloe's address on the back cover of our last issue as "Riars Wharf," it may be mentioned that the printer is responsible for this unfortunate mutilation of the word "Blackfriars."

The death is announced of Mr. J. D. Ellis, formerly partner, and chairman since 1870, of the firm of John Brown and Company, armour plate manufacturers of Sheffield. His life, as outlined in the obituary notices which his death has called forth, is a record of steady advance based on scientific achievement. He died at the age of 82 years, and migrated from Birmingham, his birth place, when 24 years of age.

The dispute with the Eley workpeople appears to have been settled on an equitable basis by the Board of Trade. The award given seems to recognise that the class of work for which prices were reduced was of a kind not requiring the standard of labour and payment previously ruling. A suitable time interval has been specified for transferring to other work those who by their age and skill would be underpaid at the rates now approved. Altogether a useful reform of prices has been put through with minimum loss on both sides and with a saving of friction, which reflects credit on the good temper of the parties concerned and on the valuable intermediary services of the Board of Trade.

The rifle match between the Queen's Westminster Volunteers and the National Guard of New York resulted in an interesting contest, which, although it did not attain the importance of the shoot for the Palma Trophy, was nevertheless keenly watched on both sides of the Atlantic. The visiting team made 60 points less than the National Guard team's score of 1,648. Both teams used the service rifle of their country, the American's shooting U.M.C. make of Government ammunition with 220-grain Peter's bullets, whilst the Englishmen used Kynoch ammunition containing Axite powder. The B.S.A. Company manufactured the rifles which were supplied and tested by Mr. Fulton.

We have been asked to give publicity to the following list of pistols and revolvers stolen from the premises of Messrs. J. Venables & Sons, gunmakers, Oxford:— One NP III. ·320 Webley, engraved "J. Venables & Son, Oxford." One NP III. ·380 Webley, engraved "J. Venables & Son, Oxford." One NP No. 5·360 Webley, engraved "J. Venables & Son, Oxford." One blued WG ·455 Webley, engraved "Patson, Southampton." One blued target ·455 Webley, *stamped* "Venables, Oxford." One blued police ·32 Colt. One blued army ·450 Colt. One NP saloon Tranter pistol 22, with peep sight and blued 10 in. barrel, engraved "Venables & Son, Oxford." Several H and R and J T American NP ejecting revolvers 22 and 30 calibre, *stamped* on top "Venables & Son, Oxford."

At a general meeting of the Société Centrale de Dynamite Nobel, as reported in the *Financial News*, the chairman acquainted the shareholders with the negotiations that are being conducted with the view of bringing the company in closer connection with the American Dynamite Trust. The Société Centrale has already large interests in the United States, by reason of its Mexican dynamite factory, and the latter will easily form the connecting link in the projected community of interests between the American and European dynamite producers. From the particulars stated by the chairman, the arrangement would not be, as might have been thought, a trust with the view of raising the market prices—a matter which would not only be illegal in the United States, but also practically impossible, owing to the large number of the competing concerns—but rather a mutual understanding, tending to improve the conditions of the production, for instance, by a combined buying of the raw material. In short, between the European dynamite industry, which has its centre of gravity in France, Italy and Switzerland, and American dynamite industry a production combine is to be arranged, which should greatly influence the dynamite production in the whole world.

NOBLE'S RESEARCHES ON EXPLOSIVES.

AT the Royal Society on the 28th of June, Sir Andrew Noble read his Researches on Explosives Part IV. It is as a matter of fact a continuation of Part III., dealing with closed chamber pressures, etc., of the more important smokeless powders for cannon. This last paper appears to bring to a close what may be described as the greatest monument in English explosives literature. No words of ours could adequately describe the obligations of students of explosives to Sir Andrew Noble, who has for nearly a half-century been giving them the results of his wide experience and unremitting labours. The paper under review is, if possible, even more important than any previous one containing as it does most essential details as to the behaviour of present day propellants.

The examination which has for its object the determination of the characteristics of an explosive, must necessarily take a form differing from that which obtains in the use of explosives, whether propellants or blasting compounds. The usual method consists in firing a known weight of an explosive in a strong vessel, hermetically closed and of a known volume, and then observing the pressure the gases attain, the heat produced from the rise in temperature of the water bath containing the bomb, afterwards measuring the volume and analysing the gases contained in the closed chamber. From these observations the details such as those in the tables opposite have been obtained. These tables contain all the more important figures in Noble's paper. The analysis of gases produced by each explosive at the various densities could not be usefully abstracted.

Turning to the tables it should be noted that the differences between the second and third columns give the number of c.c.'s of water formed per gram. Thus for M.D. density 0·20 the water formed per gram. equals 913·5 — 773 = 140·5 c.c. The 4th columns dealing with the "calories water liquid" can be converted into "calories water gaseous," viz., that which obtains at the moment of explosion, by multiplying the water in c.c.'s by 0·484. For example take again M.D. for Δ = 0·2 we have 140·5 × ·484 = 67·7 and the "calories water gaseous" equals 1030 — 67·7 = 962·3.

Noble calculated the temperature of combustion by two methods. In one case by the heat evolved divided by the specific heat of the products and in the other from the pressure obtained and the total volume of the gases. At a density of 0·20 one gram. of M.D. gives 962·3 units of heat at the moment of explosion, *i.e.*, it would raise one gram. of water to a temperature 962·3 °C. A body of less specific heat than water, viz. the products of combustion, it would raise to a higher temperature, obtained obviously by dividing the water temperature by the specific heat because water has a specific heat of unity thus :—

$$\frac{962{\cdot}3}{{\cdot}255} = 3774\,^{\circ}\text{C}.$$

This specific heat of the products Noble obtains from those published for constant pressure, and converts them into those required at constant volume by dividing by the ratio of the two specific heats. He assumes that the specific heat of the products is the same as his calculated temperature, near 5,000 °C., as exists at about 1,400 °C., an assumption the accuracy of which would be challenged in most quarters.

The calculation of temperature from the pressure is equally simple. Gases obeying Boyle and Mariotte's Laws have their volume doubled at atmospheric pressure by an increase in temperature of 273 °C. On the other hand if the gases are enclosed in a vessel this increment of temperature would double the pressure. Noble's formulæ is an example of this, being represented as follows :—

$$t = \frac{p - p_0}{p_0} \times 273$$

Where p equals the pressure on explosion and p_0 is the pressure which the gases would produce in the closed chamber at 0 °C., if they continued to obey Boyle's Law, *i.e.*, the water remaining gaseous. As an example let us take M.D. at a density of 0·20, assume the closed chamber had a capacity of 100 c.c.'s, then 20 grams. would be fired and the total gases evolved equal 913·5 × 20 = 18270 c.c.'s. From this Noble obtained p_0 as follows :—

$$p_0 = \frac{18270}{100} = 182{\cdot}7 \text{ atmos.}$$

NOTE.—Any other assumed capacity of chamber would have given the same result.

Now p = 15·45 tons = $\frac{15{\cdot}45 \times 2240}{14{\cdot}7}$ atmos. = 23549 atmos.

Then $t = \frac{23549 - 182{\cdot}7}{182{\cdot}7} \times 273 = 3246\,^{\circ}\text{C}.$

It should be noted that Noble assumes that the gaseous products obey Boyle's Law at 0 °C. and 182·7 atmos., an assumption not in accordance with the work of others.

A reference to the tables will show that with the increase of density and pressure, the volume of total gases per gram. decreases, but the heat developed increases. Also the calculated temperatures increase with the density, but those obtained from the pressure rise much more rapidly than the others, and although starting at a lower level they ultimately exceed the others in every explosive but one.

As a matter of fact the rise in the temperature, calculated from the pressure, amounts on the average to about 80% whereas the other calculated temperatures increase only about 19% on the average. To account for this wide difference in the calculated temperatures at low density, Noble puts forward the hypothesis that the products at these low densities are at the moment of explosion simpler than found on cooling. The carbonic acid gas for instance exists as carbon monoxide and oxygen, these combining as the temperature falls. He expresses the view that at high densities this dissociation would be less likely to happen. This dissociation would reduce the calories at the moment of explosion below that observed, and in this way give an erroneous value to the temperature calculated from the calories. Thus, Noble proposes to account for a difference of about 70%.

It is also pointed out that although modern artillery is loaded with densities up to 0·50, the powder burns really as if fired in a much lower density, approximately to densities of 0·17 to 0·23, this is because the projectile moves while the combustion is going on. Artillerists are, therefore, concerned with the characteristics found on firing in closed chambers of 0·20 density. This point was demonstrated by collecting and analysing the permanent gases found in a 9·2 inch gun after firing 103 lbs. of powder which gave a pressure of 16·1 tons and 2600 f.-s. velocity The following comparison is instructive.

Gaseous Components.	Gases from 9·2 inch gun.	Gases from closed chamber. Δ = 0·2.	Δ = 0·5.
CO_2	25·9 %	23·95	38·45
CO	36·0 ,,	36·35	23·15
H	18·7 ,,	21·50	9·90
CH_4	0·4 ,,	3·25	12·15
N	18·7 ,,	14·95	16·35

Obviously the relation of CO_2 and CO found in the gun is approximately the same as found in the closed chamber when fired at a density giving the same pressure as observed in the gun.

In conclusion it should be pointed out that the tabulated matter in Noble's paper does not represent the actual results, but these results after "fairing" by the usual method on

MARK I. CORDITE.

Nitroglycerine, 58·0; Guncotton, 37·0; Vaseline, 5·0.

Density of Loading.	Per Gramme. Total Gas.	Per-manent Gases.	Calories Water Liquid.	Specific Heat of Products.	Calculated Temperatures. By Pressure.	By Calories.	Pressure Tons.
	C.C.'s.	C.C.'s.			°C.	°C.	Per Sq. In.
0·05	870	670	1272·3	0·2503	2800	4742	3·25
·10	878·5	692·5	1253·5	·2521	3100	4665	7·00
·15	880	699	1244·5	·2531	3415	4620	11·70
·20	875·5	697	1246	·2540	3760	4608	17·00
·25	865	688	1252·5	·2542	4110	4625	22·75
·30	848	671·5	1265	·2544	4435	4665	28·90
·35	832·5	658	1282	·2546	4723	4720	35·05
·40	820	644·9	1304·5	·2546	4960	4800	41·35
·45	809·5	634·0	1329	·2544	5120	4920	47·30
·50	798·8	623·6	1355	·2541	5270	5060	53·30

M.D. CORDITE.

Nitroglycerine, 30·0; Guncotton, 65·0; Vaseline, 5·0.

Density of Loading.	Per Gramme. Total Gas.	Per-manent Gases.	Calories Water Liquid.	Specific Heat of Products.	Calculated Temperature. By Pressure.	By Calories.	Pressure Tons.
	C.C.'s.	C.C.'s.			°C.	°C.	Per Sq. In.
0·05	955·4	781·8	1035·9	0·2530	2345	3814	3·00
·10	948	790	1024·5	·2544	2565	3770	6·50
·15	931	786·5	1023·5	·2550	2850	3761	10·50
·20	913·5	773	1030	·2550	3240	3790	15·45
·25	893·5	754	1044·5	·2546	3623	3853	20·95
·30	873	733·5	1070	·2544	3961	3962	26·70
·35	852	714	1105	·2542	4275	4111	32·45
·40	832	693·5	1145	·2541	4551	4290	38·25
·45	810·6	673·5	1194	·2542	4817	4455	43·95
·50	789·5	653·5	1242	·2544	5051	4630	49·50

NITROCELLULOSE PROPELLANT ROTTWEIL R.R.

Soluble Nitrocellulose, 85·5; Insoluble Nitrocellulose, 14·5.

Density of Loading.	Per Gramme. Total Gas.	Per-manent Gases.	Calories Water Liquid.	Specific Heat of Products.	Calculated Temperature. By Pressure.	By Calories.	Pressure Tons.
	C.C.'s.	C.C.'s.			°C.	°C.	Per Sq. In.
0·05	993·1	814·7	874	0·2544	2260	3213	3·00
·10	980	810·5	884·5	·2560	2415	3195	6·40
·15	958·5	795	900·5	·2570	2590	3230	9·95
·20	934	776	924	·2568	2815	3312	13·80
·25	906·5	751·5	945·5	·2564	3060	3415	18·30
·30	883	730	968·5	·2558	3335	3520	22·95
·35	862	712·5	993	·2554	3590	3632	28·40
·40	841	695	1018	·2551	3832	3742	34·30
·45	821	676	1041	·2551	4033	3861	40·45
·50	802	659·5	1065	·2552	4212	3977	46·80

ITALIAN BALLISTITE.

Nitroglycerine, 47·1 per cent.; Soluble Nitrocellulose, 52·3 per cent.; Insoluble Nitrocellulose, 0·6 per cent.

Density of Loading.	Per Gramme. Total Gas.	Per-manent Gases.	Calories Water Liquid.	Specific Heat of Products.	Calculated Temperature. By Pressure.	By Calories.	Pressure Tons.
	C.C.'s.	C.C.'s.			°C.	°C.	Per Sq. In.
0·05	824·2	583·0	1330·3	0·2484	2745	4943	3·00
.10	816·0	600·0	1308·5	·2483	3060	4889	6·50
·15	811·7	604·5	1302·5	·2489	3380	4869	10·85
·20	810·5	605·5	1305·0	·2497	3686	4873	15·45
·25	808·1	606·0	1309·0	·2502	3972	4888	20·65
·30	804·5	604·5	1312·0	·2506	4235	4897	26·30
·35	800·0	603·0	1319·5	·2510	4460	4926	32·60
·40	793·9	602·0	1327·4	·2512	4655	4955	39·10
·45	788·3	600·0	1335·3	·2515	4805	4980	45·57
·50	780·0	597·0	1345·5	·2518	4930	5025	52·20

NORWEGIAN 165.

Nitroglycerine, 36·0; Nitrocellulose, 52·0; Nitronapthalene, 6·0; Secret Ingredient, 6·0.

Density of Loading.	Per Gramme. Total Gas.	Per-manent Gases.	Calories Water Liquid.	Specific Heat of Products.	Calculated Temperatures. By Pressure.	By Calories.	Pressure Tons.
	C.C.'s.	C.C.'s.			°C	°C.	Per Sq. In.
0·05	959	820	918·9	0·2520	2000	3412	2·55
·10	950	818	911·5	·2510	2365	3400	6·15
·15	931·3	802	919·5	·2504	2715	3449	10·10
·20	909·9	782	935·5	·2503	3010	3530	14·40
·25	887	762	964	·2502	3305	3635	19·00
·30	864	743	998·5	·2505	3573	3770	24·00
·35	844·5	726	1030	·2510	3850	3905	30·45
·40	821	706·5	1065	·2514	4103	4040	38·30
·45	801	687	1101·2	2519	4325	4177	46·96
·50	780	672	1140	·2521	4530	4325	56·00

NORWEGIAN 167.

Nitroglycerine, 40·0; Nitrocellulose, 50·0; Nitronapthalene, 5·0; Secret Ingredient, 5·0.

Density of Loading.	Per Gramme. Total Gas.	Per-manent Gases.	Calories Water Liquid.	Specific Heat of Products.	Calculated Temperatures. By Pressure.	By Calorics.	Pressure Tons.
	C.C.'s.	C.C.'s.			°C.	°C.	Per Sq. In.
0·05	932·4	770·3	1001	0·2492	2200	3748	2·70
·10	924	783	992	·2502	2560	3711	6·50
·15	914	772	994	·2510	2875	3717	10·40
·20	899	757·5	1005·5	·2518	3170	3755	14·70
·25	880·5	742	1025·3	·2524	3465	3825	19·75
·30	861	725·5	1050·5	·2529	3760	3921	25·50
·35	841	709	1080	·2533	4045	4034	32·25
·40	820	690	1114·5	·2536	4319	4165	40·00
·45	803·5	671	1146·5	·2539	4540	4298	48·10
·50	782	652·5	1180·5	·2538	4752	4437	56·75

squared paper. The corrections are in some instances considerable, thus, Rollweil $\Delta = 0{\cdot}3$ gave an actual pressure of 20·54 tons which was "faired" to 22·95 tons. Again the same powder at $\Delta = 0{\cdot}15$ gave a total volume of gases 970 c.c.'s, this however was "faired" to 958·5 c.c.'s. No objection can be made to this "fairing" except that a correction of 10% makes deductions doubtful. Certainly it appears to have disturbed the concordance in some instances.

THE NEW PRACTICE AT THE PATENT OFFICE.

MR. JAMES ROBERTS, Barrister-at-Law, is responsible for a shilling handbook published by Messrs. Eyre & Spottiswoode, which deals in the most complete fashion with the new considerations which arise in connection with Patent Office procedure, as a result of the 1902 Act. Although it contains only 32 pages the information conveyed must not be judged from this evidence of compact treatment. The detailed work has been done privately by the author; and his summarised conclusions are laid before the reader.

On the subject of the anticipations of an invention, which which the Comptroller's search may discover, there is a good deal of misunderstanding as to the precise meaning of the disclaimers which are inserted upon the advice and under the direction of the Comptroller. A specification, as sent in by the patentee and objected to by someone else, may be amended by a positive statement that he is aware of Letters Patent so and so, granted to so and so for such and such an object, and that he does not claim anything described therein, but what he does claim is . . . Such an amendment is known as a "specific reference," and it provided a way out of the difficulty which arose when a prior patentee objected to the sealing of a patent on the grounds that it was covered by his own earlier claims. The exact position which the inventor takes up is very clearly expressed by Mr. Roberts in the following paragraph:—"The effect of this disclaimer was to give a certain notice to the reader of the specification, that is the public, which may be paraphrased and applified as follows:—"My invention is something beyond that of A.B. If A.B.'s alleged invention turn out to have been incomplete, unworkable and a failure, then my claim is to be taken in its widest sense. But if A.B.'s invention is 'workable, then my claim is confined to such novelties as are not included in his, and if the Court hereafter construe his claim as a wide one mine will be consequently narrowed and perhaps may then fail for want of subject matter. Whether my claim be wider or narrower, my patent valid or invalid, whatever it may hereafter be held to include, there is one thing it does not include, and that is A.B.'s invention.' It affected the construction of the whole specification."

To quote again from Mr. Roberts "The provisions of the first section of the Act of 1902 appear shortly to have the effect of extending the practice above described to all applications, as if the examiner were an opponent, with the following modifications:—(1) The Act applies not only to cases in which the invention has been wholly or in part *claimed* in the earlier specification, but also to those cases in which it has been so *described* without being claimed. (2) In the event of the applicant not accepting the examiner's views, the Comptroller after hearing the case has not power to refuse the application, but only to direct that references should be made in the specification to the earlier specifications in question; and (3) the references are for the purpose of acquainting the reader, *i.e.*, the public, with the existence of the prior specifications, and therefore are not to be necessarily confined to 'Master Patents.' If the applicant refuse to insert proper references to the earlier specifications the Comptroller can refuse to accept the specification."

These brief and, of course, disjointed, quotations from Mr. James Roberts' book will give an excellent idea of the way he treats his subject. The following further extract may be given in conclusion, as showing the effect on patentees of the new Act:—"During the year 1905 the actual number of cases investigated by the examiners were 10,379; of these there were formal hearings and decisions in 803 cases, and the official references under Rule 10 were made in 154 cases, that is in 1·48 per cent. But the rule has operated *in terrorem*, and is shown by a paragraph quoted from the Comptroller's Annual Report for the year 1905.

APPLICATIONS FOR PATENTS.

OCTOBER 22—NOVEMBER 17, 1906.

23,615.* Miniature Ammunition. G. Horsmans.
23,733.* Ordnance Breech Mechanism. Fried. Krupp, A.-G. (Date of application in Germany, March 2, 1906).
23,821. Targets. D. W. Holt,
23,836.* Ordnance Pointing Appliance. Fried. Krupp, A.-G. (Date of application in Germany, March 5, 1906).
23,902. Targets. B. W. Valentin, W. Long and A Lewis.
23,932. Bolt Guns. L. B. Taylor and E. H. Parsons.
23,976. Sighting Apparatus. A. T. Dawson and G. T. Buckham.
23,979. Breech Loading Gun Mounting. A. T. Dawson and G. T. Buckham.
23,983. Mechanical Machine Gun. H. C. Heide.
23,993.* Guns. L. Mertens.
23,995. Prevention of Miss-Fires in Ordnance. A. T. Dawson and G. T. Buckham.
24,240.* Explosives. C. Claessen.
24,305. Ordnance Shell Bodies. J. W. Spencer and C. Finch-Hatton.
24,382. Automatic Small Arms. J. Carter and F. T. Murray.
24,391. Clay Birds. W. P. Jones and J. F. Wheat.
24,397. Breech-Loading Firing Mechanism. J. H. Bromilow and Kynoch, Ld.
24,493. Cleaning Tool for Rifled Barrels. F. Hirst.
24,534. Ordnance. Sir A. Noble, Bart., and Sir W. G. Armstrong Whitworth & Co., Ld.
24,560. Ordnance. C. R. S. J. Hallé.
24,874. Hard Lined Gun Barrel. G. W. Clark.
24,882. Windage Backsight for Rifles. R. A. Rogers and F. Cantelo.
24,983. Automatic Charge and Discharge of Guns. J. Theofanidis and A. Pallis.
25,025.* Securing the Magazines of Repeating Pistols. N. Pieper.
25,132. Toy Breech-Loading Guns. R. M. Painter.
25,421. Ammunition Hoists for Heavy Guns. A. F. Petch and F. W. H. Shepherd.
25,524.* Gun Carriages. A. F. Petch and R. Redpath.
25,538. Gun Wads. R. W. Munro.
25,550. Miniature Rifle Automatic Target. A. Blanks.
25,618. Rifling for Gun Barrels. J. B. Lane.
25,664. Air-Gun Target. F. Field.
25,745. Air-Guns. T. Moss.
25,830. Air-Rifles. Birmingham Small Arms Co., Ld., and A. H. M. Driver.
25,927. Score Gauge for Targets. W. E. Dunn and T. Turner.
26,001.* Small Arms. E. C. R. Marks.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

OCTOBER 25—NOVEMBER 15, 1906.

COMPILED BY HENRY TARRANT.

17,099 (1905). **Range Finders.** H. Gérard, France. A range finder in which the direct and refracted images of the object are produced by rays entering the apparatus along the optical axis. Prisms are arranged around the axis leaving sufficient space for the direct rays to enter. The objective aperture really comprises two zones concentric with the axis, one only permitting the rays to pass without refraction and the other refracting them by an amount varying with the distance of the object. Accepted October 23, 1906.

21,354 (1905). **Practice Tubes for Ordnance.** A. T. Dawson and G. T. Buckham, London. The breech blocks of large ordnance are adapted to take the screw collar fitted to such small pieces as 3-pounders. The smaller piece is used as an aiming tube to impart practice with the parent gun. Other patents quoted which deal with practice tubes for ordnance are Nos. 3,024, 1904, and 8,286, 1905. Accepted October 18, 1906.

21,529 (1905). **Explosives for Firearms.** M. Abelli, Italy. With the usual constituents of an explosive having nitroglycerine or nitrocellulose as a basis dicyandiamidine nitrate, nitroguanidine or nitrosoguanidine or any two or more of these are mixed. Whilst these additions are explosive in themselves it is said they reduce the temperature of combustion and practically eliminate corrosion of the barrel. Accepted October 4, 1906.

22,828 (1905). **Howitzer Mounting.** C. Hölmstrom, Sheffield, and A. E. Mascall, London. A howitzer is trunnioned in a saddle which is trunnioned in the mounting co-axially with the howitzer trunnions. The sighting apparatus is mounted on one saddle which also carries the mechanism for angularly displacing and altering the elevation of the gun. Accepted October 11, 1906.

22,844 (1905). **Ordnance Firing Gear.** C. Hölmstrom, London, and E. Middleton, Sheffield. The firing pin of the type set out in patent No. 15,364, 1904, is provided with two loose thimbles. The one mounted on its forward end is adapted to retract the striker after it has held the main spring up and allowed the striker to continue its movement for firing the detonator by its own momentum. Accepted October 4, 1906.

23,601A (1905). **Semi-Automatic Ordnance.** In patent No. 23,601, 1905, breech mechanism for ordnance was described which was operated, if of the interrupted screw type by a rack and pinion, and if of the wedge type, by a sliding arm. The rack or arm recoiled with the gun and was held by a pawl so that the breech was opened when the gun returned. This apparatus by the present patent is applied to ordnance having concentric threaded breeches. Accepted October 25, 1906.

25,448* (1905). **Bolt Breech Action for Miniature Rifles.** F. Greener, Birmingham.

25,939 (1905). **Shot Gun Explosives.** C. C. Dawson-Smith, Stoney Stratford. A method of preparing cellulose nitrates by the use of gelatinising solvents which are subsequently removed by treatment with hydrocarbon solvents, such as benzene. As an example 150 parts of highly nitrated cellulose are gelatinised by means of 100 parts of amyl acetate. The resulting jelly is formed into the required shapes and is treated with benzene or alcohol so as to leave only nitrocellulose as a tough hardened colloid. The patentee is aware of patent No. 949, 1896. Accepted October 25, 1906.

1,272 (1906). **Back Sights for Rifles.** C. H. Watson and F. W. W. Baker, London. Fine degrees of sighting are secured through the ordinary type of tangent sight leaf by a revolving ring-like cam, which lies on the sight bed. A depending finger on the underside of the leaf is pressed by a spring on to the spiral or helical surface of the ring. Accepted October 11, 1906.

2,035 (1906). **Platform for Siege Guns.** C. Hölmstrom, London, and E. Middleton, Sheffield. A portable platform for siege guns is constructed in two or three parts which may readily be separated to facilitate transport. Accepted October 18, 1906.

2,506* (1906). **Solvent for Lead Fouling.** The King's Norton Metal Co., Ld., and T. A. Bayliss, London, and H. W. Brownsdon and H. Melville Smith, Abbey Wood.

3,966 (1906). **Fuse for Lyddite Shell.** The King's Norton Metal Co., Ld., and T. A. Bayliss, London, and E. Whitworth, King's Norton. In a double action fuse for lyddite shell is a rotatable cover arranged between the detonator and the needle pellet. This cover is removed only when the shell strikes or grazes an object. The detonator is provided with a gas vent covered by a seal. If the detonator is discharged accidently the gas escapes through this vent and the blown out seal gives evidence of the fact. Accepted October 25, 1906.

6,728 (1906). **Blasting Apparatus.** H. and A. Walker, South Normanton. A tube containing a needle is inserted into a blasting cartridge and the whole is placed in the shot hole which is then rammed. The needle is removed from the tube and the detonator inserted through the tube vacated by the rod. If the detonator misses it can be withdrawn and another inserted. Accepted October 18, 1906.

7,952 (1906). **Firing Mechanism of Ordnance.** Col. H. C. L. Holden, F.R.S. Friction tubes are usually ignited by pulling a rod through a sensitive composition. The patentee renders the operation more certain and simple by providing a push friction tube, the rod of which is designed to be forced inwards by a lever working in the breech block. Accepted October 25, 1906.

7,994 (1906). **Wind Gauge Rifle Sight.** S. S. Peacock, Australia. With the ordinary tangent back sight leaf and sight bed a bracket is combined which is adapted through an attached screw threaded shaft and knuckle to move the leaf bodily across the bed. The bracket is fixed to lugs rising from the bed. Accepted October 11, 1906.

10,146 (1906). **Lubrication of Bullets.** H. F. Clark, U.S.A. The edge of the mouth of the cartridge case is turned in on to the sides of the parallel sided bullet so as to form a space between the inside of the mouth of the case, the sides of the bullet, and its enlarged base which presses tightly against the case. The space so formed is filled with a suitable lubricant. Patents Nos. 468, 1885, and 173, 1886, also dealt with lubricated bullets. Accepted October 11, 1906.

10,604 (1906). **Wind Gauge Rifle Sight.** W. J. C. Downey West Australia. The slide carrying the V notch on a tangent leaf sight for rifles is mounted on a screw spindle, by which it may be carried in a lateral direction to compensate wind. A similar spindle is adapted to elevate the slide. Accepted October 18, 1906.

10,611 (1906). **Ordnance with Recoiling Barrels.** K. Haussner, Argentine Republic. In place of metal springs, bars of india-rubber are used to carry the gun back into the firing position after recoil. Lightness and simplicity are claimed for this invention. Accepted October 18, 1906.

11,266 (1906). **Ordnance Breech Mechanism.** C. D. Abel, London (Agent for *Rheinische Metallwarren und Machenenfabrik, Germany*). The pressing lever of firing mechanism for guns having a breech-closing wedge is pivotally mounted with a bolt in the closing wedge, so that it has only a turning movement instead of a lateral movement as hitherto, which necessitated the cranking of the cheeks of the carriage. Accepted October 4, 1906.

12,791 (1906). **Explosive Projectiles.** C. Chronic, U.S.A. The cavity of an explosive projectile is divided into two compartments—the one containing the charge and the other a quantity of gasolene. A fuse is provided in the plug forming the base and the gasolene is adapted to fire surrounding inflammable material when the shell bursts. Accepted October 4, 1906.

13,388 (1906). **Projectile Time Fuse.** Fried. Krupp, A.-G., Germany. The connection between the timing cap and the body of a time fuse is so perfected that when the retaining screws are tightened up their pressure is distributed over a large surface and a fast clamping of the timing cap on the body is avoided. Accepted October 4, 1906.

13,860 (1906). **Gunpowder Flaking Machine.** C. Dobbs and J. R. Pitman, U.S.A. A machine for producing flakes or grains from strips of gunpowder. It is provided with feed

rolls and rotating cutters, the teeth of which co-act with a non-rotatable cutter. Accepted October 25, 1906.

14,023 (1906). **Automatic Pistol Mechanism.** Max Hermsdorff, Germany. A removable cover is provided for the breech mechanism of an automatic pistol. It works on a hinge and is held in position by a spring catch. Accepted October 25, 1906.

15,307 (1906). **Moving Targets.** W. H. Pike, Manchester. A target is mounted on a standard pivoted to a trolley capable of being pulled backwards and forwards to and from the firing point. When the target is returned a cam-like surface engages the lower portion of the standard which is caused to swing pendulum-like. Accepted October 25, 1906.

16,517 (1906). **Double Action Fuses for Projectiles.** The Electric and Ordnance Accessories Co., Ld. and R. F. Hall, Birmingham. In combined time and percussion fuse construction in which the time and percussion pellets are in the form of simple bolts arranged one in front of the other within a removeable casing the pellets are normally restrained from moving by shear pins. These pins are held in place by suitable means. Accepted October 4, 1906.

16,725 (1906). **Smokeless Gunpowder.** Dr. C. Claessen, Berlin. To reduce the temperature of combustion and increase the stability of smokeless powders without affecting ballistic results urea is added, in which the four hydrogen atoms of the ammonia residue are replaced by organic radicals. Accepted October 25, 1906.

17,026 (1906). **Blasting Fuses.** F. Render, Manchester. In order to provide for identification as to whom fuses have been distributed a small metal tube is securely attached to the wires at the head of the fuse. Accepted October 25, 1906.

17,891 (1906). **Nitroglycerin Explosives.** Westfälisch-Anhaltische Sprengstoff A.-G. The addition of mono-nitro-mono-chlorhydrin and the nitrated dichlorhydrin were set out in Patents Nos. 6,361, 1905, 4,057, 1905, as suitable to prevent freezing of nitroglycerin. Further experiments have shown that dinitro-mono-chlorhydrin and nitro dichlorhydrin is more suitable and renders the explosive less sensitive to blows. Accepted October 18, 1906.

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

SELECTED PATENTS.

SOLVENT FOR LEAD.

2,506 (1906). King's Norton Metal Co., Ld. and T. A. Bayliss, London, H W. Brownsdon and H. M. Smith, Abbey Wood. A solvent principally designed for removing lead or alloys rich in lead from the barrel of a rifle, is described in this patent. It is a modification of the cupro-nickel solvent set out in Patent No. 13,297, 1905

The solvent is made up by dissolving 25 grammes of sodium hydrate in 100 cubic centimetres of water. To this solution when cold ten grammes of ammonium persulphate are added. Ammonium persulphate in a caustic soda solution is very unstaple, and it is necessary to add the former to the solution immediately before use. To render the operation of weighing by the user unnecessary, the persulphate is ground into powder and five to twenty per cent. of ammonium carbonite is mixed internately with it. The mixture is pressed into tabloids containing any desired number of grammes of persulphate.

A tablet is added to the sodium hydrate, and when the persulphate has dissolved the solvent is ready for use. The barrel to be treated is suspended muzzle downwards and the solvent poured in. An india-rubber tube is fitted over the muzzle and a clip on the tube is designed to hold the solution in the barrel. It is allowed to remain about half-an-hour and when the clip is removed to allow the solution to run off the barrel is thoroughly washed and lubricated.

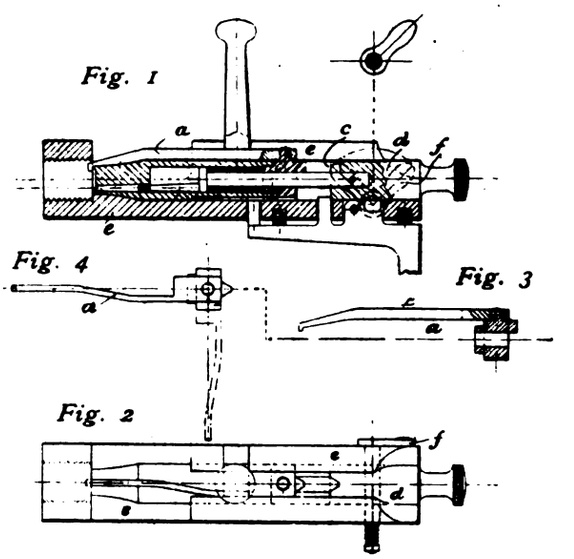
The solvent removed may be tested to prove the presence of lead by sulphuretted hydrogen or by an alkaline sulphide. A black precipitate is brought down varying with the amount of lead fouling which has been removed from the barrel. Accepted October 25, 1906.

BOLT MECHANISM FOR MINIATURE RIFLES.

25,448 (1905). F. Greener, Birmingham. The breech mechanism described in this patent is designed for rifles of the bolt type adapted to shoot rim fire ammunition. It is simple in construction and may be easily taken to pieces without the aid of tools. A safety bolt is designed to lock not only the trigger but also the cocking piece and the bolt itself.

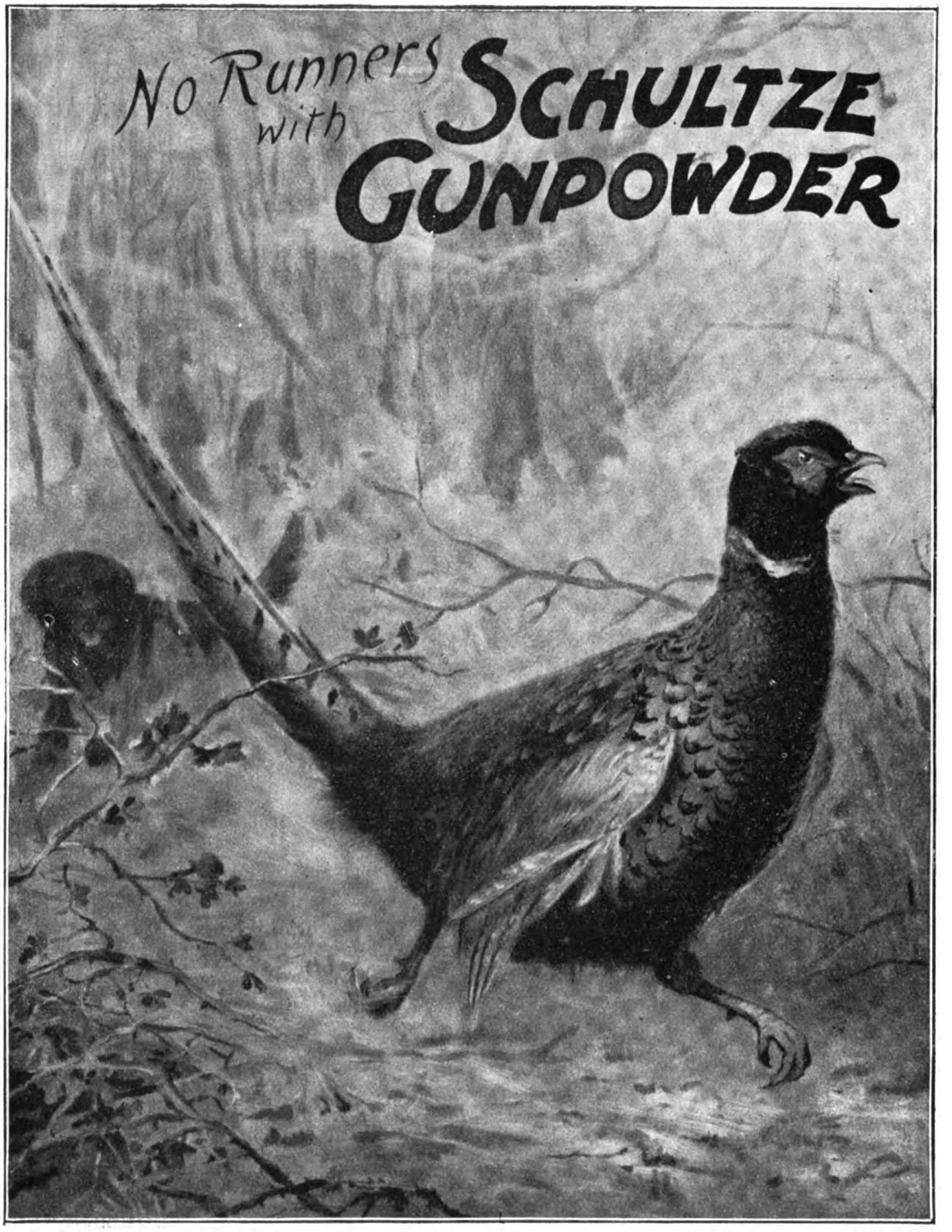
The mechanism is illustrated in the drawings here reproduced. The bolt follows the usual lines of construction, but the extractor *a* screws on to the striker nut *b*. The extractor may be turned round at right angles to the bolt as shown in dotted lines in the detail drawing, so that it may be used as a lever to unscrew the nut from the bolt. With the nut away the parts, consisting of the striker and its spring, may be separated from the bolt.

The striker nut has a V-shaped projection which is adapted to enter a slot *c* of corresponding shape in the cocking piece *d*. When



turning the bolt handle to extract the spent cartridge from the chamber the striker nut turns with the bolt, whilst the cocking piece remains stationary. This disengagement of the projection and slot always exists except when the bolt is "home," and it will easily be understood, therefore, that the rifle can only be fired when the bolt is in its proper closed position.

The safety bolt is situated on one side of the shoe *e* of the rifle. Opposite sides of its spindle are filed flat as illustrated, and the lever actuating the bolt is allowed to move through the quarter of a circle as is shown in dotted lines in Fig. 1. When the lever *f* is pushed towards the barrel the round sides of the spindle are carried directly above the flat on the trigger just behind the trigger pivot. The trigger is locked, and the same movement also depresses the back portion of the trigger and raises the front, so that a projection rising from the blade is caused to engage the bolt and so lock it. The upper round surface on the bolt *f* engages a slot in the underside of the cocking piece *d* and prevents the latter moving forward should the trigger be allowed to release it. The backward movement of the safety bolt releases trigger bolt and cocking pieces by replacing the curved surfaces by flat ones. Accepted October 18, 1906.



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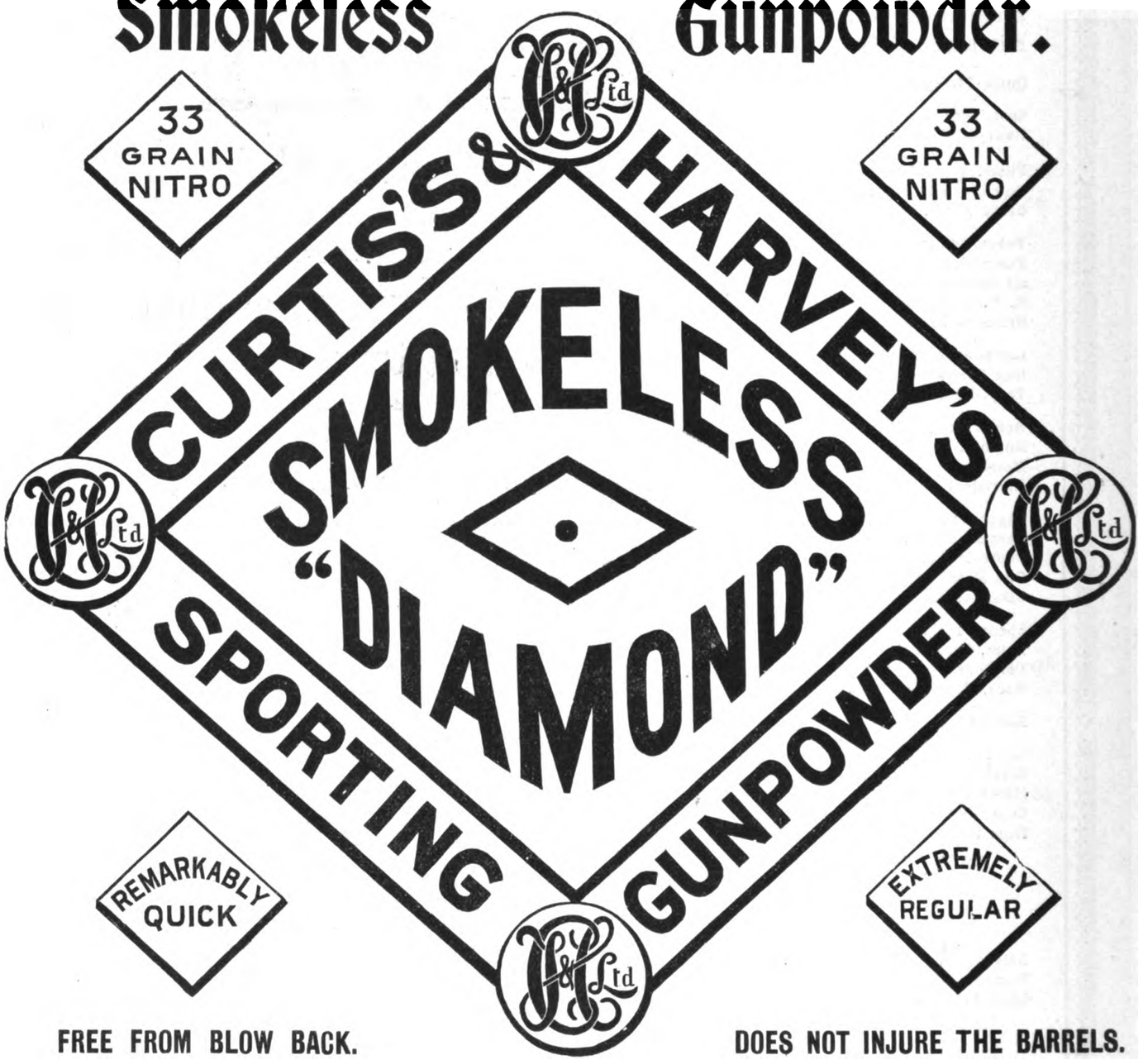

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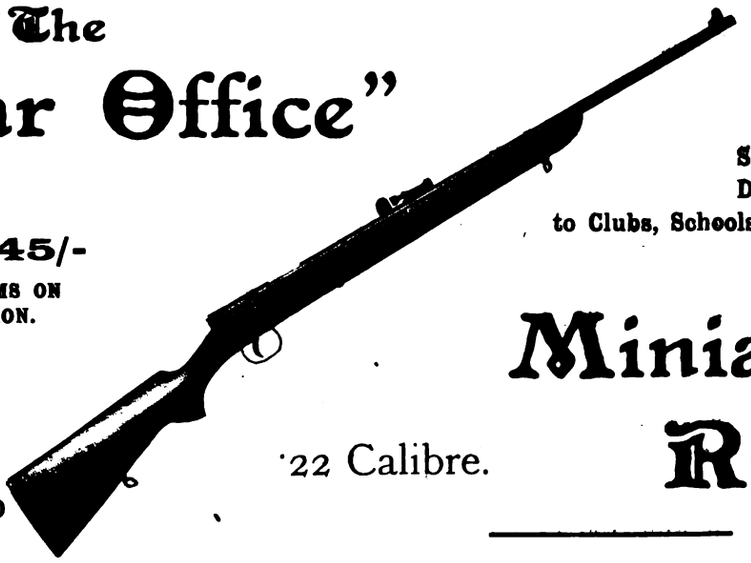

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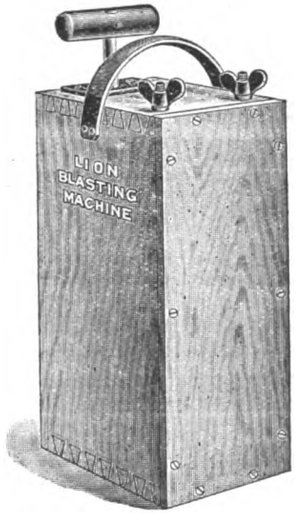

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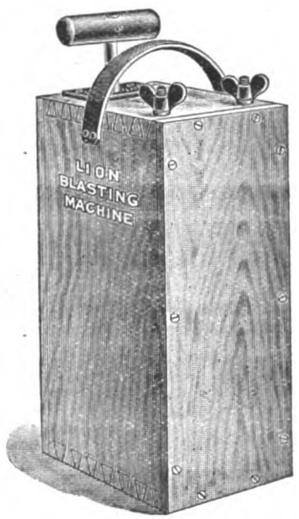

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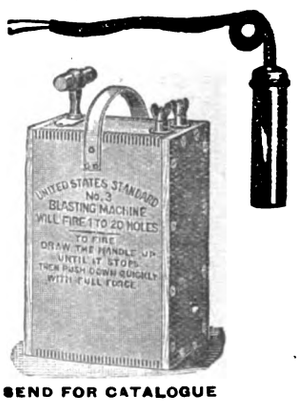

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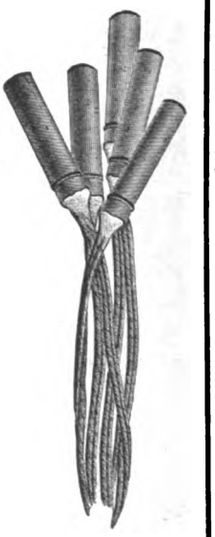

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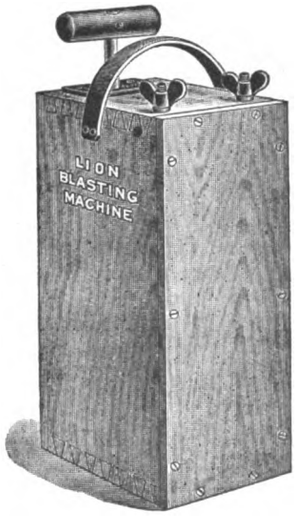

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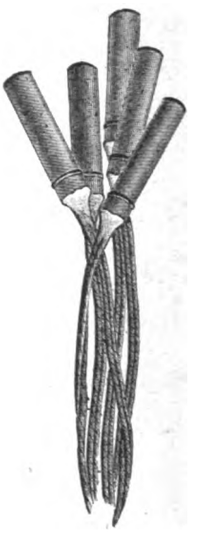

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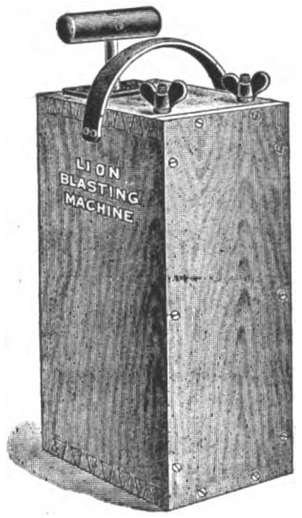

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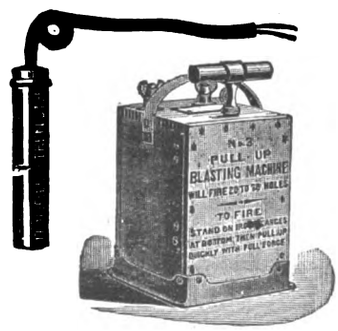

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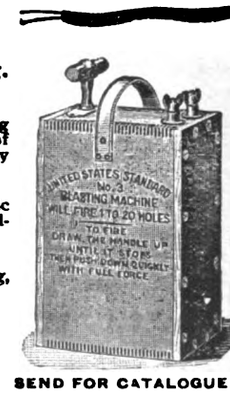

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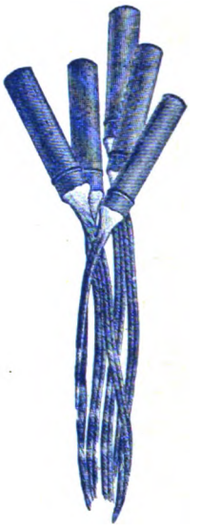

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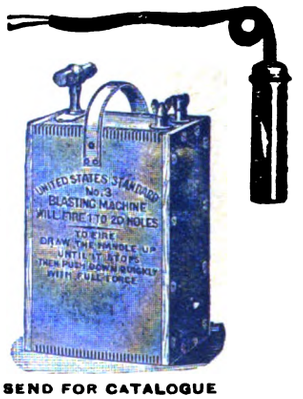

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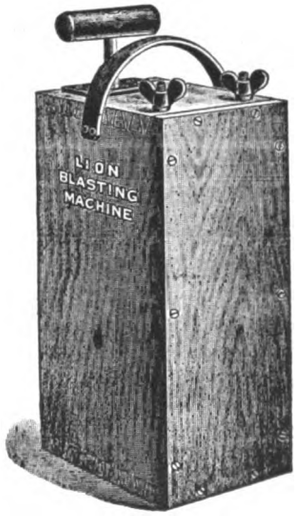

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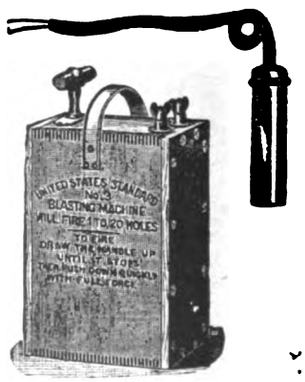

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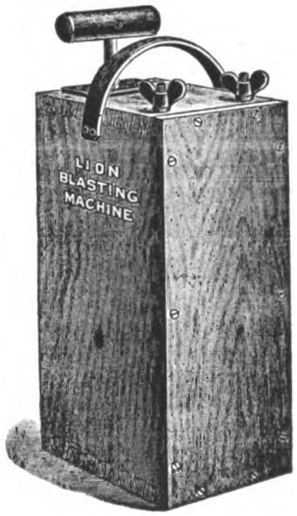

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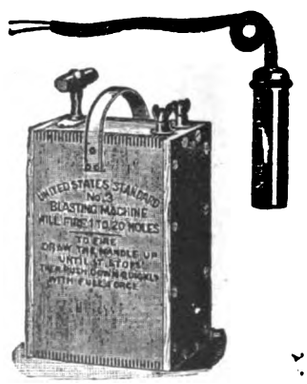

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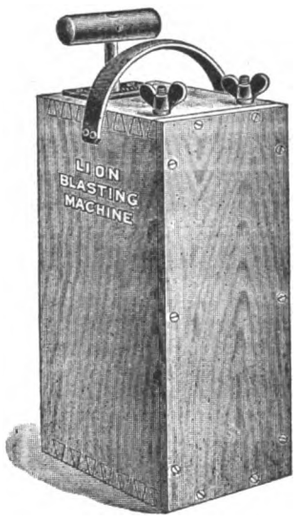

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