Magazine and Repeating Rifles

Captain Walter H. James F.G.S., lato R.E

To cite this article: Captain Walter H. James F.G.S., lato R.E (1887) Magazine and Repeating Rifles, Royal United Services Institution. Journal, 31:138, 135-161, DOI: [10.1080/03071848709416409](https://doi.org/10.1080/03071848709416409)

To link to this article: <http://dx.doi.org/10.1080/03071848709416409>

Published online: 11 Sep 2009.

Submit your article to this journal [↗](#)

Article views: 6

View related articles [↗](#)

Friday, February 25, 1887.

MAJOR-GENERAL E. H. OLIVE, late Grenadier Guards, Commandant
Staff College, in the Chair.

MAGAZINE AND REPEATING RIFLES.

By Captain WALTER H. JAMES, F.G.S., late R.E.

IN response to the invitation of the Council of this Institution I have undertaken to lay before you a brief summary of the present state of this question, the most important one which now demands a solution from our military authorities.

What is it we seek to obtain from the magazine or repeating rifle? Surely the rapidity with which a good form of single-loader can be fired will suffice. With the Soper rifle forty-three well-aimed shots have been fired in a minute, and what more can be desired or required in war?

This argument, though usually brought forward as a reason against the introduction of repeaters, does not really deal with the true reason for their adoption. In a lecture I gave in this theatre seven years ago, I said, "The future undoubtedly lies with repeating rifles. The advantage of this form of weapon is that it enables a sudden shower of bullets to be poured in at a moment when increased intensity of fire will decide the victory."¹

This sudden intensity, this conversion of the shower of bullets into a blinding rain, is to be obtained from the magazine rifle alone. It is for this gain that we face the additional complication due to the repeating action, it is for this great quality that the nations of Europe are spending millions of money in the re-armament of their infantry, and that we too must follow their example.

No breech action, however rapid, can give the same rapidity so long as the magazine supply lasts. In a properly constructed magazine rifle the time taken to press the cartridge into the barrel is eliminated. Drawing back the action cocks, throws out the old case, brings up a fresh cartridge. Closing the breech pushes the cartridge home, which is therefore never touched by the man's hand; he has not to take it from pouch to the breech.

The magazine rifle has one other advantage, besides that to which I have just alluded, viz., the moral support which it gives to the soldier, who knows that he has a reserve of power constantly at hand. No single-loader can give that confidence which a man feels who has five or more shots at his instant command.

¹ Vol. xxiv, p. 384.

A repeating rifle is of advantage both on the offensive and defensive. Troops, whether acting on the one or the other, have to pass through that supreme moment when the combat trembles in the balance, and to both alike the special quality of the magazine arm is of the highest importance. Conceive for a moment two lines holding one another in close action, one is suddenly enabled to quintuple its fire-rate, what will be the fate of the other? At times when surprise is of moment, such as counter-attacks, it is also of the utmost value. To sentries, to small bodies of men acting by themselves, such as reconnoitring parties of cavalry, the use of a repeater is of the greatest assistance.

I do not propose to occupy your time with instances of the use of these weapons, because the types which have been employed in former wars are now quite obsolete; but you are doubtless aware that they were used with considerable effect both in the American Civil War and in the Russo-Turkish. In the former it was said that one man armed with the Spencer¹ was equal to five with the ordinary muzzle-loader. In the latter the Winchester¹ did good service to the Turks, who not only armed their cavalry with it, but on occasions their infantry also for the close defence of works, as at Plevna. I propose to take it for granted that the magazine rifle is to be introduced for the reasons I have given above, and to examine briefly how we should use it.

To anticipate a little, allow me to assume that we have a weapon which holds five or more cartridges in the magazine, that the latter can be easily loaded, and that the rifle can be used as a single-loader.

Under ordinary circumstances the rules of fire discipline will remain the same as heretofore. Fire should be by volleys alone, the frequency of which will depend on the range and object, but on the offensive, the final rush should be prepared by the use of the magazine which should be reloaded the moment the position is carried. On the defensive, the magazine may be similarly employed, but possibly a little more often and earlier. For instance, at the advancing troops during their rushes, when they are so much more visible and form so much better targets than when lying down to fire. The fire during these transitory moments should be intensified because good results may be obtained from it. In fact we may say generally that either on the offensive or defensive the magazine is chiefly for the close combat, though occasionally it may be used at longer ranges. Should it ever be employed for real long-range fire? Rarely. For it would probably give rise to a great expenditure of ammunition without correspondingly adequate results. Against favourable targets which from their nature are exposed only for a short time to fire it may be made use of. For example, against masses of infantry, the staff of the enemy, cavalry, or artillery unlimbering. But it should chiefly be reserved for the decisive stage, when its proper employment may decide the issue.

Will the introduction of repeaters increase the expenditure of ammunition? To a certain extent yes. Hence it is highly desirable

¹ Specimens of both Spencer and Winchester carbines are in the Museum.

to lighten the cartridge. To this I shall allude further on. But as a practical fact the increased expenditure of ammunition is not so much due to the magazine rifle, which, if its employment were limited to one or two moments in a fight, would not greatly increase the number of rounds fired. Rather is it due to the fact to which I have before drawn your attention in this Institution, in the first instance nine years ago,¹ that having rifles of long range it would be very foolish to limit their employment to short distances. The school of fire is gradually gaining the day, to it belongs the future, and I look forward to the now not far distant day when it will be universally acknowledged in England as it is on the Continent to a great extent now, that in the proper use of long-range fire, in the adequate training of the men to pour in closely delivered showers of lead from distances up to 1,500 yards or over, lies the path to military pre-eminence. To this training the magazine rifle forms the proper complement. Armed with it the duly trained soldier possesses the power of multiplying his fire enormously at close range or increasing its volume at long ranges when necessary. Such weapons require careful training both of the Officers and men, frequent practice in their use, and careful working out of the problems they give rise to.

How are you to carry the increased number of rounds the soldier *must* have? He cannot carry beyond a certain weight, and that weight must in the future consist very largely of cartridges, his kit must be carried for him, the regimental supply of ammunition must be increased until each man at the moment of battle has 100 rounds on him, and at least 40 to 50 in the regimental supply. Is it possible under modern fire to send cartridges to the fighting line? I doubt it: far better at the last moment before entering an action serve out an additional supply fairly sufficient for the fight, and to regard sending more into the firing line as an exceptional circumstance.

So far for the tactical, and now for the technical considerations.

It is, I think, desirable that I should give you a short account of the present state of the question in European armies.

As usual, in all military reforms in the van of progress stands Germany. Immediately after the war of 1870-71 the experiments which had been begun before it broke out were again taken up and resulted in the Mauser rifle, known officially as Model 71 from the date at which the pattern was definitely decided on. This rifle now lies on the table for your inspection.²

A few years after endeavours were made to increase the rapidity of fire, and for a time it seemed probable that the Löwe magazine would be adopted. But its clumsiness prevented its introduction, and I feel sure when I tell you that this is the article in question, fig. 1, Plate IV, you will agree with the German military authorities.

Besides, all such contrivances are admissions of the necessity of a repeater, and must be regarded as clumsy makeshifts permissible only as temporary expedients. The question then had to be definitely

¹ See vol. xxii, p. 893, *et seq.*, "Musketry Instruction and Long Range Infantry Fire."

² A specimen is in the Museum.

answered—Repeater or no repeater? In Germany, as usual, common sense carried the day, and after trying various forms, the Mauser magazine rifle, which I have here, was definitely adopted. It is, I believe, now in the hands of five army corps, and before the summer the whole German Army will be furnished with it.

Its principal dimensions are given in Table A.

It can be used either as a single-loader or a magazine weapon. The magazine is placed under the barrel and holds eight cartridges, these with one in the elevator and one in the barrel make ten in all. There is nothing particularly worth drawing your attention to in the construction of the lock or magazine system. To shut off the magazine, open the breech and push the small arm *a*, figs. 1, 2, and 3, Plate III, on the left side of the rifle forward; this moves the other end of the cam of which it forms a part forward into the underneath portion of the elevator *b*, and thus fixes it so that it does not fall down when the magazine is closed.

The Mauser repeater, M. 71/84, fires the same cartridge as the Mauser rifle, M/71, but latterly experiments have been made with an improved one containing 89½ grs. of compressed powder and a steel-covered lead bullet. With this cartridge the muzzle velocity is greater, the penetration considerably more, and the trajectory much flattened, especially at close ranges. This will be seen by reference to the Table A and to Plate V, which shows the trajectory.

In France no definite solution as to the arm to be adopted has as yet been come to. It seems, however, probable that the arm will be the Lebel, which is called after the name of its inventor, a Colonel in the French Service. I am unable to give you any definite information about it beyond the fact that its calibre is 78 mm. or 0.307 in., and that the magazine under the barrel holds eight cartridges. Later on I shall deal with this question of small calibres, and will not therefore further discuss it now. For some years past, however, the French Navy has been armed with the Kropatscheck repeater, of which this is a specimen and which is shown you in fig. 4, Plate III. It differs not materially from the Mauser except in being a little more complicated, and the chief points with regard to it are given in Table A. For detailed account of the reasons which led to its introduction I will refer to an article I contributed to the Journal of the Institution some eight years since, vol. xxiv, p. 384, *et seq.*

Austria has definitely adopted the Mannlicher rifle, figs. 5, 6, Plate III. This rifle presents several peculiarities worthy of notice. In the first place the bolt is withdrawn by a straight backward motion, which renders it much quicker than one in which it is necessary to make a turn as in most bolt rifles, and hence it can be worked without taking it down from the shoulder. The cartridges are carried packed in tin frames containing five, fig. 7, which are placed in the case placed under the bolt-chamber, and whence they automatically fall when empty. The cartridges are carried packed in these frames, two being wrapped round with paper, and thus issued to the soldier. The frames weigh 385 grains each, *i.e.*, roughly the weight of a bullet, and cost less than a halfpenny to manufacture. When these cases are

TABLE A.

Name of rifle.	Weight.	Calibro.	Weight of bullet.	Powder charge.	Twist of rifling in calibres.	α° .	Muzzle velocity.	No. of cartridges in magazine.	
	lbs. ozs.	in.	grs.	grs.			feet.		
Mauser	10 2	0.433	386	77	1 in 50	3.416	1,410*	Eight	* 1,571 with new Rothweiler powder.
Kropatscheck.....	9 14½	0.433	386	80	1 „ 50	3.416	1,430	Seven	
Lebel	..	0.307	..	..	..	..	..	Eight	
Mannlicher.....	9 8½	0.433	371	77	1 „ 63½	3.547	1,437†	Five	† 1,575 with the new cartridge.
Jarmann.....	10 1½	0.397	337	77	1 „ 55	3.222	1,536	Eight	
Enfield-Martini ..	9 5	0.400	394	85	1 „ 37½	2.917	1,570	—	
Vitali.....	..	0.414	312	62	1 „ 63½	3.726	1,430	Four	‡ The Vetterli, the present arm, weighs 9 lbs. 9 ozs.
Vetterli	10 8	0.414	312	55	1 „ 63½	2.932	1,427	Eleven	
Hebler.....	9 14½	0.307	225	83	1 „ 15½	2.932	1,942	—	
Gaude.....	..	0.323	264	69½	1 „ 35	2.769	1,673	Unknown	Magazine and breech action same as Kropatscheck.
Pieri	..	0.323	284	83	1 „ 36½	2.569	2,057	Five	

placed in the rifle, *e.g.*, when arranged for magazine action, it cannot be fired as a single loader, although there is no reason why more than one round should be fired. The cartridge used is the same as that employed for the Werndl rifle, the weapon hitherto in use in the Austro-Hungarian Army. Experiments are, however, being made with an improved cartridge giving a higher initial velocity.

In Italy, experiments have been conducted for some years past, and it has been finally determined to alter the Vetterli rifle, which is an ordinary form of bolt-gun, in accordance with the system known as the Vitali. A magazine is fixed in a central position under the bolt-chamber, in front of the trigger-guard, in which four cartridges packed in a special cardboard box are pushed from above. I have not been able to get a specimen of this weapon, but, so far as I am informed, it, like the Mannlicher, cannot be used as a single-loader when the cartridges are placed in the magazine. This change is avowedly only a temporary expedient pending the introduction of an improved and probably smaller bore rifle. It only costs 11 francs per piece.

Russia has, like other nations, experimented with repeating rifles, but has not yet definitely settled on a pattern. She has introduced Evans' repeater into her navy—a specimen of which system is in the museum. It is distinguished from all others by the large number of cartridges it holds, *viz.*, thirty-five, which are placed in the butt. I do not think, however, it is likely to be introduced into the army. In the meantime, it is stated in the "Times" of the 19th February that a form of attachable magazine has been introduced for the Berdan rifle, which holds three cartridges, and which can be fitted with a metal case containing five others, or eight in all, and that this apparatus, whatever it may be, can be fixed in less than ten minutes to the rifle.

Sweden has for some time had the Jarman rifle. I am sorry I am not able to show you a specimen of this arm with the magazine under the barrel, as in the Swedish regulation arm, but it does not possess any special peculiarities or advantages. Its action is shown in fig. 8, Plate III.

Switzerland has for some years had the Vetterli rifle, fig. 2, Plate IV, which has a rim-fire cartridge, and is scarcely now on the first rank of weapons. Portugal has recently adopted the Guêdes rifle with the Kropatscheck breech and repeating action. This rifle is distinguished from all the others I have mentioned by its small bore and high initial velocity.

It will be seen, therefore, that every nation has either definitely adopted, or is experimenting with a view to deciding on some form of magazine. We, too, have, I believe, made up our minds to follow suit, and I venture to think our authorities are to be congratulated on having determined to do so rather than to re-arm our infantry with an ordinary breech-loader, as was proposed but six months ago.

I have here, by the kindness of the Secretary of State for War, two rifles, the one known as the Lee Burton, the other as the Improved Lee. Of each of these rifles a limited number will be manufactured

and issued to the Army for trial, but no pattern of magazine rifle has as yet been definitely settled on for the future armament of our troops.

It is, of course, natural that this universal determination to change the armament of European armies should have given a great stimulus to inventors, and I suppose there is hardly a day that does not bring forth a fresh weapon. I propose, therefore, to discuss briefly the lines of progress in rifle reform, bearing in mind that what we require is a soldier's weapon, not a match rifle.

The first point to consider is what do we want our rifle to do? To shoot well and closely at ranges up to 1,500 or 2,000 yards; to have a flat trajectory within what I may describe as the decisive fighting zone, say 600 yards. These two conditions, other conditions being equal, require—

A, a high proportion of weight to area of bullet (i.e., $\frac{d^2}{w}$ as near unity as possible).

B, a high muzzle velocity.

The recoil depends upon the weight of the bullet, the weight of the rifle, and the amount of powder. To fulfil A without unduly increasing recoil and maintaining B as high as possible, it is necessary to have a long light bullet, in which the proportion $\frac{d^2}{w}$ is kept low, i.e., a small bore is a necessity. If we could use 500 to 600 grains of lead as is done in some match rifles, we could have a bore of 0.45 inch, but then the charge of powder necessary to obtain a flat trajectory would be so large and involve so heavy a weapon that the soldier could not use it; for the firearm must not be heavier than 9 to 9½ lbs. These facts have induced many experiments in England and also abroad with a view to ascertain whether it was possible to design one which should combine as much as possible the qualities of the express and long-range rifle. Among others who have followed out this line of research I may mention Lieutenant-Colonel Bode in Germany, Major Rubin and Professor Hebler, formerly an artillery Officer, in Switzerland. The last-named has published a work called "Das Kleinste Kaliber oder das Zukünftige Infanteriegewehr," which I can strongly recommend to the attention of all who take an interest in this subject. The two latter gentlemen have for some years carried on experiments with small-bore rifles, and both alike directed their endeavours to find out a projectile which should take the grooves well, not lead them, and yet not wear the barrel. With very long projectiles driven at high velocities through a quick twist, there is the danger that the projectile, if too soft, will strip; if too hard, will wear out the barrel. Messrs. Rubin and Hebler both determined that the best form of projectile was lead covered with a thin shell of harder metal; the former and also Colonel Bode chose copper; the latter, steel. Specimens of both kinds of bullet are on the table (see Plate V), but I believe I may fairly say that the lead covered with steel is the better of the two, and this projectile, due in its present form to Herr

Lorenz, the proprietor of the well-known ammunition manufactory in Karlsruhe, is, I think, destined to play a great part in the future. The advantages claimed for it are, that it does not lead the grooves or wear the barrel, while it takes the grooving accurately and has no tendency to strip. Moreover, it renders unnecessary the use of lubricators, and it maintains its form better in penetrating objects than does any projectile of lead. I am induced to dwell on the Lorenz compound steel-jacket bullet, because of the attention it has attracted in all foreign countries, and because I believe its use to be necessary if a really small calibre rifle is to be used. It has been largely experimented with in France; it will in all probability be introduced in the German Army; it has actually been adopted for the new Portuguese rifle. I have here a bullet which has been fired from the Hebler and one which has been fired from the Guedes, *i.e.*, the Portuguese rifle. You will observe that in each case the thin steel jacket is not cut, but merely pressed into the lead, which I should state consists of 97 per cent. lead and 3 per cent. antimony, and is attached to the steel by a thin coat of tin. The clean close-fit surface of the steel polishes out the bore every time and removes fouling, and hence it is unnecessary to use a lubricator, and as the steel is so thin, it has not half the wearing effect of a really hard lead picket, and, as a practical fact, I may add a Hebler rifle has fired 1,500 rounds without showing the slightest degradation. Latterly the steel shells have been nickel-plated, which still further improves their shooting and does away with any liability to rust.

Here are also Martini-Henry bullets and the new Mauser bullet. With regard to the latter I may say that the compound steel projectile penetrated through two blocks of beech wood, $3\frac{1}{2}$ inches thick, and eleven planks of deal, 1 inch thick, when fired with the service charge of 75 grs., whereas the old form of lead bullet barely penetrated through $3\frac{1}{2}$ inches of beech.

Table B gives a few details of some experiments conducted at Enfield on the 12th July, 1886.

TABLE B.

Distinguish- ing letter.	Rifle.	Powder charge.	Bullet.	
			Weight.	Nature.
A	Enfield-Martini	85 grs. R.F.G. ²	grs. 384	hard lead.
B	do.	do.	284	do.
C	Mauser M/71	76 grs.	386	soft lead.
D	do.	76 do.	386	do.
E	do.	80½ do. compressed	386	steel compound.

Target.	Rifle reference letter.	Penetration.
Sand	A	9·75 inches.
	B	16·5 inches.
	A	1 block.
Two beech blocks, each 3 inches thick, with deal planks behind, 1½ inches apart and 1 inch thick	B	2 blocks and 6½ planks.
	C	1 block.
	D	2 blocks and 12 deals.
	E	do. do.

The results speak for themselves, and show clearly that the steel compound shot has a higher penetration than the others. I am of course aware that a very hard picket may be made which will penetrate as well as the steel compound bullet, but such a bullet cannot be fired out of any rifle continuously without ruining the rifling. Such projectiles must be looked on as experimental toys, and not as intended for practical use. An extensive series of experiments conducted by Dr. v. Beck, and which are fully described in his book, show that in traversing the body, whether of man or animals, it is much less liable to deformation.

Many of you will doubtless remember that in the interesting lecture given by Colonel Arbuthnot on the Enfield-Martini rifle he stated that the reason why the calibre of 0·4 had been chosen was that with smaller bores the shooting was not so regular. This view does not agree with that held on the Continent, for although Germany and Austria have kept to their present bores of 0·433 inch for reasons of economy and rapidity of transformation, because the existing barrels can be used for the new repeater, it is by no means certain that the former at any rate will not eventually adopt a smaller bore of 7 to 8 mm., while it is almost certain that France will do so. I know that in Austria economy alone prevented the adoption of a calibre of about 8 mm.

In England we are about to adopt a magazine rifle. I should, speaking for myself, like to see experiments conducted under public conditions with bores smaller than 0·4. It must not be forgotten that a Government rifle designer has not the free hand a private one has. The latter can do as he likes with regard to cartridge case, powder, and bullets. The Government official has to consult two other Departments, who may not agree in his views. To have a rifle which shall fulfil the most necessary quality in a good military arm, viz., flat trajectory, a small bore is an absolute necessity. To illustrate what I mean, look at the trajectories in Plate V. A is the old Snider, B the Martini-Henry, C the Enfield-Martini, D a rifle of 0·35 in. calibre, E and F of 0·32 and 0·30 in. respectively.

In the lowest the $\frac{d^2}{w} = 2·093$, in the highest 4·855, and the calibres corresponding are shown in the Table C.

TABLE C.

Reference Letter.	Bullet.		$\frac{d^2}{w}$	Muzzle velocity.
	Weight.	Diameter.		
	grs.	ins.		
A	450	0·577	4·855	1,210
B	450	0·450	2·953	1,315
C	334	0·400	2·917	1,570
D	300	0·350	2·858	1,720
E	300	0·320	2·391	1,700
F	300	0·300	2·093	1,700

The highest points of the trajectories of bullets E and F for a range of 1,000 yards are: for E, 31·09; for F, 28·70.

Speaking in this Institution some seven years ago, in a lecture which I gave on "Modern Fire," I predicted that we should go to much smaller bores, and suggested 0·38 inch. I also prophesied that the repeater was the weapon of the future. I had hoped that we might have taken the lead in these advances, and not have followed respectfully in the wake of foreign nations. But I am glad to find that at last we are to have a magazine weapon, and I sincerely trust it will be the best that the most open competition can produce. The Officers selected to decide on this, the most important question of the day, will of course be chosen for their practical knowledge and their acquaintance with the subject, and I am sure we shall leave the choice with great confidence to them. It seems to me, however, that before finally deciding on the calibre further trials should be made of small-bore rifles. Personally, I think that with our present experience a rifle of 0·32 bore with a bullet weighing 336 grs., and a powder charge of about 90 to 100 grs., would be a desirable combination.

There is one objection which is usually put forward against small-bores, viz., that the bullets fired from them are much more affected by a side wind. Now, in the first place, I would point out that the wind does not always blow across the trajectory, and if it do so, and admitting that the light long bullet is more affected than a short heavy one, if this idea is to be carried to its logical conclusion it would necessitate a return to round bullets which are equally weighted on all sides. But as a practical fact, when this objection is raised a very important consideration is completely lost sight of, viz., that on the field of battle it is the mass fire of numbers, not the aimed fire of individuals, that has to be taken into consideration, and that therefore lateral deviation, considering that we aim at broad targets of little depth, is of far less moment than is flatness of trajectory. This latter is the great object to be attained in a military rifle, and is of far more importance to the soldier than lateral error, however much that may be objectionable to the match shooter. Flat

trajectory, i.e., a long depth of shot-swept space, we must have, and to it we must sacrifice, if necessary, some less needed qualities in the rifle. Moreover, in these days when the good old superstition that having a long-range rifle, we should endeavour to prevent it being used until we come within the ranges at which alone the feeble weapons of our forefathers were effective is rapidly dying out, and long-range fire is now universally admitted, and infantry tactics based on its employment. Long-range fire, breech-loading rifles, magazine arms, all represent as many steps along the path of increasing expenditure of ammunition. The soldier must carry more cartridges; he can only carry a certain weight, to get more rounds of ammunition out of that weight it must be further subdivided, therefore the cartridge must weigh less, i.e., the bullet must weigh less, to give a flat trajectory $\frac{d^3}{10}$ must be small; in short, a small bore is the logical outcome of modern requirements in an infantry arm.

There is only one other point to which I shall allude, viz., the objection to small-bores sometimes put forward, viz., that they lack stopping power. Stopping a man depends largely on where you hit him. A kitchen poker which grazes an Arab's ribs will not stop him so well as a 50-grain bullet through his head, or through the lower half of his trunk. I wish those gentlemen who still hold these opinions would kindly look at the medical records of the Franco-German War. Let them read Sir William McCormac's "Work done under the Red Cross," Dr. Esmarch's work on Military Surgery, Dr. Beck's Experiments with Small-bore Bullets, and they will find that rapid moving long bullets with angular velocity enough to keep them point foremost, will, striking half way down the femur, go through and split it up into the hip-joint, involving amputation at that point. I remember when express rifles were first introduced we were told they were not as good as the old round bullet: who says so now? It may take a ton of lead to kill a man, but don't ask the soldier to fire it all at once, or the number of rounds he can carry will be very much limited.

Having determined upon the bullet, the next steps are the rifling and the powder. The question of rifling has been so fully threshed out that I need hardly allude to it. Nearly all rifles have, nowadays, broad, shallow grooves and narrow lands; fig. 1, Plate V, shows you the form employed by Professor Hebler. The rifling is, you will see, about 5000ths (exactly 0.0052 in.) of an inch deep, which is an ordinary amount. The lands are 0.0195 in. wide, the grooves six in number. Table D gives some idea of the accuracy of the weapon in question, while the diagram of trajectories shows that for 600 yards range, the ground would be practically swept from the muzzle to 650 yards.

TABLE D.

Range.		Radius of circle in feet containing half the shots.
Metres.	Yards.	
500	517	0·852
1000	1093	2·625
1500	1610	6·854
2000	2187	13·012

As to the powder. Great strides have been made in the last few years in the manufacture of gunpowder. The sharp almost detonating action of the old form has given place to slower burning compositions, which give equal velocities with less pressures. In small-bore rifles, where the number of expansions allowed to the charge owing to the great length of the barrel is large, very slow burning powders can be used. With such powders the recoil becomes more a push than a blow, and is consequently less felt. Greater charges can therefore be fired.

On the Continent a large number of experiments have been made with compressed powder, and it seems destined to come into universal use, because with it the charge can be made more uniform, and hence more uniform velocities obtained. Here is a German cartridge loaded in this manner, and Hebler and other experimenters have employed it too. Compressed powder has one great advantage, viz., it occupies less space for the same weight, and hence gives a better shaped cartridge. With regard to this latter point, viz., the form of the cartridge case, with large charges and small-bore bullets, the case becomes very "bottled;" this is clearly shown in the case of the Martini-Henry and Hebler cases, see Plate V. It seems to me that the truncated cone shape is a far better one, such as I now show, see No. 2 cartridge, Plate V, which is intended for the Enfield-Martini rifle. This case is much less likely to stick, as it has not got the long narrow neck, and, moreover, when once it is started it cannot do so, as the surfaces of the cartridge and chamber come apart. I am informed by a large manufacturer of ammunition that this form is no more difficult to make than the bottle shape.

I think, then, from what I have said, we may fairly make three deductions. First, that we should have a very much smaller bore than hitherto employed, probably between 0·36 and 0·32, but as near the latter as possible, that $\frac{d^2}{w}$ must be low to give with a relatively large powder charge a very high velocity. Secondly, we must seek

for a slow burning powder, which should be used in a compressed form. Thirdly, that we should use a conoidal cartridge.

Here let me draw your attention to the desirability of using smokeless powder. A considerable amount of attention has been given to this question on the Continent, and I need hardly point out to you the enormous advantage to be gained from it. Advancing lines would no longer be indicated by their smoke, the defenders of a position would no more be compelled to cease fire to obtain a view of the ground in front of them. I am sorry that I cannot give you details of the composition of any of these experimental forms of powder, but such matters are, as you are aware, always kept a profound secret. I am aware, however, that the French have lately been trying a white powder, which is said to have given astonishing velocities, though what it is made of I do not know.

The next point we have to consider is the magazine, i.e., the reservoir from which we draw our stream of continuous fire.

All forms of magazine can, so far as their position is concerned, be divided into four classes:

1. In the butt.
2. Under the barrel.
3. Over the barrel.
4. Under the breech.

No nation has the first-named, except Russia, in the Evans repeater. The second has been adopted in France (Kropatscheck), Germany (Mauser), Switzerland (Vetterli), Sweden (Jarmann), Portugal (Kropatscheck). It has the advantage of giving room for a number of cartridges, but the very great disadvantage, which it shares with first position, of being difficult to load. Moreover, the balance of the rifle is altered each time a shot is fired. The German rifle is very faulty in this respect, and is, when the magazine is filled, an extremely awkward and ill-balanced weapon, besides being very heavy, weighing 11 lbs. Over the barrel is extremely awkward for the soldier, and in the case of those weapons which have the magazine on one side, is bad for aiming, especially when the sun is shining from the opposite side to that on which it is fixed. These three forms of rifle, viz., the Burton (see Plate XII, vol. xxvi), the Lee Burton, and the Owen Jones, fig. 3, Plate IV, have such magazines. Underneath the breech, is, on the whole, the best. The rifle is more compact and far better balanced. Its sole disadvantage is the fact that it is difficult to arrange for more than about five cartridges. These rifles, viz., the Mannlicher, figs. 5, 6, Plate III, the Schulhof, figs. 4, 5, 6, Plate V, the Pieri, and the Lee, and the Improved Lee, all have this form of magazine. All hold five cartridges except the Schulhof, which will take ten arranged round a drum like a revolver.

Should the magazine be attachable or fixed, i.e., form part of the rifle? I think the latter plan to be preferable, because there is then no chance of its being lost at the moment it is wanted, and if a

number of loose magazines are to be carried, or the cartridges have to be packed in special attachable frames, the armament becomes more costly, and a lot of unnecessary weight has to be carried.

The theory, one I think essentially of peace, that the soldier can carry one or two magazines which he can affix just at the most critical moment of a combat, leaves out of consideration the disturbing elements of the fight, which would in all probability render it very problematical whether all the magazines would be forthcoming, and if they were would certainly interfere with the fixing of a large proportion of them. No great European nation proposes to adopt this system, such as you have here in the first form of the Lee rifle.

In the under-barrel forms of magazine rifles, it is not proposed to load the rifle during the heat of an action. It would be filled before going under fire, cut off from acting, and only brought into use at the supreme moment. In rifles like the Mannlicher, the Lee, the Improved Lee, the Pieri, the cartridges can be very easily replaced, and consequently a more prolonged intense fire be given than where this cannot be done, as in the under-barrel type. I may instance as a proof of this, that the five shots from the Mannlicher can be fired in $3\frac{1}{2}$ seconds, and that 46 have been fired in one minute, i.e., the frame has been six times replaced. If the magazine holds ten rounds, as in the Schulhof, the fire will undoubtedly at the supreme moment be more intense, but it cannot be kept up at the same rate as when set after set can be fired, as in such rifles as the Pieri, Mannlicher, &c. Probably, therefore, on the whole, the latter is better, but nothing but actual experiment in large numbers placed in the hands of infantry soldiers can really decide this point.

There can be no doubt that it is desirable to have a magazine holding a fairly large number of rounds, but too many would so increase the weight of the rifle as to strain the soldier far beyond his powers. This was found to be the case in some French experiments, in which the extra weight carried, owing to the cartridges in the magazine, took so much out of the men that they did not fire as effectively as those armed with a single-loader. This then is one great advantage possessed by those rifles which hold only a comparatively small number, but in which the loading of the magazine is only the work of a few seconds, such as the Mannlicher, the Pieri, and the Lee. The loading process in the Schulhof is very quick, and can be made quicker by packing the cartridges in special frames.

What action shall our rifle have? The much-abused bolt is of course a necessity, indeed of all the weapons I have here one alone, the Jones, is a block gun; shall it be one which pulls simply straight, backwards and forwards, or one which require a turn as well? I would point out that to fire without removal from the shoulder the former is a practical necessity, as with the latter form of action the aim would be too much disturbed, and the twisting motion required to open the breech is extremely difficult to carry out when keeping the rifle at the present. The Austrian (Mannlicher) and the Schulhof have bolts of this description, the Jones has a straight pull back too, all the others that I have here require the double motion. I do not

think that there can be any doubt that the one simple motion is the better.

I now propose to call your attention to the different rifles to which I have just alluded :—

The Jones rifle has a simple pullback action worked by drawbar, *a*, just behind the trigger guard. The breech action is a falling block one, and the magazine, which holds five cartridges, is on the side. Pulling back the drawbar depresses the block, ejects the exploded cartridge, pushing it forward again brings a cartridge up from the magazine into the breech. This rifle is a very quick one to work. Its chief drawback, though, of course, this is only a relative one, is the large number of parts of which the action consists.

The Schulhof presents several points worthy of attention. In the first place the cartridges are placed in a drum, *a*, in a central position, figs. 4, 5, 6, Plate IV, and are brought up one by one by the backward and forward motion of the breech bolt. The drum can be loaded with a single cartridge or any number up to the maximum it contains. The action is extremely simple, and the bolt is worked by a simple backward and forward motion. Altogether this system appears well worthy of attention and trial on a practical scale.

The Pieri is chiefly noteworthy for the arrangement by which the cartridges are fed up one by one as required, a ratchet being worked by the motion of the breech bolt, which is of the ordinary Gras construction.

The Bethel Burton has two special qualities. First of all the whole breech mechanism is carefully covered from dust; secondly, the breech bolt is locked by means of an interrupted screw, the motion of which in opening materially aids the extraction of a tight-fitting cartridge. The magazine, which is on the side, acts by gravity alone. This was described by Lieut.-Colonel Fosbery in his lecture here four years ago.

The Winchester, a tried and proved weapon which has done good service in the field, I need hardly describe. A specimen is in the Museum.

In concluding this lecture, I can only say that my endeavour has been to put before you, as fairly as I could, the present state of the rifle question, to describe the various systems now adopted, or proposed. I could not within the limits of a lecture go into a mechanical examination of all the systems that have been put forward. I have, therefore, limited myself to type forms, or to those which have actually been introduced into various Services.

The CHAIRMAN: It will be convenient if, in the discussion, we confine ourselves to the point that Captain James has brought out so strongly, namely, that what we are now trying to arrive at is the best rifle for the British soldier. The question of supplying magazine arms to our troops has been a good deal debated of late, and I hope than any gentleman who is good enough to address us will confine his remarks to what I may call the military points, and not go into purely mechanical matters of construction which we cannot follow out.

Major-General BRAY, C.B.: Mr. Chairman and gentlemen, the question whether or not we are to have repeating rifles appears to have been settled, and it is high time,

I should say in this assembly, it was settled. The Committee has been a long time over it, though I do not blame them much, because it is a very great and an extremely difficult question. We have a vast number of rifles now on hand, perhaps as many as a million, and the question that they have had to deal with has been how to manipulate and arrange so that the adoption of magazine rifles shall not cause the entire re-arming of the British Army. The same difficulty has occurred with other nations, and those rifles which we see before us are adaptations more or less of the barrels that they had on hand. With regard to the rifles themselves, I have examined nearly all the rifles that are now before us, and out of that number I have selected three as being out and out the best repeating rifles that have yet been produced. The first one I would mention is what has been called the Remington-Lee rifle. The Remington-Lee is a splendid weapon; it has a magazine underneath which contains six cartridges; it has a beautiful barrel, and is an admirable weapon, having this advantage, that the Captain of the company can control the magazine fire. Looking at the Remington-Lee you will see that the American soldier recovers the arm at the word from his Captain "Magazine load!" It is done in an instant. Then he can also give the order "Magazine unload!" So that he controls the fire of his company. Whereas if the cartridges are in the barrel of the gun, or in magazines under the entire control of the soldier, when you once get into action you will find it almost impossible to control the fire of your men. That is most important, because there are two views to take of a rifle, the accurate fire question and the military efficiency question, and they are as distinct as two things can well be one from another. The Committee now sitting on these rifles contains theoretical men and practical men; the theoretical men are all for hitting bulls'-eyes at a thousand yards; the practical men are for putting a rifle into the hands of the British soldier with which he can shoot down his enemy at distances under 400 yards; these important points must never be separated. The trajectories look very nice on paper, but to arrive at those trajectories, the rifle must be fixed in a rest, because if it is put in the hands of a soldier who is firing, the trajectory entirely depends upon the angle at which he holds the rifle. Therefore for mere fighting purposes you may take it for granted, and there are a great many gentlemen here who have not seen war at Wimbledon only, but all over the world, who know this perfectly well, that the real fighting of the soldier begins at 400 yards, and finishes within that distance. Now the Remington-Lee I considered an admirable weapon until I looked at it carefully. If you take the Remington-Lee No. 1, with the magazine underneath, you will find that the spring which attaches that magazine is just inside the trigger-guard, and if you touch that awkwardly or intentionally out drops the magazine between the soldier's feet, and of course that defect is fatal and kills the rifle. It has been improved, I believe, and therefore is a better rifle than when I saw it. The next rifle I selected was the Burton. All these rifles have the *bolt* action, but the Burton has this advantage that it has a closed bolt-action. It has, however, one great disadvantage, and that is that you have to fix the magazine on the side of the rifle, which is very awkward and clumsy, and though it has the very great advantage that the cartridges drop into their place by gravitation, still, I think that a magazine stuck up on the side of the rifle, either on the right or the left, is a great drawback. If Mr. Burton could get rid of that difficulty, I am certain that his rifle would be one of the finest that we have seen. I have also seen the Mauser rifle. This rifle weighs 10 lbs. 2 ozs.; it is, however, very badly balanced, and the reason that the Germans have adopted it is simply because they wanted to utilize the rifles that they had in their Army. They have, therefore, made an adaptation, and have made the best use of their rifles which they could. The Germans carry greater weight than the English soldiers, and more easily, and as a German told me the other day, no man in the German Army would object for one instant to carry the heavy Mauser. There is a great deal of difference between the weight of that rifle and that of some others that have been mentioned. I consider the most wonderful and the cleverest rifle of all is that by Herr Schulhof of Austria. The Schulhof rifle has been shown last, but I think it might have been shown first. It has got the magazine underneath, it works with the greatest facility, is admirably made, and the lock action is remarkably simple; it is a beautifully balanced rifle, though it looks

large and clumsy, and the stock is wonderfully improved; it has a grooving down the side, which catches your hand the moment you take hold of it. The wood part covers the rifle so completely that the fire-action does not hurt or heat the hand in any way. I am quite surprised that it has not taken the prize as far as the Committee has gone. Of course the Committee have looked into the matter with the greatest possible fairness and care, and I hope that they will arrive at the best rifle that has ever been introduced in Europe for the British soldier; that they will take the best parts, as they generally do, of the competing rifles put before them, and make the most perfect weapon that has ever been produced.

Colonel Hore, U.C.: I would ask whether Captain James does not consider that if this $\frac{d^2}{w}$ were reduced still further below unity it would not be an improvement; and, secondly, whether he could favour us with a sight of any of the recent cutlasses.

Mr. C. FREDERICK LOWE, Queen's Westminster R.V.C.: Mr. Chairman and gentlemen, I will not enter into any technical question about any pattern of bolt or repeating rifle, but I think probably gallant Officers may be interested to learn the reason why for so many years our military authorities would not look at a bolt gun. I believe some twenty years ago, that while firing a primitive form of bolt rifle, an accident happened to a member of the House of Peers, and also fourteen or fifteen years ago a very awkward accident happened to a well-known shot at Wimbledon, and for those reasons the military authorities will not look at a bolt gun—"Oh, it is a bolt gun, it will not do for Her Majesty's Service;" but when nearly every foreign nation has adopted the direct mode of extraction, instead of getting at the head of the cartridge through a series of levers, common sense has at last prevailed. I heard that while a bolt rifle was being tried for rapidity, a cartridge hung fire, and exploded when partly extracted, and according to official reasoning that was a very strong argument why the bolt gun should not be used. Of course the same accident would have happened with any other description of rifle. As regards the form of cartridge, I believe the military authorities would be only too glad to shoot with the conical cartridge that Captain James has shown us, but there are difficulties in the way of manufacture. I remember that these cartridges were made by Westley Richards and Co. for Sir Henry Halford, who fired a 0.40 bore Metford rifle so chambered at Wimbledon. As regards the barrel, we have this remarkable fact, that according to the experience of the most skilled shots in the world at Wimbledon, during the last fifteen or sixteen years one system of rifling, the Metford, has come to the front, and has driven the other systems of rifling out of the field. Men are not foolish enough to pay heavy entrance fees to shoot with rifles that won't carry straight; they always go in for the rifle that gives the most bulls'-eyes. Whenever any phenomenal shooting has been done it has been with the Metford. As long ago as 1866 there was a competition at 2,000 yards with telescope rifles at Gravesend, when Mr. Metford and Sir Henry Halford between them swept the board. With a heavy Metford muzzle-loader, three or four years ago, Sir Henry Halford, firing with the Metford, 0.40 bore, with a taper cartridge before mentioned, put ten shots running into a small parallelogram at 2,000 yards, and beat the Enfield-Martini hollow at that distance. The other day, as was stated in the "Times," at 1,000 yards, Mr. Gibbs, of Bristol, put 50 consecutive shots into a 4-foot circle, and 48 of them into a 3-foot ring bulls'-eye. Every time the bulls'-eye was hit the bell rang, and could be heard a mile off, so there could be no mistake about it. The accuracy of this shooting was certified by Sir Henry Halford in a letter to the "Times." Moreover, in 1880 some excellent shooting was done with a 0.45 bore Metford-Martini, by Major Sweeting, in the second long-range match that took place between Birmingham and London. I was witness to that, and he put 27 consecutive shots, at 800, 900, and 1,000 yards, into a parallelogram of 2 feet high by 4 feet broad. I have also been informed that the German Government, after a long series of official experiments, have come to the conclusion that the best form of grooving for a military rifle is a circular groove as shallow as possible, and no sharp corners, in short the Metford system. It is very curious indeed to find that in the face of these facts the Enfield authorities have adopted the reversed ratchet, which gives the longer slope as the

driving edge. Colonel Arbuthnot stated to me that the object of reversing the ratchet was that the bullet might be driven in against the short slope to clear out the fouling. I submitted this statement to a skilled expert, who declared that the statement was so absurdly grotesque he could not believe it was ever made. I challenge Colonel Arbuthnot, in the presence of this meeting, to give a tangible explanation for reversing the ratchet. Attention has been drawn by the gallant lecturer to the matter of smokeless powder. I beg to be allowed to mention that about a month ago I fired at 800, 900, and 1,000 yards with a Metford rifle, at Wimbledon, with fair success, and at 900 yards I put five consecutive shots into an elevation of a foot, and this was done with a smokeless powder, the invention of a German. I was told that at 300 yards the smoke was invisible; it seemed to be vapour rather than smoke, for it vanished in the air. I also have with me a specimen of the French explosive, of which we have recently heard so much, known as melinite; if you would like to see specimens of these powders flashed, I shall be happy to show you; there is not the slightest danger. I saw in last Saturday's "Engineering" a statement that the Germans, put on their mettle by the experiments of the French in blowing up a fort, had conducted some similar trials, and that the German powder had beaten the French powder. I have also got a small pinch of that, but not enough to make an exhibition of.

Major MACKINLAY, R.A.: I was glad to hear Captain James draw attention to the subject of flat trajectories, because they are most essential in enabling hits to be made, whether at a long or a short range. If the trajectories of the present rifles had been inserted in the diagrams before us, we should see that the advantage which is anticipated from the new arms is simply following in the same direction as the progress which has already been made, and the present Service rifle again has a flatter trajectory than that of a few years ago; there cannot be a doubt that greater facility of hitting any target is thus gained; in other words, the more nearly the trajectory approaches a straight line the less difficulty there is in adjusting the sight of your rifle, and errors in estimating the range become of less importance. A flat trajectory in small-arm fire at practical ranges can only be obtained by the use of a small bore. The new Enfield-Martini rifle has made some advance in diminishing the size of the bore, but there is still room for further progress in this direction. I believe fouling is apt to occur with small bores, and the suggestion of a compound bullet of lead jacketed with steel certainly appears to deserve the very greatest attention; the compressing of the powder in the cartridge also seems to be an important matter, as it enables a larger charge to be placed in the same space. In order that recoil may not be excessive the increased muzzle velocity required for the flat trajectory of a modern rifle necessitates a lighter bullet than has been previously employed; it may be said that with a bullet of less weight you would not have such stopping power as before, but in order to attain a flat trajectory you must have high velocity, and you can then afford to sacrifice weight of bullet, since the measure of the blow inflicted on striking depends on weight and velocity. The Enfield-Martini rifle is doubtless a great advance on what we have already, but future progress may certainly be made by increasing the muzzle velocity and further flattening the trajectory with a diminution of bore and weight of bullet, and probably an increase of the powder charge.

Colonel ARBUTHNOT, R.A.: I think, Sir, the subject to which the lecturer has drawn attention, namely, the reduction of the bore of the barrel, is one to which too much consideration cannot be given. There is no doubt, as Major Mackinlay has just said, that the Enfield-Martini is a step in the right direction; but we might go still further, and that in the direction in which we are moving will be found to be the correct one as time advances; but I do not think that we are as yet sufficiently advanced in our knowledge to jump all of a sudden to a very much smaller bore. There are other considerations besides flatness of trajectory which have to be taken into account when you come to the reduction of the bore of the rifle barrel—and of these the question of weight is no doubt one of great importance. The bore of the barrel cannot be greatly reduced without increasing its weight, because if the barrel is left of the same dimensions as at present, it must of necessity be greatly thickened, whereas if the outside diameter of the barrel is reduced it is made too weak to stand the rough usage it is likely to be subjected to; therefore in considering the

reduction of the bore you cannot eliminate the question of weight. But, apart from that, flatness of trajectory is not quite so all-important as appears by looking at the diagrams before you. It is perfectly true that with a bore 0·3 in diameter you have a trajectory at 500 yards of about 5 feet 4 inches, and with the Enfield-Martini, with a bore of 0·4, you have a trajectory at 500 yards of 6 feet 6 inches—about a foot higher. But that is not quite the way to look at it. The Enfield-Martini is sighted true for 150 yards. Firing at that range the bullet will travel 350 yards before it strikes the ground; and during the whole of that range the enemy is under fire. There is no drawing to show that, but that is the case. Now, by reducing your trajectory to 4 feet 6 inches, it will astonish many of you to hear that a bullet will only travel about 350 or 390 yards before striking the ground; so that the only gain in range is the difference between 350 and 400 yards—you only gain the range of 50 yards by the extra lowness of the trajectory. Again, another point must always be borne in mind, namely, that the height of the trajectory is very deceptive. You talk of a 4 feet 6 inch, 5 feet 6 inch, or 6 feet 6 inch trajectory; that means the height of the trajectory above the line of sight. If the man is standing up the bullet is 4 feet 6 inches from the ground at starting; therefore if you take a trajectory of 5 feet 6 inches, the bullet at its highest point is 10 feet from the ground. If the firer kneels the rifle is still 3 feet from the ground, and therefore the highest point of the trajectory will be 8 feet 6 inches from the ground, and therefore the bullet will be over a man's head for a considerable part of its flight. That is apt to be overlooked. Again, the difference in height of trajectory between barrels having bores of 0·4 and 0·3 is very immaterial. At 300 yards an infantry soldier would be covered by both; at 500 yards by neither, and, therefore, the gain from 0·15 to 0·4 is infinitely greater than the gain from 0·4 to 0·3. But I am quite prepared to admit that we shall probably come to a smaller bore, in the way we are advancing. I think the advantage of a small bore is that the weight of the ammunition can be reduced, and therefore the soldier will be able to carry more rounds than at present. In a magazine rifle that is a consideration which will have to be thought of. Not that I think the magazine rifle will necessarily bring about a larger expenditure of ammunition. I think, on the other hand, it will make the man husband his ammunition; because, now, a man loads when he sees his enemy, and fires as far off as he can in order to get as many shots into him as possible while he is advancing; but if he is certain that he will be able to fire six shots without having to reload, I think the tendency would be that he would husband his ammunition, and not begin to fire till he knew he could hit his man, and get off the six shots before the man could reach him. I think the tendency will therefore be rather to husband ammunition than to expend it. There have been many systems of magazine rifles under consideration this afternoon, but it is quite unnecessary for me to enter into any details with regard to them, seeing that Captain James has very thoroughly exhausted the subject. I think that the two systems that we are about to issue for trial will materially clear the air and enable us to arrive at a system which will be the best in Europe. We are not behind other nations at present with the exception of Germany, for no other country has adopted a magazine rifle as yet definitely; I mean they have none made; some nations have only just completed their experiments, while others are still experimenting; and no other nation, perhaps, with the exception of Switzerland, can really provide its Army with a magazine arm—always excepting Germany. I hope, therefore, we shall be quite prepared for any emergency which may happen, and ready to arm as quickly as most European countries can with a magazine rifle.

Colonel LONSDALE HALE: There is a certain class of members who attend these lectures, and who are always conspicuous by their silence; and they are the very members to whom, in this Institute, one of the objects of which is supposed to be to draw out practical information, we should most of all wish to listen. I refer to those Generals, Colonels, and other Officers who have had in the field practical experience of the fire discipline of the British soldier. It is very interesting no doubt to know whether the bolt gun is right or wrong—whether the steel-covered bullet or the copper-covered bullet is the right thing to adopt; but I do not think we care so much about that after all. The burning question for the British Army is how far we can trust the British soldier in the use of his firearm—and therefore

what form of magazine rifle, from the point of fire control, should be put into his hands. Is there any Officer here with the experience of Majuba and Egypt who would dare trust in the hands of the British soldier any one of those magazine rifles on the table? My friend Captain James has passed over in a few words the question of the "removable" magazine or the "fixed" magazine. I was under the impression that the removable magazine was the sole means by which you could control the fire of the British soldier. The Officer commanding a company could then at once see whether the magazines were on or not, and therefore for the British soldier, with his weak fire discipline, the removable magazine is the only magazine that will be full when he arrives at what tactical authorities consider the point where it must be used, at 400 or 500 yards from the object. We should be, I am sure, very grateful to any Officers present if they would give us the result of their experience, and tell us how, tactically and otherwise, they would conduct the magazine fire of the British soldier.

NOTE.—With reference to remarks made subsequently in the discussion, I may say that the supervision must, in order to be effective, be easy. Whether a bolt stopping the action of the magazine is in a particular position or not can hardly be ascertained in the heat of battle. The presence of a magazine on the rifle is discernible at a distance. The argument that removable magazines would be lost or thrown away has been applied to removable entrenching tools and removable iron rations, and yet somehow or other they are now regarded as absolute necessities in modern war.—L. A. H.

Colonel FRASER, R.E.: I had not intended to say anything on the subject. I confess I do not agree with Colonel Hale about the removable magazine. My view is, that if you have anything in the nature of an arm in two parts, that is, to go through the contingencies of fighting, the probability is that the removable magazine will not be in its place at the critical moment; for which moment alone we are justified in sacrificing the simplicity of the single-loader. I do not think it is possible to have things too simple for war. That is the result of what I have noticed on the few occasions that I have been present in action, and I am sure that if the soldier has to fumble for the movable magazine in order to fix it on his rifle at any supreme moment, the arrangement will not work. I have seen troops with repeaters in action in the war of 1877, and I do not recollect any special difficulty as to their ammunition. Control of fire is impossible during the crisis, for the sake of which a repeater is being introduced. At other times, it does not depend on the arm, but on discipline in all ranks and on coolheadedness of race, supplemented by training. May I say how entirely I agree with Captain James, and how warmly I support him in the desire he has expressed that we should arrive at something like finality about the bore, so as to have the lightest ammunition that is thoroughly efficient. Colonel Arbuthnot has told us that we are coming presently but not now to a smaller bore than the 0·4. The 0·4 bore may be the best in the world for the present, but I think before we commit ourselves for the next 15 years definitely to that size of bore, it would be very desirable indeed that the question should be further threshed out, in view of the results already obtained with smaller bores and the evident tendency on the Continent. May I ask Captain James whether steel-covered bullets have ever been tried on the carcasses of horses?

Captain JAMES: Yes, they have.

Colonel FRASER: With what result? Do they flatten or not?

Captain JAMES: They do not flatten.

Colonel FRASER: Then I do not think that they will have the effect of the lead bullet. I believe the effect of the lead bullet is due to its flattening like a mushroom, and so producing a larger wound. This expansion, and the consequent shock of the sudden stoppage of the bullet, varies with the velocity. It is slight with the Martini, considerable with the Gras and express rifles, and more so with the smaller bores yet tried, when they have still higher velocities. The destructive efficiency of very small bores is, I think, secured by this fact, and would be lost with steel-covered or very hard bullets. In the Transvaal War about 50 per cent. of our men struck with bullets died at the time or in hospital—a percentage greatly in excess of what has occurred in other wars. The percentage of wounded to

killed is usually, I believe, something like 5 to 1, but where the Boers shot with express rifles, I think about every second man struck died from the effects.

Admiral SELWYN: May I claim to say a few words on the subject of the cartridge? First, the assertion by Captain James that the flatness of trajectory, the high velocity and other qualities to which he attaches great importance cannot be obtained but in one single way, that is to say, by resorting to a small bore. Now I think on that point we have not attempted to exhaust the subject yet. On the contrary, all that we do know shows us that by the regulation of the grains of powder, of the nature of the powder, and in other ways, we can obtain a much greater velocity than has ever been attained by the use of the smallest bore, and without resorting to any other rifle or calibre than that which we possess at present. The velocity of the Martini-Henry has been raised by such means by Mr. Nordenfelt with the same weight of powder, with the same black powder, no new powder at all, from 1,350 feet per second to 1,700 feet. If that can be done, that is the direction in which we should try first to exhaust the experiments. No good progress, no sound progress, can ever be made by violating any of the first principles of physics, and you do violate one of the first principles of physics when you resort to a bullet composed of a metal of a lighter specific gravity than lead. I do not care for what reason you do so. Those reasons may disappear, but the master fact, the physical law, can never disappear and must always remain, and if you go into compromises with it, you are sure to get a result which will eventually falsify itself. We have not yet exhausted the question of fouling rifles which has brought you to that decision in some measure of the small bore: we have not yet exhausted that which was long ago brought before us so well by Captain O'Lea, taking away the rifling altogether through the greater part of the barrel. We only know that it did give us a much higher velocity and a perfectly flat trajectory at a long distance, in what was then considered an obsolete rifle. Why not carry out that experiment, which might easily be done, before you decide on a new departure? You may fire a knitting needle, if as was shown by Whitworth you increase the pitch of the rifling with a very flat trajectory and a high velocity, but the question is, what effect will it produce at long ranges, and where will it go after striking the ground? Still greater is the question, are you prepared to recommend two natures of ammunition in the field, one for machine-guns and one for the infantry rifle, or are you to fire knitting needles out of machine-guns? These things ought to be solved first, and it is therefore that questions concerning the rifle in any way whatever ought to be left aside until you have decided what projectile you would use, with what charge of what powder you will drive it, and what case you wish to put that charge and bullet in. The difference between the use of the ordinary cartridge and a long and fine projectile is, that with the long projectile you must make a long cartridge, and thereby you introduce difficulties as to the breech action required for that cartridge. You then resort to the conical cartridge, but have you settled what quantity of powder is necessary, or what is to be the nature and length of the cartridge? The cartridge should not be longer than two inches, including the powder and the bullet, and if you make it three or four inches long, you immediately get into a series of difficulties. Then, again, do you wish to have compressed powder or melinite, which I strongly suspect of being something very near an old discovery of Mr. Revely's, which was called sugar gunpowder, made of prussiate of potash, chloride of potash and sugar, which does not give any smoke, which is white, and gives very high results, but it does give also this, which I beg you to remember, that whenever you get no smoke you are making carbonic acid, and you may also be making nitrous or hydrochloric nitrous acid, and these are the most corrosive things you can possibly put into a rifle. It will eventually, even though you may clean your rifle as thoroughly as possible, produce roughness of barrel, and you ought to look into this question long before you decide that melinite, because it produces certain effects, is therefore the best powder. I admire very much a great many of the rifles that Captain James has shown us, but at the same time I have a very strong feeling that until you have decided the question of the cartridge and the bullet, it is no use talking about the rifle. We might have to change it all, because we had a new cartridge to deal with, and we should then wish to place it in a different part of the rifle. I know that Captain

James is very much with me in my contention that you have not exhausted yet the question of getting rid of useless weights. It has been pointed out that a certain rifle weighs 11 lbs. : have you got rid of all the useless wood? What is the use of that wood? Cannot you have an equally resilient body giving equal protection from the heat developed by the firing, without a piece of wood? Is the wood a necessity? It is a very serious matter, and when you take away even 2 lbs. of it, that gives you 20 cartridges without an increased weight of rifle; 20 more cartridges carried in the arm economized from its useless weight. It is in these things that we should make real progress, and if the Committee would determine to take the first question into consideration first of all, and not the last first, I should believe that some solid progress, progress which was not likely to require repudiation, would be made; but at present we are going on in the direction which must necessarily land us in a reopening of the whole question within a very few years' time, and another expenditure of money will then be needed.

Admiral BORS : I rise to make one or two observations bearing on the naval part of this question. I believe it to be a fact that we in the Navy require a magazine or repeating rifle even more than they do in the land Services. With us it is an absolute necessity. In these days of fast torpedo-boats and ships passing each other at very high speeds, a very rapid rifle fire is most important, and it is equally important that we should have it without further delay. One great objection to magazine arms which we float are free from is that our supply of ammunition is ready to hand. Our small-arm magazines are so near that there is no difficulty in regard to the supply and expenditure of ammunition. Having been connected with this magazine arm question some time ago, is my excuse for offering an opinion. I would observe that the rifle I appreciate most amongst those that we have seen here is the Austrian, for the simple reason that the cartridges are supplied in a detached magazine; the firer has not to fumble about to fill a magazine, perhaps, in action, but puts the packet itself ready filled into his rifle, and when it is empty and done with, away it goes. There may be an objection to the cost, but I think the extra cost is small now, and might still be reduced. Whatever principle of magazine rifle may be approved, my recommendation would be that it should have a contrivance in which the cartridges could be stowed, supplied, and used in the rifle without having to fill another magazine from it, or to carry another article of equipment in the shape of a metal case. With reference to the stopping power of the small-bore rifle, I do not see that the argument Captain James employs is quite sound when he says that a small-bore bullet will, "striking half way down the femur, go through and split it up into the hip joint." It is all a question of comparison. If a small bullet does this at a certain distance, it is perfectly clear a heavier bullet will do the same at a considerably greater distance. May I ask one question with respect to magazine rifles? If in any rifle that Captain James is cognizant of, the action of loading is done with the left hand by a slide underneath the barrel, so that the finger is never removed from the trigger nor the eye from the sights—when, in fact, the whole operation of extracting and loading is performed by a sliding block underneath the barrel.

Captain P. H. COLONB, R.N. : I may, perhaps, usefully confirm what Admiral BORS has said in reference to the value of the magazine rifle for naval purposes, by the case of the fight between the French and German ships, the "Bouvet" and "Meteor," during the Franco-German War, in the West Indies. The two ships closed, the one endeavoured to ram, and the other to avoid the ram, and there was considerable rifle fire in the few moments of passing. Nearly the whole of the loss took place from the rifle fire at that instant. There was a thought which came into my mind when I was presiding over the Magazine Gun Committee, seven or eight years ago, and when we had the earliest forms of magazine rifles before us. That thought has been in my mind ever since, and it is very much confirmed by what the lecturer and others have stated to-day. It is that even with your rifle without the magazine your firing power is somewhat ahead of your supply powers, that you are likely to be short of ammunition as it stands, and if what the lecturer has said be the truth, in opposition to what Colonel Arbuthnot has stated, it would appear that with the magazine your firing power is going to be still more increased without, so far as I understand it, any steps being taken for increasing

your supply. It appears to me, from that consideration of things, that you must be on the eve of some still greater and more complete change than is proposed at present in rifles.

Lieutenant TUPPER: I wish to ask Captain James if he can tell us whether the Austrian soldier carries *all* his ammunition in those little tin frames. If that is the case, I think that system has a great advantage which I have not heard mentioned, namely, that the ammunition is not so likely to be lost out of the man's pouch. The rifle is loaded in a second, and any one who has had experience of skirmishing knows how difficult it is to control the loss of ammunition whenever the men lie down and rise up. They generally lose several loose cartridges from the ready pouch. It is a very great advantage to enable the soldier to retain his ammunition. If those frames were adopted it seems to me that a great deal of the waste of ammunition would be saved, as it is much easier to retain the ammunition in the frames than it is when loose in the pouch, and I hope to see that in the magazine rifle adopted for our Services some such plan for loading and for carrying the ammunition will be provided.

General DUNN: I to a certain extent agree with what Colonel Lonsdale Hale has said. It is absolutely essential with the soldiers of the present day that there should be some power of restraining the magazine fire, and I think if they were provided with rifles with magazines, it should be with such magazines as would be in some manner stopped. I think Captain James mentioned one in which there is a stop.

Captain JAMES: The improved Lee.

Major-General DUNN: That I think is what strikes me as the best, that is to say, it would have the effect of saving ammunition. There would be great difficulty in getting soldiers even in a sham fight to ship or unship the magazines, and there is no doubt many morable magazines would be lost; but if we could have a rifle like the one Captain James has mentioned, with a stop on it so that it can be stopped or started without being unshipped, I think that would both meet what Colonel Hale has said, and also what has been said by Colonel Fraser. I am certainly in favour of some control over the fire.

Major LESLIE: There is one matter I wish to draw attention to here, and which I shall be glad if the lecturer will kindly answer. He especially alluded to the Burton rifle, and condemned it—the inventor I see is here present; but he did not draw attention to this particular fact, which I hope he will refer to in his reply, that the Burton system is by gravitation—that is to say that the bullet falls into its place. All other systems introduce springs which are very likely to get out of order, but the Burton acts by gravitation. I think the strongest argument that can be adduced against the Burton is that it is unsightly. In warfare you only want to use the magazine when the enemy is close to you, and then the æsthetic argument is not of much consequence. It may be unsightly, but I deny that it is not efficient.

The CHAIRMAN: Ladies and gentlemen, I shall not delay you long. So far as the remarks about the mechanical part of the rifle are concerned, I agree with Admiral Selwyn that we ought to have some point from which we are to start. Do we want the rifle for accuracy of fire or for flatness of trajectory, or the bullet for lightness or deadly effect? We hear that experiments are now going on at Enfield, and Colonel Arbuthnot tells us he thinks he is on the road to reducing the bore; but it seems to me that after the breech-loading rifle has been in use so long, with all Europe trying to invent the best variety of it, we should have by this time known absolutely the best rifle, the best mode of rifling, and the best metal to make the bullet of and to cover it with. However, though we have not made our selection, the Continental Great Powers have done so; though it is likely the power of converting their respective arms into the new magazine rifle has had something to say to the choices that they have respectively made. I will therefore dismiss this part of the subject by assuming that our inventors will be successful in producing a perfect magazine arm for military purposes. We will grant the rifle as found: we will assume it is a handy well-balanced arm—not too heavy for the soldier, with a flat trajectory, properly rifled, with a bullet made of the right weight and material, and the powder right in quantity and quality; and, when we have got all these things, we have not done then half our task, for we have to provide the man to use

this perfect arm. It is of no use to put a very delicate weapon into an unskilful man's hands—and it may be really dangerous to put a magazine rifle into the hands of a man unless he has been surely trained to be sparing of his ammunition. That will be our great difficulty. One sentence of Captain James's lecture will show you the way in which these serious essentials are dismissed. He says: "In the under-barrel forms of magazine rifle, it is not proposed to load the rifle during the heat of an action. It could be filled before going under fire, cut off from acting, and only brought into use at the supreme moment." Now, gentlemen, who is to be judge of the supreme moment of a general action? There are a great many Officers here who have been in general actions often enough, but they cannot say which is the supreme moment till the latter is over. Let us picture to ourselves the private soldier with his magazine rifle: he loads it up full of cartridges, and when he sees the enemy coming at him he says, "This is my supreme moment!" and fires off the whole of his store of cartridges. Twenty minutes afterwards he might experience a suppler moment, and twenty minutes after that the supremest moment of all may come, when, with his magazine empty and nothing but his bayonet to rely upon, he may with his life pay the penalty of not having correctly recognized which was to be his supreme moment. Granting, therefore, all that Colonel Arbuthnot can do, and the War Office can do, the real difficulty we have to fight is to find men who have quick eyes, steady hands, and cool heads to use them. This morning when leaving home I happened to see lying about a lecture which I had the honour of delivering on the 12th of April, 1878, in this hall: it was on the breech-loader, and in the first paragraph of that lecture I defined the two principal points for consideration connected with the breech-loader as—"The formidable properties of the arm in attack and defence," and "The helplessness of the arm when short of ammunition." *How are we going to teach the soldier to husband his ammunition?* It can only be done (1) by impressing into him the conviction that with a magazine rifle, plenty of ammunition, and a cool head he is absolutely unapproachable; (2) by making him responsible at the field-days of peace service, that however hot the fire, he must always have ten, or certainly five rounds in his possession, and, if possible, his magazine full; and when he has been so trained, morally as to realize his power, and physically that he husbands his ammunition, there will be no danger in putting a magazine arm in his hands, and he will be fit to use it. Commanding Officers, Adjutants, and Captains must teach the soldier that he must expend his rounds as he does his shillings, and be careful of them. I do not think anybody can conceive a more pitiable case than would be presented by two opposing lines in presence of each other; one line being short of ammunition, and the other line having their magazines full. Therefore, by whatever means it is done in this country, it is absolutely necessary that when the private soldier is enlisted the first object should be to train him to shoot, and the second should be to teach him to economize his rounds, as the most valuable possession he has; because I am perfectly certain there can be no greater danger to the British Army than to allow our men to go into action without that kind of training being previously assured to them. We must recollect the men we get into the ranks are not like the men that Continental nations get by conscription, two out of every three of whom are educated men. These are not the material we get for our Army; therefore we must make our training such as to meet that danger; and even when our men are so trained the action may nevertheless be so long, or the fire so hot, that pouches and magazine are alike in danger of exhaustion, and we must arrange to provide a fresh supply of cartridges. For this purpose in our Service we have a reserve ammunition cart attached to the battalion; and I think we should on every occasion make use of that cart either by issuing a small supply of blank ammunition to men, or by engaging battalions for a considerable time so as to test our system for supplying this ammunition to the troops. I think it would be a very great advantage if on every field-day at Aldershot one or more battalions should run out of their ammunition simply in order to see that our arrangements for supplying fresh ammunition are efficient. The ammunition cart must be made constant use of if we issue this new rifle. It is not given to the troops because we want a quicker shooting rifle than the breech-loader: it is only given for the moral effect, because it would not answer our purpose to send our troops armed with our present rifle

against a civilized enemy. With magazine arms our soldiers would have a kind of moral feeling that they were armed as well as the enemy, and this might qualify their value as soldiers. Therefore as it has been decided to issue magazine rifles, we have to train the men in peace-time, so that when they go into action they shall keep their heads cool and shall feel that with the best rifle and plenty of ammunition nothing can come near them. If the British soldier can only be trained to feel that, he will be careful with his cartridges. I think the question of ammunition carts has not been half enough considered, and it is a question whether making the party in charge of the reserve ammunition cart responsible that it communicates with any part of the battalions heavily engaged as to their requirements in respect of ammunition, might not provide a double security against this greater danger that the issue of the magazine arm may introduce.

Captain JAMES, in reply, said: I will deal first of all with General Bray's remarks. The Remington-Leo does not hold six rounds, but only five. Then he discussed the question about practical and theoretical men, and he was of opinion that practical men would reserve their fire till 400 yards. There were practical men, I believe, at the battle of Gravelotte. The fire from St. Privat certainly ranged over 2,000 yards, and killed a very fair number of Prussians at that range. Therefore, I think it would be difficult in like circumstances to reserve your fire till you get within 400 yards. The Mauser rifle I have shown you this afternoon is an entirely new arm, a new barrel, and a new arm altogether. The old arms have not been altered into the Mauser repeater; new arms entirely have been manufactured. General Bray thinks I should put the Schulhof first. I am perfectly aware of the many advantages of the Schulhof; it is an exceedingly good rifle, but I carefully stated at the beginning of my lecture I did not propose to absolutely advocate any particular weapon, and I think you will agree with me that was the best position for me as lecturer to take up. Had I come down here as an advocate of any special or particular form of weapon, you would very justly have said "Captain James has come here not to give us a lecture on the general question but to forward the particular weapon of some special inventor." I scarcely think that would be becoming in my position, as one who proposed to deal generally with the subject; therefore, whatever may be my own personal opinion of the Schulhof I should feel it wrong to have come down here to advocate that to the exclusion of any other. Colonel

Hope asked me about the $\frac{d^2}{10}$, whether that could not be reduced to one. I should

like to see it reduced even lower were it possible, but if you get it much lower than two, the difficulty becomes so great of using it in the rifle, because you get such an enormously long projectile. With regard to the rifling, I may say rifles are now being made at Enfield with the Enfield-Martini bore—0.4, rifled on the Metford system. There is also a new form of rifling which gives very good results indeed, in fact, so far as the results show, this form is as good as the Metford. Now I will deal with one or two points that Colonel Arbuthnot alluded to. Colonel Arbuthnot's position is this: "A small-bore! Yes. I believe we are going in the direction of a very much smaller bore, but I do not want to go there yet." That is just where I differ from him. I want to get to a final position as soon as we can. I said in a letter I wrote to the "Times" some months ago on this question, that I had sufficient knowledge of the Chancellor of the Exchequer to be quite sure that if we screw out of him the money for the new armament of the British soldier, we are not likely to get a similar sum every two or three years; hence when we settle on our rifle let us for goodness' sake go as far as we can along what is evidently the path of progress. Now as to the height of the trajectory, of course everybody knows the heights are measured from the straight line along which they are plotted, over the horizontal line. But Colonel Arbuthnot omitted one point, namely, that a large proportion of the firing would be delivered when the men were lying down, and consequently if you aim at the feet of the object, as the German soldier is habitually taught to do, the trajectory is very much more like that (pointing) than it would be if the rifle were held absolutely horizontal; and hence the real results more nearly approximate to that—I allude to figures—than Colonel Arbuthnot implied. Moreover, there is another point. Experiment shows distinctly, and I am perfectly sure anybody who has ever seen any firing knows it to be the case, when troops fire a volley the

ground is struck very often fairly close to the rifle, and the bullets go on pretty close to the ground up to a distance beyond the object aimed at. When you get a very flat shooting rifle what you do is you sweep the ground up to long ranges. It is perfectly possible to construct a rifle that shall, for practical soldier purposes, only want one sight up to 700 yards; that is to say, that you shall sweep the ground up to about 700 yards. Allowing for differences in aim, which is a practical thing which is first of all worked out by the Germans in long-range rifle experiments, you will find that with these differences in aim the ground is with a flat trajectory rifle swept for a very long distance, almost from the muzzle of the rifle, and that is why the flat trajectory is such a very great object to the soldier; because, practically, taking into consideration how soldiers do actually fire, and the variable aims that they have, you do get the ground so thoroughly well swept up to long ranges with a flat trajectory rifle. Colonel Hale spoke in favour of removable magazines. Colonel Hale and I are very old friends, though we have before differed here on tactical subjects, so that I am really not surprised to find he again differs from me, as he does from most lecturers in this Institution. The detachable magazine has been tried in America, and it was found the next day that a large number of detachable magazines had been left behind. The result would be that often when the soldier, even a highly-trained man, calm and capable of attaching the magazine, was required to do so he would be in this unfortunate position—that he had not got it. Like the French Admiral who said he had a hundred reasons why he could not fire a salute, the first being that he had not any powder, so would it be with the soldier in the case of the detachable magazine, he would have detached it once for all, and he would not be able to use it when the proper moment came. Detachable magazines may be lost, and when it is the weapon is no longer a repeater. Moreover, how is the Officer practically to ascertain under fire whether the soldier has affixed his magazine or not? Such theoretically fine distinctions savour much more of the study than of practical experience of war. Be certain of one thing, there will come a time in every fight when no power will be able to prevent the soldier using his magazine, whether fixed or detachable, and do not attempt to introduce an inefficient weapon simply for an illusory and theoretical advantage. How can you tell in action when one out of ten soldiers has fixed his magazine? You cannot even be certain at target practice of the exact number of rounds each man fires in open order, much less can you under heavy fire when all your energies are taken in watching your men, in looking to the effect of your fire, in observing the movements of the enemy, afford to devote your attention to ascertaining whether each individual Tommy Atkins has or has not attached something to the underneath portion of his rifle. Admiral Selwyn stated what I believe to be the right way of regarding a rifle. In making a rifle what have you to deal with? First of all you have to deal with the bullet. Let us start with what the bullet is. What do you want it to do? To give a flat trajectory. You want, therefore, a high velocity. Then see what powder you require to obtain this, what sort of case you are to put it in. What rifling do you want for the barrel, and then, lastly, comes the breech and the magazine. Admiral Selwyn says you cannot have a cartridge-case with a bullet so that the two together are longer than 2 inches. Now I must point out to the audience that the whole of Europe is on the other side; personally, I am on the side of Europe. Admiral Selwyn also says you violate a physical law by using another metal than lead for the bullets. I am prepared to violate all Admiral Selwyn's so-called laws, but which we must remember are only his personal views about the laws, if I get what I consider a better bullet. I must draw attention to another point. He stated that if you use certain powder you will injure your rifle very much. That is perfectly true, but it does not follow that the white powder would produce nitrous acid. It does not follow that there are any nitrates in the composition. There may be chlorates, but it would be an extraordinary chemical process to make nitrates out of chlorates. Major Leslie objected to my remarks about the Burton rifle, and said as far as he understood what I had said that I did not like the Burton rifle because it did not please my æsthetic feelings. Well, I candidly admit I am very æsthetic. I admire everything that is beautiful in nature and in art, whether it be in the surrounding scenery or even in the magazine rifle. But I venture to draw attention to this point, that I never used the word æsthetic,

and I never said anything in my lecture which would lead anybody who I think brings an unbiased judgment to bear upon the subject to believe that I objected to the Burton rifle because it was not beautiful in form. If it is a rifle that suited our requirements I should be the first person to advocate its adoption. I stated that I did not advocate any particular form. I say once more, a magazine on the side is not as well suited for the soldier as a magazine underneath. I think the Burton in many respects an admirable rifle, but I do think the arrangement of the magazine on the side is not as good for the soldier as it is when underneath. I decline to enter into any argument as to mechanical arrangement, because I do not think a lecture theatre is the proper place for it. I can only once more say, I do not think it is so good as other forms of magazine, but I certainly did not condemn it in strong terms, because I believe I spoke in the most guarded manner about it. Admiral Boys asked me if I was aware of any form of magazine rifle which worked by means of the left hand, so that the right hand did not get taken away from the trigger. There is a form of rifle for a small cartridge; but when you come to a long cartridge, as you must have, it is quite impossible to use that system because the travel of the left arm would be so great. Lieutenant Tupper asked me whether the ammunition of the Austrian rifle is always kept in these cases. Yes, it is. As I stated, it is served out to the soldier in two cases put together and wrapped round with paper. That is the way that the ten rounds are issued to the Austrian soldier, so that he always has his cartridges in a form out of which they cannot easily tumble. And now one word about what Major-General Clive said in his remarks. I am perfectly certain of this, that whatever system of rifle you have, whether a magazine or an ordinary breech-loading rifle, it is no good having the most perfect one in the world unless the men into whose hands you place it are themselves properly trained. I do venture to say one thing most distinctly, and I am perfectly certain a large number of Officers in this theatre must agree with me, that the present practical training of the British infantry soldier is by no means on an equal footing with that of the foreign soldier, and it has by no means reached the level which it must reach if the British soldier is to go into the field as thoroughly conversant with his duties and as able to carry them out as is at the present moment the German. General Clive mentioned one point on which I personally have a very strong feeling: he said the Colonels and Adjutants, and Captains must look to the training; but he must go one step lower, he must go to the Lieutenants. Every single Officer who leads his men into action must fully know beforehand what is required of him. He must have that training which practice in peace under conditions of war alone can give, and for anyone to imagine that troops who may be excellent at marching past, who may drill like a stone wall, are tactically fit to meet a properly trained foe, is a delusion which will only be done away with at the price of defeat and slaughter on the battle-field. This is a question to which the attention of all the higher authorities in the Army must be called. It is useless for us to imagine at the present moment that our troops as they are are fit to meet any foreign foe, because they are not trained on any system equal to that of the French, German, Austrian, or Russian, in fact, not equal to the system of any nation who practically knows what war means.

Major-General DENNE: The lecturer having the last word, it is impossible for me now to reply to the unexpected remarks on the want of proper training amongst our men, but coming from our principal School of Instruction at Aldershot, I must protest against much that has been said against the way we prepare our troops for war, and I beg this meeting to believe that we are not a quarter as bad as we have been painted. (Applause.)

A vote of thanks to Captain James for his interesting lecture was then carried unanimously.

MAUSER, FIG. 1.

ARRANGED FOR MAGAZINE FIRE. CARTRIDGE IN POSITION TO BE PUSHED FORWARD INTO CHAMBER.

MAUSER, FIG. 2.

ARRANGED FOR MAGAZINE FIRE. CARTRIDGE IN CHAMBER, ANOTHER IN ELEVATOR (C). BREECH CLOSED.

MANLICHER, FIG. 5.

MANLICHER, FIG. 6.

FIG. 7

JARMANN, FIG. 8.

MAUSER, FIG. 3.

MAGAZINE CUT OFF.

Plate 4.