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Monday, April 17th, 1871.

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Harbord, J. B., Chaplain, R.N.
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ON THE MILITARY BREECHLOADERS OF PRUSSIA, FRANCE, AND ENGLAND.

By Captain MERVIN DRAKE, Instructor of Musketry, R.E.

THE subject of military breechloaders has been so often and so fully discussed here, that it needs no introduction from me. I propose, then, this evening briefly to remark on the rifles used in the late Continental War, and to endeavour to bring before you the position of our own country as regards breechloaders down to the latest date.

The Prussians—I take them first, as having been the first to adopt breechloaders generally—used during the late war, and are still using, the same weapon which they used at Königgrätz in 1866, and the same which, patented in England in 1835, was adopted as the arm of the Prussian infantry in 1840—a date when in England, the first mechanical country in the world, as we are pleased to think it, we were still satisfied with the old Brown Bess, and with the flint lock which had lasted us for more than a century and a half. The needle-gun is so familiar to you all that I need not enter into any detailed description of it. I will, therefore, merely remark on the advantages and disadvantages which it appears to have when looked at by the light of modern experience of breechloaders. First, its advantages. It is strong; only two parts, the spiral spring and needle, are liable to damage; of these the soldier carries a reserve supply, and they can be replaced with great ease. It is simple. Its action depends on old and well-known mechanical principles. It can be made, as pointed out by Mr. Latham in this room, by any engineer accustomed to lathe work; it is taken to pieces, “stripped,” as we call it, without the least

difficulty and without mechanical knowledge; and it can be disabled in a moment by removing the breech mechanism. This last was an advantage claimed for it by the inventor, but one on which I confess I do not lay much stress, being inclined to think that a soldier who was so hard pressed that he threw away his rifle and ran for it, would not be very likely to stop to remove his breech mechanism as a preliminary measure. It is cheap. The fulminate being placed in front of the powder is less exposed to accidental ignition than if placed at the base of the cartridge, and perfect combustion is ensured. On the other hand, it has its disadvantages. 1. It is very heavy, weighing without bayonet 10 lbs. 10 oz. 2. It is clumsy. 3. It requires two more motions to load and make ready than are necessary with the best modern arms, the last of these, which I may call cocking, being somewhat hard to do, especially on a very cold day. 4. It is liable to escape of gas. On these two last points the Small Arms Committee report as follows: "The breech mechanism of this rifle was slower and more difficult of manipulation than that of many other arms brought before the Committee. * * * There was a great escape of gas at the breech." 5. It fires a paper cartridge; and all paper cartridges were condemned by the same Committee, as being more liable to injury by rough usage, damp, and exposure, and more liable "to accidental explosion" than the Boxer cartridge, which was made the standard. I am speaking now of the *present* needle-gun, the old pattern, such as I have in my hand, was loaded by emptying the powder into a chamber and then putting in the sabot and bullet. The cartridge is now made up as shown in the drawing on the wall. So much for description of the celebrated Zündnadelgewehr. I have recapitulated its good and bad points, because, although it has been familiar to many people, and especially to regular attendants at these lectures for years, it has lately been much talked about, and there may possibly be some present who are not acquainted with it.

While the Prussians have used in this terrible war but one rifle, their antagonists have been compelled to use a variety. Indeed, most of the numerous breechloaders which have cropped up on "the supply and demand principle" during the last few years, are represented among the French arms in use. Of these it will be only necessary to mention two, as being Government breechloaders, the Tabatière and Chassepôt. The Tabatière is a conversion, like our Snider, which, as you see, it very closely resembles; it gets its name from the closing of the breech being so like the shutting of a snuff-box, and gave the lively little "Pantalons Rouges" the chance of welcoming it with the song of—

J'ai du bon tabac dans ma tabatière,
J'ai du bon tabac, Bismarck, en voudras tu ?
J'en ai du fin, j'en ai du rapé,
C'a serait bon pour ton schu nez.

The Chassepôt, the adopted arm of the French, is, as you see, very much like the needle-gun in mechanism. Both being what are known as "bolt-guns," the principle being that of an ordinary door-bolt. Let us look at its advantages and disadvantages. Advantages:—

1. It is light and handy, weighing only 9 lbs. 2. Throwing a light bullet (380 grs.) with a comparatively small charge of powder (85 grs.); the ammunition is light, and occupies but little space. 3. Requiring one motion less than the needle-gun, it is quicker of manipulation. 4. Having Whitworth rifling it is capable, so far as the barrel goes, of giving great accuracy. 5. It has a very flat trajectory—a matter of infinite importance for general purposes of action. 6. It has a half-cock. I mention this because it is claimed as an advantage, not because I consider it so myself. On the other hand: 1. It is an expensive gun to make. 2. Like the Prussian gun, it fires a paper cartridge. 3. The end of the steel cylinder through which the needle works gets very hot and makes loading both difficult and disagreeable. 4. The india-rubber washer is apt to get burnt away. 5. The cartridge is difficult to make correctly. 6. The cap is difficult to make, the cap composition having to be put in wet and pressed. 7. The gun requires frequent cleaning. 8. The spiral spring gets dirty, and then fails to force out the needle.

The opinions on this arm given to the Small Arms Committee in February, 1868, by those who had tried it in England, or seen it used in France, were that it was liable to miss-fires; that though the trajectory was flat at short ranges, the accuracy was not good at long ranges; that there was a loss of power in consequence of the large size of chamber necessary to consume the paper cartridge; and that the india-rubber wad was liable to stick to the end of the needle cylinder and then get left in the chamber. The Committee themselves found the same difficulties in loading, and had many miss-fires.

These difficulties, owing chiefly to the use of a paper cartridge, might be obviated by the adoption of a metal one. But the Chassepôt, like the needle-gun, is, be it remembered, on the bolt system, and with that system there is always the danger of the cartridge being exploded when pushed up by the bolt, which happened to Sir Henry Halford at Wimbledon.

As regards the effects of the needle-gun and Chassepôt during the war, I have been favoured with the following interesting information from a gentleman, Mr. Pratt, who was employed as an Assistant Surgeon under the "*Croix Rouge*." He says that the lightness of the bullet used in the Chassepôt caused it to be very easily affected by wind. The half-cock (so-called) far from being a position of safety proved to be very much the contrary; all day long in the camps round Metz chance shots were heard going off, and many sad accidents occurred from this cause. The arm was very liable to foul; one constantly saw the men spitting into the breech and trying to clean it out with their fingers. Although the rifle would shoot true up to 800 yards, the men seem to have wanted musketry instruction, for Mr. Pratt says he has seen several crack shots trying to pick off outposts at 600 or 700 yards without success. He adds, "I believe that their implicit belief in the enormous range of their rifles was one of the principal reasons that the French soldier lost so heavily from want of ammunition at the proper time. It was no uncommon thing to hear a smart fusilade going on, and see the men firing away

from the hip at 1,000, or even 1,100 yards, I need not say without any effect." The Prussian gun, he says, carried accurately up to 500 yards, and the men, not opening fire until nearly at that range, had ammunition left when they got to the terrible 200, where trajectory has ceased to matter, and a large majority of bullets find their marks. The difference in the wounds produced by the two arms was very striking. The Prussian skittle-shaped ball traversed limbs, in and out, doing but little damage. The wound of entrance is very small, sometimes hardly admitting one's little figure, and, strange to say, the wound of exit, in nearly every case, is very small also, the only thing to mark it being that the edges are everted. "I have seen," Mr. Pratt says, "cases where four apertures were made by a bullet traversing the anterior fleshy mass of both thighs, where the wounds of exit and entrance were not larger than a shilling, and where the wound healed up with only a slight suppuration along the track of the bullet. In cases where the bone was fairly struck, there was, of course, a large amount of mischief; but even then the bone in many cases was simply fractured across at the point of impact, with perhaps a slight exfoliation afterwards." Of the effect of the Chassepôt speaks very differently. "The wound of entrance is small, *but with jagged edges*, whilst in some cases you might put your fist into the wound of exit. This is not always the case, but invariably the exit wound is large and most severe. In cases where a 'long bone' is struck, not only is the bone broken, but it is splintered for several inches, both above and below the point of impact, thus rendering amputation the only resource."

Here we have the results of high velocity and rapid rotation, as shown also by the experiments made by the Small Arms Committee on the 3rd of November, 1868, when, in firing at the body of a horse recently killed, the Martini-Henry, striking the near shoulder, smashed the shoulder-bone into so many pieces that it was like small shot; the leg was cut out from the skin of the off shoulder, a piece of bone being carried through.

I shall have to speak more particularly of the accuracy and trajectory of the Chassepôt when I come to compare it with English Government arms.

I come now to speak of English Government breechloaders, and will confine myself to infantry arms. But first it will perhaps be desirable to recapitulate briefly what has been fully detailed in this matter at different times—the history of our adoption of breechloaders in the infantry.

In July, 1864, General Russell's Committee reported that it would be desirable to arm the whole infantry with breechloaders. In August, 1864, an advertisement was issued, calling for proposed systems of converting the Enfield, and the Snider system was adopted. This system stood well for the breechloading prize at Wimbledon, but failed to succeed entirely on account of the badness of the ammunition. Colonel Bertram invented a cartridge, Colonel Dixon improved the mechanism, and we had a breechloader at least as good as any continental army had at that time, and therefore quite good enough to do until further

experiment had proved whether a better could be found. In October, 1866, an advertisement from the Secretary of State for War called for proposals for breechloading rifles, either repeating or not repeating, the 5-grooved Snider-Enfield, and Boxer cartridge being the standards required, if possible, to be surpassed. Colonel Fletcher's Committee weeded the 104 systems to 9, and recommended that six arms of each system should be submitted to further trial. This was done. Evidence from Officers of experience, gunmakers, and others was taken by the Committee, and fresh trials of the nine selected arms of the previously rejected systems, and of 44 fresh ones, were made, resulting in the recommendation of the adoption of the Martini breech action, the Henry barrel, Boxer cartridge case, and Henry wad and bullet. 200 long-actioned rifles and ammunition were issued to regiments and ships for trial in December, 1869, and a Committee was appointed to collate and remark on the reports received. They recommended some alterations to be made in rifle, ammunition, and bayonet. In October, 1870, 22 short-actioned arms were issued for trial, and on the 8th February, 1871, the Committee made its final report, recommending the adoption of the short-actioned Martini-Henry rifle, short-chamber (or bottle-neck) Boxer-Henry ammunition, and for land service the Elcho bayonet.

Perhaps I may venture here to make a few remarks on the action taken by Government in this matter, with reference to the numerous strictures that have appeared on the subject. It seemed to be desirable to get breechloaders; a Committee inquires into the whole question, hears the *pros* and *cons* (and remember that, at that time, there were very many *cons*), and reports that it is desirable. A means is sought of converting and utilizing the large amount of valuable arms in possession; in about six months we have 40,000 breechloaders better than those in use by any army in Europe, and a Committee sets to work to find out what is to be the arm of the future. The constitution of this Committee has been much criticised, especially by disappointed inventors, and their friends. Who composed it? The President, a Field Officer of the Guards, of experience and known judgment, just returned from the American War; as members, two Musketry Instructors, approved by General Hay, the Chairman of Council of the National Rifle Association, himself a very good Enfield and small-bore shot, and a gentleman, who, besides being a first class deer-stalker, had won the gold medal by small-bore, and the silver medal by Enfield shooting in the Queen's Prize at Wimbledon. Surely a Committee competent to judge of the suitability of a rifle for the Soldier, the Volunteer, and the Crack-shot.

In their second series of experiments, this Committee strove to find the best barrel and the best breech action separately; then they put them together, and finding that their junction had not lessened the good qualities of either, they adopted the arm so made. The opponents of the arm still said, that the arm would fail in the hands of soldiers: Government then had it tried by soldiers; improvements suggested themselves, were adopted and tried, and from the results of these last trials, a pattern arm has been arrived at. Be it observed, also, that the Committee, which received the reports of trial and suggested the

J. Joblins

alterations was *not* identical with that which first adopted the arm, only the President and one Member remained, four fresh officers were put on; for Lord Spencer was substituted Lord Elcho, who certainly could not be accused of being prejudiced in favour of the arm, and to satisfy objectors, Mr. Gregory, late President of the Institute of Civil Engineers, was added. Complaints have been made, on the one hand, that Government did not, on the recommendation of the first Committee, straightway arm the whole Army with the gun of their adoption; and, on the other, that they have acted *unfairly*, in "tinkering" up the gun to make it equal to the requirements of the service. What Government had to do, was to furnish the Army with the very best breechloader that could be got; and I submit that the course taken was admirably adapted to accomplish that object. Surely it was better to go on improving where possible; all private inventors have done so, the latest patterns of their breechloaders differing in many points from those of a very few years ago; and, as regards the delay, surely it would not have been wise to make expensive machinery to turn out guns, which experience might prove, as it has proved, to require minor alterations. It being always borne in mind that all this time we were not unarmed; we had an excellent breechloader in the Snider, about which I must say a few words, as it will probably for some time be the arm of our Reserve Forces. The Snider-Enfield is, as you know, the Enfield rifle of 1853 converted into a breechloader, on the system of 1857, as shown in Henry the Eighth's gun in the Tower; its accuracy, therefore, is simply that of the Enfield; briefly, it shoots fairly up to 600 yards, badly at longer ranges, and has a simple and (as improved) safe breech action, giving considerable rapidity of fire,—the *extreme* rapidity was, I think, stated by Captain Majendie to be 15 rounds per minute. Altogether quite a good enough arm to trust to until we could get a better one, and learn to avail ourselves of its superiority. Until the Emperor adopted the Chassepôt, I believe that the Snider-Enfield was the best "arm in use."

I now come to the most important part of my subject, the "arm of the future," the Martini-Henry rifle. Every breechloader consists of three component parts—barrel, cartridge, and breech mechanism; and although these three are so entirely dependent on each other, that the value of an arm can only fairly be estimated by considering the three as forming one harmonious whole, yet, for convenience sake, I may perhaps be allowed to speak of them separately. They have been so well described in this room by Captain Majendie, that I will only give a brief description for the benefit of those who may not know the rifle. First, then, the barrel. This is the invention of Mr. Henry, the Edinburgh gunsmith. It has seven grooves, as shown in the drawing; its length is 2ft. 7½ins., its weight 3 lbs. 6¼ oz.; the grooving has no turn in 22 inches, the 3-grooved Enfield, it will be remembered, had one turn in twice the length of the barrel, or 78 inches. As a proof of its accuracy, I give the following summary of results obtained by taking the average of 5 targets of 20 shots each:—At 500 yards, 15 foot; at 800 yards, 1.47 foot; at 1,000 yards, 2.80 feet; at 1,200 yards, 3.46 feet. The accuracy of the Henry barrel, however, is well

established. Mr. Westley Richards has adopted it for his new and excellent breechloader in place of the one he formerly used, which was an application of the Whitworth system. The bore is .45, the calibre found, after long experience, to give the best combination of accuracy and trajectory.

An infantry arm, now that there are no special sharpshooter corps, has to fulfil two conditions: to give great accuracy at long ranges, so as to enable marksmen to oblige an enemy to keep out of its reach, to annoy artillery in the field and working parties at sieges, and also to be a deadly and effective weapon when fired into masses of men at comparatively short ranges; and for this latter condition flatness of trajectory is eminently necessary. The aim taken by troops in the heat of action at an enemy within 300 yards of them is not likely to be very careful, nor is much attention likely to be paid to the adjustment of the back-sight; the arm, therefore, which will be least affected by mistakes on this point is, *ceteris paribus*, the most valuable for short ranges. At 300 yards, the greatest height of the trajectory of the Henry barrel, using the Boxer-Henry ammunition, is 2' 7" above the horizontal line of sight; at 500 yards, it is 8' 2". By this table of velocities of the Chassepôt, Martini-Henry, and Snider-Enfield, calculated by Lieutenant Sladen, R.A., you will see that the Henry, though starting with less initial velocity than the Chassepôt, holds its velocity better in consequence of the greater weight of the bullet. At 150 yards you will observe that the velocities are nearly equal; from this point the Henry takes up the running, and at 500 yards its bullet is travelling 30 feet a second faster than that of its French rival; but the Henry bullet would not overtake the Chassepôt until 450 yards, which distance is accomplished as follows:—

Chassepôt in	1.28269 second
Martini-Henry in	1.28200 „

At short ranges, then, the Chassepôt has a flatter trajectory than the Henry, but at longer ones the advantage lies with the latter and increases with the increase of range. Of course the trajectory of the Henry could have been flattened by using a lighter bullet, such as the Chassepôt of 380 grains, but the difference was found on experiment not to be sufficient to warrant the sacrifice of accuracy which would have followed as a matter of course. The Henry has also the great advantage of being less affected by wind.

The penetration given by this rifle is very good, as shown by the following facts. The Henry penetrated 17 half-inch elm planks, one inch apart, from 30 yards; Snider failing after the ninth; at 100 yards, the Henry went through three balks of dry fir and one of green fir, each 3 inches thick; at 350 yards, the Henry went through a mantlet, consisting of four thicknesses of 3" rope, which was proof against the Snider at all ranges; at 25 yards it went through an ordinary gabion filled with earth and also through a sap-roller, both of which were found proof against the Snider at 10 yards; at 100 yards, it went through a filled sand-bag in one case only. It was commonly urged against the introduction of a small-bore rifle into the Service, that it

would not stop large game, such as horses and men; "that it was well known to Indian shikarrees that to stop large game of any kind you *must* have a big bullet; that a small bullet travelling at a high velocity would simply go through, making a small flesh wound." The following experiments would go to prove that this fear was somewhat groundless. They were made on a horse directly after death.

Henry, at 45·50 yards, broke thick part of thigh-bone of off hind leg; the bullet remained in, the bone was smashed to pieces. Henry, at 45·50 yards, struck near shoulder, smashed shoulder-bone into so many pieces that it was like small shot; bullet cut out from skin of off shoulder, a piece of bone was carried through. On these experiments Veterinary Surgeon Harrison, R.H.A., who was present, reports: "The smaller bullets appeared to me to produce the most severe fractures, the larger ones more disposed to flatten and traverse the soft tissues adjoining the bones."

So much for the barrel. Now for the breech action, on which, after long and anxious experiment, the Committee decided. It is called the Martini, having been originally entered for competition by Mr. Frederick von Martini, of Switzerland. In the original competition it stood but seventh in order of merit, having been wedded to an inferior barrel and supplied with faulty ammunition.

It is on the falling-block system of the Peabody and the present Westley Richards, and various other rifles. The breech-block falls and rises on a hinge, and is worked by a lever behind the trigger-guard; this block contains a spiral spring and piston, which is driven directly into the cap of the cartridge. The action of opening the breech throws out the empty case by means of a lever extractor, and at the same time cocks the rifle. In lieu of half-cock, a position of safety is obtained by means of a sliding-bolt. It passed satisfactorily through the very severe tests to which the arms were subjected by the Committee, viz., carefully covering the action, both opened and closed, with fine sand; using purposely damaged and extra sensitive cartridges; exposure, and rapidity. On one occasion, after exposing the arm to the influence of rain or of water, artificially applied for seven days and nights, it fired 20 rounds in 1 minute 3 seconds; the breech action worked as smoothly as it had done when the arm was clean, and in every case the extractor ejected the cartridge. When taken to pieces and examined, the block containing the spiral spring was entirely free from rust, and the other portions of the breech mechanism were only slightly discoloured by it. For rapidity, Captain Mackinnon fired 20 rounds in 48 seconds.

The ammunition known as the Boxer-Henry consists of a Boxer-coiled case, made in what is known as the "bottle-neck" form, to avoid extreme length, containing 85 grains of Waltham Abbey No. 9, or Government K, powder, a wax lubricating wad placed between two jute wads, and a Henry bullet, which is solid, and hardened with one-thirtieth of tin. Its weight is 480 grains.

Putting then the parts which I have so briefly described together, we have the Martini-Henry rifle with its Boxer-Henry cartridge.

The arm has been very fully criticised, and it will be interesting to try to find out the value of the many objections which have been raised.

These I will separate into two classes; 1st, those found to exist on actual trial when the rifle was put in the hands of soldiers and sailors; and 2nd, those which have been raised theoretically against the arm considered as a piece of mechanism. I will take the faults mentioned in the reports of the officers who conducted experiments *seriatim*, and comment on them. Certain questions were addressed to these officers, and answered after each month of trial.

Question 1. "What accidents, if any, have occurred?" No accidents properly so called are reported; two cases, of rifles going off when not intended to, having evidently been caused by the actions having been "regulated" by the armourer-serjeant of the regiment.

Question 2. "What difficulties, if any, have been found on loading?" Many complaints were made under this head; in the majority of cases the difficulty was caused by the paper covering of the long cartridge which got "rucked up" and jammed the cartridge, or by the cartridges getting bent in the pouches (although it was very easy to straighten them by means of the breech action itself); a few cases were reported of cartridges with large base caps. The adoption of the short-action rifle with the bottle-neck cartridge and no paper, seems to have entirely got over these difficulties.

Question 3. "What difficulties, if any, have been found in extracting cartridge cases?" No difficulties were reported attributable to the arm. In this case, however, the short action does not seem to act quite as well as the long, more power being required at the end of the stroke of the lever.

Question 4. "Has the lever in any case been broken, or so bent as to impede the action?" No.

Question 5. "Has rust been found to accumulate about the breech so as to affect its working?" The answers to this question were most satisfactory. The exceptions were in the case of some rifles at Montreal, which are stated to have got very wet on three successive days, and to have been much affected by rust; and of a rifle at Hythe left accidentally at full-cock, of which the striker got rusted firmly into the block. On the other hand, at other places the action seems to have gone through rather severe trial successfully; for instance, at Rawul Pindie the arms were exposed for 42 hours to very heavy rain, dust-storms, and sun. Twenty rounds of blank were then fired from each arm without a miss-fire. One of five rifles which I had to try, was not cleaned once during the four months of December, January, February, and March, during which time it fired 3,102 rounds without a miss-fire. When I took it to pieces, I found but little rust, though a considerable quantity of dirt, which however did not in any way affect the working of the action.

Question 6. "Has the coil spring been found to become weak or inefficient?" With the long-action arms first issued, there were numerous miss-fires, attributed to defective mainsprings. On inquiry it appeared that instead of 40 lbs., the strength originally fixed by Mr. Martini, the springs of these rifles weighed only 26 lbs. Stronger springs were substituted, and the miss-fires have ceased. The strong springs have, however, increased the labour of loading, and given rise

to difficulty of arranging the pull-off satisfactory, which has, I believe, been overcome in the pattern arm now before you, but which I have had no opportunity of testing. For my own part, I liked the weaker coil-springs best. I fired many hundreds of rounds from the five rifles sent to me for trial, and I never had a miss-fire; it depended entirely on the way of pulling the trigger.

Question 7. "Is the action of the extractor in throwing out the empty cartridge case considered too sudden?" It was not found so, but it is less sudden in the new arm.

Question 8. "The stock being in two parts, has it remained firm and strong?" The screw bolts of some of the rifles became loose; this has been rectified in the new arm.

Question 9. "Has the butt end been found to shrink or become loose from the effect of hot dry temperatures?" A few cases are reported, but the new method of stocking will get over this.

Question 10. "Is any inconvenience experienced from recoil?" The replies to this question vary considerably, some regiments thinking the recoil greater than, some equal to, and some less than that of the Snider. The fact appears to be that the recoil is rather greater than that of the Snider, but is not sufficient to be any objection when the men become used to the arm, and it is to be hoped that, being armed with so good a weapon, they will have more opportunity of becoming used to it.

Question 11. "Is the weight of the arm a practical objection on service?" Here again opinions differed materially, the balance, however, being against the arm on this point, the long-action rifle weighed 9 lbs. 7 oz. Now all sportsmen will agree that in a long day's shooting, even partridge shooting in England, when one carries as little weight as possible, the weight of the gun makes a considerable difference in one's freshness, and man-stalking is at least as hard work as any other stalking, especially when you consider the weights to be carried besides the gun; knapsack, great-coat, sword, ammunition, haversack, and water-bottle. The Committee seem to have had this opinion, for the new pattern arm weighs but 8 lbs. 7½ oz. A 12-bore breechloader generally weighs about 7 lbs.

Question 12. "Is the position of the back sight approved of?" It was liked for shooting, but found to be in the way when carrying the arm at the trail. This was a question of balance, and the barrel having been shortened and lightened, the back sight is no longer in the way.

Question 13. "How does the sword bayonet answer as a weapon of attack and defence?" Generally approved of, but the position, or rather shape of the lever, found inconvenient. This has been altered, and a new pattern of sword bayonet, the Elcho pattern, has been adopted.

Question 14. "Does it answer as an implement on service for cutting wood?" The first pattern was not handy to use, it hurt the hand; the Elcho pattern seems to be approved of.

Question 15. "Are the cleaning implements found useful?" They were found so, but the cleaning rod worked loose in firing: this has

been obviated. A suggestion was made from various quarters that a *ramoneur* should be carried, such as is supplied with sporting guns and carried by the Americans; this would appear worth consideration.

Question 16. "Is the muzzle-stopper found generally useful, and is it desirable to introduce it?" On this point opinions differed; the muzzle-stopper was liked in itself, but many people objected to a muzzle-stopper at all, on the ground that it is dangerous and likely to be lost, thereby putting the soldier to expense. Obviously, it is a good thing to have a muzzle-stopper in the rifle when it is not in use, and a bad thing when it is. Might not the stoppers then be fastened to the arm-racks instead of being loose? they would then afford protection to the rifle when in the rack, and could never be taken on parade or lost. If a rifle be cleaned after a man comes off guard, as it ought to be, surely it would receive no damage from the amount of rain which might possibly run down the barrel in one guard.

Question 17. "Has the ammunition been found liable to become broken or damaged in transport or when carried in men's pouches?" The long cartridges got bent; the short ones seem better adapted to transport, though not quite so able to resist wet.

Question 18. "Has any difficulty arisen from this cause in loading or extracting?" The paper of the long cartridges caused difficulty, which no longer exists now that the short bottle-neck is adopted.

Question 19. "Is the form of the cartridge found convenient to use?" The short one is much liked.

Question 20. "Have any of the cartridges cut round the base?" On this point the evidence is satisfactory, only one instance of cut being cited with the new cartridges.

Question 21. "Have any of the caps given way?" No.

General observations were made by the officers conducting the trials as to their opinion of the arms, and suggestions as to minor alterations were offered. To give an idea of what the arm can do in the hands of soldiers, I will give you a few of the results obtained during our trials at Gravesend. Firing individually, giving each man a 2nd class target to himself, at 500 yards I found that a steady man would make about 20 hits in two minutes. In March I had an opportunity of having the rifles fired by a squad of recruit officers to whom I purposely gave no previous drill with it: they used it with the greatest ease, and made good practice. Some of them felt the recoil.

The general observations were very favourable to the arm, especially as regards the short-actioned one. It is commended on all hands for accuracy, not being affected in shooting by side-wind, simplicity of action, and durability. Some objections are raised to the platinum lines on the back sight, as not being easily seen when the light is in front of the firer; this might be easily remedied by cutting a small square notch in the centre of the bar, and smaller ones of the same, or even of different shape on either side. In fact, the objections *found* to exist in the first arm have been remedied in the present one, and may be considered got rid of.

So much for practical objections. Now for theoretical or imaginary ones. These, being matters of opinion, had to be so considered and met

by opinion. The last Committee, besides having among its members Mr. Gregory, late President of the Institute of Civil Engineers, took evidence from mechanical engineers of high standing, in order to find out whether the statements so confidently asserted as being those of "every practical mechanic" were in reality so or not, as, if they were, it was obviously their duty to institute further experiment, in order to find out whether these opinions were supported by fact before finally recommending as the arm of the whole British Army and Navy a rifle so radically wrong in construction as the Martini was supposed to be. They therefore examined Mr. Nasmyth, the inventor of the steam hammer, a gentleman with 40 years' active experience as a mechanical engineer; Dr. Pole, who was for many years Professor of Civil and Mechanical Engineering at University College, London, and was a member of the Iron Plate and Armstrong-Whitworth Committees, who had been brought up from his youth in a mechanical workshop, and been connected all his life with mechanical engineering; Mr. Woods, a Member of Council of the Institute of Civil Engineers, with 35 years' experience of mechanical engineering; Colonel Dixon, R.A., the Superintendent of the Government Small Arms Factories, through whose hands most systems of rifling and breechloading must have passed during his tenure of office at Enfield; Mr. Davidson, the mechanical manager of work in the Laboratory; and Mr. Perry, a practical gunmaker, with 16 years' experience at Enfield. It can scarcely be said that the witnesses called were not capable ones, and the vulgar suggestion, which I read in a paper the other day, of their opinions having been influenced by their retaining fees, is of course simply beneath consideration. We will examine the various objections which I have been able to collect *seriatim*. 1. The whole recoil is taken by the block axis-pin; if this pin gives way, the breech-block blows out. I have heard this objection urged frequently; the opinions of the scientific and practical gentlemen whom I have named show that theoretically this assumption is incorrect, and fact proves it still more conclusively. Lead block axis-pins have been used, and not bent in the slightest degree, and one regiment, while reporting on accidents, says that this pin, having become loose, and dropped out from one rifle, 40 rounds were fired without replacing it, and no inconvenience was experienced. This objection, then, is disposed of, both by theory and experience.

Objection 2. "The position of the lever is bad; it acts at the wrong end of the block, and it would be inefficient for elevating and depressing the block, and for retaining it in its place." First, as a matter of fact, the lever does elevate and depress the block with ease and certainty, and, as regards the support when firing, the Peabody block has no support at all, and yet is quite safe. As regards opinion, Dr. Pole considers that, instead of calling this a lever, it should be considered part of a system of toothed gearing; also, that the present arrangement being strong enough for its purpose, there would be no object in departing from it for the sake of a mere hypothetical advantage. Mr. Woods says, "The working lever possesses adequate strength for the performance of its various functions, viz., lowering, raising, and

"supporting the lock, cocking the rifle, and working the extractor." Mr. Nasmyth says, "So far as I am capable of judging, the working lever is placed in a suitable and convenient position, and has at the same time ample power for performing the duties assigned to it, and with every reasonable probability of doing so without undue wear and tear." Colonel Dixon quotes the case of the Peabody in proof of the sufficiency of support. Mr. Perry gives no direct evidence on this point. Mr. Davidson "considers the lever properly placed for the duty it has to perform." Experience and opinion seem again to concur in favour of the system. It is not contended that putting the lever at the other end would not be stronger, but that additional strength is not required.

Objection 3. The spiral spring (*a*) would rust; (*b*) would get weak with use; (*c*) would not give a sharp, but a pushing blow; and (*d*) is an innovation on a well-known and long-tried system of ignition. Mr. Davidson disapproves of the spiral spring; he thinks it would be liable to rust; that extreme cold would tend to snap it, extreme heat would weaken it; that great difficulty would be found in getting uniformity of material, although there ought not to be; that the spiral spring would give a pushing blow, although the one in the Martini action does not, because you have an overplus of force bottled up in the spring; that his experience of spiral springs in machines was unfavourable; that all springs are liable to failure, the spiral more so than the flat or lever spring; at the same time he thinks the form in which this particular spring is applied is very compact and convenient, and by storing up an excess of power may serve the purpose required, and that in its present form, combined with the striker, it is in the best possible position for applying the stored-up force in almost a direct line with the axis of the barrel, but thinks the limited space through which the striker moves an unfavourable feature. This, be it observed, is chiefly opinion, with the exception of the experience of the failure in certain machines; but, on further examination, it appeared that the springs of which this gentleman spoke were, by his own account, "not made of the very best material," "were roughly made," and "that their character could be improved by a system of careful selection;" also, that he "did not consider the spiral spring as at present applied to the Martini-Henry a positively objectionable feature." Let us then compare it with other opinions. Dr. Pole remarks that the spring and striker are completely housed, not only within the general case, but also further within the block, so as to get very great protection; says he has calculated the velocity of the blow given by the Martini spring to the cap, and finds it nearly 35 feet per second, while that of the main-spring of the Snider is only 30; that the spiral spring is used for railway buffers and chronometer balances, and found to answer; that it is applied to the Salter's spring balance of the safety valve of railway locomotives, where, if the force varied with age or use, the spring, and therefore the balance, would be untrustworthy, and therefore not used; in fact, he considers the spiral spring of considerable value, and an important feature of the action, as giving compactness, directness, and safety to the lock. As regards the innovation, he points out that in the old

side lock it was necessary to find a means of giving a downward blow to the percussion cap on the side of the gun, and that the somewhat, indirect action of the flat spring, swivel, tumbler, and hammer, had to be resorted to, but that now the necessity for this indirect action no longer exists, and we are able to come to a direct application of force to the centre of the cartridge. Mr. Woods thinks the action of a spiral spring more liable to be affected by rust than that of a flat spring; but that in the Martini action is sufficiently protected to guard against ordinary liability to rust; that a spiral spring can be made to resist great variations of temperature; that a permanent "set," or strength which the spring will retain, can be got by making the spring a little too strong at first, say 2 or 3 lbs. to the 40 required. Mr. Nasmyth is of opinion that the spiral spring and striker may be confidently relied on to perform their duties effectually and permanently. He says a uniform blow can be obtained; explains the "set;" thinks a spiral more durable than a flat spring, and says that he has had considerable acquaintance with the employment of spiral springs in machinery; speaks of Mr. Ryder's machine at Enfield, in which the spiral springs have to undergo 300,000 violent compressions and expansions in every eight hours, and there they have been at work nearly ten years without deterioration; that the spiral spring is more trustworthy and less liable to fracture than the flat gun spring; that it will give due momentum to the striker; that being well enclosed, and in an oil-retaining part of the apparatus, there is very little liability to rust; and that he thinks it one of the most remote of all causes of anxiety about the construction of this rifle; that they can be made perfectly uniform, and explains a process of hardening which would ensure uniformity. Colonel Dixon says, the more we (he and his workmen) examine the action of the spiral spring, the more we like it; that there would be no difficulty in ensuring uniformity in large quantities; that the price is about a halfpenny against 1s. 4d. for the flat spring of the Enfield lock. Mr. Perry approves of the spiral spring, and says there is no difficulty about the maintenance of the proper strength and regularity if the size and proper quality of the material be strictly adhered to. So far opinion against opinion; now for fact. (a.) Mr. Parry states that it was he who stripped the breech action of the arms returned from the troops; that though the bodies and blocks were rusty and dirty, when the springs were taken out they were covered with oil, as when first put in; there was not a symptom of rust upon them. (b.) An exposure to a temperature of 15° below zero at Montreal broke no springs; one report from India states the coil springs got weak towards the close of the experiments, but this is not confirmed by reports from eight other stations in India. (c.) The spring *does* explode the cap, which is its object, whether the blow be pushing or sudden. (d.) The flint lock was an innovation, so was the percussion cap, the rim-fire, and then the central-fire cartridge; it does not by any means follow that an innovation should not be an improvement, or we might go back to "hand gones," and let them off by means of a lighted stick.

Objection 4. An uniform pull of trigger cannot be obtained.

Dr. Pole says the pull varies from 4 to 7 lbs., according to the lubrication, but sees no reason why the variation should be greater than in the ordinary lock. Mr. Woods says the retention of steady pull will depend on the maintenance of uniform power in the mainspring, on the durability of the engaging surfaces, and on the good fitting of axis holes, and pins. The first condition I have shown can be obtained; the second is matter of fact, as I shall show hereafter; the third we may safely trust to the accuracy of the Enfield workmanship. Mr. Nasmyth thinks the pull-off can be kept as uniform as in the old lock. Colonel Dixon sees no difficulty in this point; thinks the pull might be made as light as 3 lbs. if necessary, and is of opinion that, after considerable use, there need be no alteration of pull. Mr. Perry thinks the same. Having had no means of testing the new pattern arm in this particular, we can only go by the balance of opinion, which refutes the objection.

Objection 5. "That the parts would wear out and the action become impaired." I need not trouble you with counter opinions on this subject. There are the parts of an action which has fired at least 10,000 rounds; they have been carefully tested by Mr. Woods and Mr. Nasmyth with the standard gauges, and no sensible wear could be detected; the much-abused spiral spring even was as good as the day it started from Enfield. This disposes of this objection.

Objection 6. "That the safety-bolt will stick." All the witnesses pitch upon this as the weak point of the mechanism. Dr. Pole, while thinking that the principle of the bolt itself is good, says the mechanism is delicate and the motive power applied at a disadvantage; Mr. Woods thinks it delicate and liable to stick, but that it might be easily remedied; Mr. Nasmyth thinks it should be more substantial; Colonel Dixon thinks it strong enough for its work, but that it would not be used, and would prefer an automatic bolt to work with the action; Mr. Perry thinks the same.

Fact goes to prove that the safety-bolts did not break on trial except when the action had been dismantled and improperly remounted; but this may, and probably was, caused by the fact that the safety-bolts were never used. My own experience was that the safety-bolt was inconvenient to use, being liable to stick. Personally, I am of opinion that no safety-bolt is required; that a breechloader should *never*, under any circumstances, be loaded except at the moment of firing, and feel convinced that that is the best safety-bolt. Since the introduction of breechloaders, I have never allowed my men to load in the ranks, only when they step out to the front to fire. All you want is a pouch from which you can get a cartridge in a moment, the loading itself is a matter of almost no time with the Martini.

Objection 7. The stocking, being divided, is weak. Here, again, I will give you facts. Experiments made at Enfield showed that the strength of the Snider-Enfield and Martini, when used as clubs, was about equal. Both remained uninjured by a fall of about 4' 6"; both were broken by violent blows, but with this remarkable difference, the Martini broke in the small, or the stock-bolt broke, while the Snider broke across the lock, showing that its weakest part was where the

wood has been cut away to a mere shell to admit the block and lock. An alteration in the metal and method of fixing the stock-bolt and doing away with the "trap" in the stock, will make the new arm stronger than the old.

Objection 8. It is difficult to dismount and remount the action. Dr. Pole says, "It is at present a little more difficult (than the Snider), " on account of the knack for getting out the block, but that is very " soon learned. The Enfield lock requires a cramp to be used, a turn-screw alone is required for the Martini." Mr. Woods thinks an intelligent private soldier could do it if well instructed. Mr. Nasmyth says a man of a very ordinary degree of intelligence and handiness could undo all the parts, and dissever them and put them together again, with the greatest ease and rapidity. Colonel Dixon calls it rather a nice operation, and does not think you could instruct every man to do it; remarks that the armourer-serjeant is the proper person to do it, and not the private soldier. Mr. Perry thinks a non-commissioned officer or intelligent soldier could be instructed to do it. Having had considerable experience in the instruction of recruits in dismounting and remounting locks, and having taken down and put up the Martini action, I must say that my opinion agrees with Colonel Dixon's,—a good deal of knack is required, not to get the block out, but to get it in again. I saw an armourer-serjeant fiddling at one for 10 minutes, with the printed instructions before him, and had to do it myself at last; and people who know how to do it cannot always do it on the first attempt; either it must be simplified or the soldier made to leave it alone, and there is no need for him to take it out. If dirt gets in, it does not interfere with the action of the breech-block or force of the blow, and periodical cleaning by the armourer would be enough to keep the arm in working order.

Objection 9. "The whole thing is unmechanical." This is the "bogus" objection, always kept in store to let off on people who venture to refute other objections. I have heard it raised with much effect by a person in a gunmaker's tent at Wimbledon, who said he "was a civil engineer, and must know." Mr. Nasmyth speaks of it as a "slang term in mechanism," and says "there is nothing unmechanical " in any constructive arrangement that accomplishes its object; and if " that object is accomplished in a simple and effective way that combination is good, and it is the best mechanical system that attains its end " in the most simple and durable manner: he thinks the ends in question " are very admirably obtained." It is objected, he says, that it is a lifting of the weight at the wrong end. The whole mechanism of the human frame is based on lifting weights at the "wrong end;" the muscles are all at the "wrong end," but they perform their functions well. Mr. Perry thinks the system the most simple and substantial one he ever met with (and he must have examined most of them): he adds the simplicity of this action, the manifest strength of its component parts, and its power, in manipulation, pointed it out (when sent with the other selected 8 to the factory), as being something out of the ordinary run of breech actions.

Should then the Martini-Henry be adopted as the arm of the Service,

we shall have a weapon giving, as far as the barrel is concerned, great accuracy at long ranges, combined with a very flat trajectory, and, therefore, fearfully destructive at the shorter ones, with terrible smashing power and great penetration, not liable to fouling, easily cleaned, and not injured by being left uncleaned, with grooves which do not lead nor wear out; a breech mechanism easily constructed by machinery, easily worked, not liable to get out of order, utterly unaffected by rust or dirt, wearing well. Putting the two together, a rifle quickly loaded, light, handy, strong, and durable. But if we are to have this gun we shall want more musketry instruction. It is of no use to put such an arm into the hands of men and not make them able to take advantage of it. It has often been urged that the Enfield barrel was quite accurate enough for the Army because its shooting was better than that of the men, the answer to which is evident. Make the men better shots, and give them a better arm. Ought we to have gone on with Brown Bess because our men could not shoot? If there be an advantage in having an accurate long range rifle, and in these days of rifled artillery and mitrailleuses no one will be found to deny that, then men *must* be trained up to the level of the rifle, not the rifle lowered to the level of the training of the men; and to do this we require more practice, 90 rounds a year is of little use in making a man a good shot or keeping him one. Ask any crack shot and he will tell you that he fires much more nearly 90 rounds a week when he is in practice. The Martini-Henry, though a very good breechloader, is still a breechloader with the principal fault of a breechloader, viz., the facility for wasting ammunition. Our men are no better than others in this respect: I have known men in the trenches, on a pitch dark night, fire away into the darkness as fast as their frozen fingers could load their Miniés at a perfectly imaginary enemy. With breechloaders they could do this with fatal ease. Soldiers are terribly apt to fancy that so long as they are firing, they must be doing good. The French soldiers, not well drilled to their Chassepôts, seem to have wasted their ammunition sadly, according to Mr. Pratt's account. In Colonel Walker's account of the Battle of Königgrätz, we are told that the Prussian companies, who occupied the southern skirts of the village of Rosberitz had exhausted their ammunition in an unceasing exchange of shots with the Austrian riflemen in their front, and were driven into the interior of the village by an attack which they had no longer the means of resisting; whereas on the same day five companies of the Prussian guard repulsed a whole brigade. I quote from Colonel Walker's lecture of the 20th June 1868. "Scarcely had the wood (of Lipa) been carried " by the Prussians, when Austrian columns were perceived in full march " against the heights of Chlum. Apparently a whole brigade, they " crossed the high road between Rosberitz and Lipa unchecked by the " Prussian fire from Rosberitz, and climbed the hill with a gallantry " which only resulted in a fearful loss. The Prussian infantry detach- " ments of the guard reserved their fire till the leading files were " within a hundred yards of the weak line of less than five companies. " Two well-directed volleys, and a withering file fire from the destructive " needle-gun, brought the columns to a halt, and finally drove them

"across the high road in the direction of Langenhof." Two better instances could scarcely be found to show the very great necessity for teaching men to reserve their fire and save their ammunition. Much may be done by drilling men not to fire unless ordered, doing away with independent firing and substituting rapid volley firing, by word of command; but after all, in the heat of action, drill may be forgotten, and the true remedy appears to be to give the men plenty of practice, thorough acquaintance with and confidence in their weapon, so that they may know by experience that a shot unaimed is a round wasted, and that that round might save their lives later in the day. That practice does tend to the saving of ammunition, I know from experience. When I was conducting trials of the Martini-Henry last winter, I used to set the men to fire against each other, giving them a target each, and letting them fire for two minutes. New hands always devoted their energies to getting off as many shots as possible in the time, while the more experienced thought only of the aiming, with immense advantage in points when the targets were compared. Of course, in time they became able to combine rapidity with accuracy, but the best hands were too sharp ever to hurry an aim for the sake of getting off an extra round in the time, and the best results on the whole were produced by about 22 rounds in two minutes, at 500 yards.

Public opinion every now and then gets a fit of excitement about military matters, it seizes hold of one idea, insists on some one thing, is satisfied and goes to sleep again, fully convinced that that one thing being done all is secure. During the Prusso-Austrian War, the newspapers were full of sensation accounts of Prussians firing from the hip and mowing down hordes of their enemies at impossible distances; the needle-gun was the thing, why had not we the needle-gun? look at the way it had won all the battles in that campaign. Experiments were made: the British Army supplied with a breechloader, and public opinion was satisfied that it could, *therefore*, do all that the Prussian armies had done. Far be it from me to say that we should not have a good breechloader; it is evident on the face of it, that our very wealthy country, keeping a very small army, should supply it with the very best weapon that can be got; but even when we have it, and have men trained up to it, do not let us imagine that we have done everything necessary to ensure success to our forces. Campaigns will depend hereafter, as heretofore, on other things than the goodness of weapons, whether of artillery or infantry. First among these I would place discipline, on which all other things depend, the real basis of success, and which it is becoming somewhat the fashion of amateur army-reformers to undervalue and deery. Then power of marching—including the actual physique and walking power of the individual man—dress, food, hygiene, transport (rendered so much more difficult by the increased rapidity of fire), and last of all strategy, the art of manœuvring so as to bring large numbers to bear against smaller numbers.

The Chassepôt is superior to the needle-gun in range, accuracy, and trajectory, but it has not saved France; the Martini-Henry is undoubtedly superior to both, and as good as any other, but it will not win

campaigns by itself, nor will its goodness avail to set at nought the great military principles which have ensured victory in all ages.

Commander GILMORE, R.N.: May I say, as regards muzzle-stoppers, that some years ago I proposed to the Admiralty that, instead of using muzzle-stoppers as at present, an india-rubber capsule should be supplied, to go over the top of the rifle. It would perfectly exclude all air, and keep the barrel free from rust; and no danger would possibly accrue from the men firing them off by inadvertence.

Mr. CORNISH: I would say a few words upon this subject. The lecturer spoke of the Werder and the Tabatière rifles. I am the inventor of both those rifles. The Werder rifle is, I believe, about to be adopted into the Prussian service. The principle is precisely the same in every detail with the rifle which I brought forward here in 1866, under my own name, the Cornish rifle. The Tabatière was a compound of that rifle with the Snider extractor. I was put to very considerable expense by the French Government in the matter; and had it not been for this war I was to have had a sum voted at the commencement of this year. Colonel Fletcher, whom I see here, is acquainted with my arm. The principle of the extractor when produced was entirely new. It was a pivotted cam-lever, and the opening of the breech-block struck it and jerked the cartridge out. On several occasions I have put my claim forward in the newspapers, and it has never been denied; in fact the dates show it.

Major-General BOILEAU: Captain Drake made an observation with respect to the size of the Chassepôt bullet, which does not quite agree with measurements I have taken from a bullet brought from the field of battle by permission of the Prussian Government, and which with the cartridge was placed in my hand for measurement. I make the diameter of the bullet, at the top of the conical frustum, only $\cdot 420$ of an inch, that is $\frac{1}{100}$ th less than the calibre of the rifle itself. At the base of the cone I make the diameter $\cdot 464$ of an inch, and that of the small band at the bottom $\cdot 470$ of an inch. These are small results with regard to the action of the bullet itself. I made the measurements carefully and critically, in case they should be mentioned here this evening. Those dimensions are different from what Captain Drake has given. I think Captain Drake also stated that the weight of the powder in the Chassepôt cartridge was the same as that in the Government bottle-shaped cartridge, 85 grains. I make it, by careful weighing, 81 grains. In fact, the Chassepôt cartridge complete weighs exactly the same as our bullet only, and the cartridge entire weighs only a little more than one-half what the cartridge does which we now use in the modified form in our small-bore rifles. It has occurred to me to suggest whether it would not be to our advantage if the weight of our bullet could be slightly diminished; instead of having a bullet weighing a troy ounce of 480 grains, whether it would not be sufficient for all military purposes and for purposes of accuracy, to reduce the weight of the bullet to the avoirdupois ounce of $437\frac{1}{2}$ grains. I have made several bullets of this weight, into some of which I have introduced a wooden plug for the purpose of balancing it; not introduced into the base, but introduced into the body of the bullet, to give it an exact balance. As far as I am able to judge from shooting in the Hythe position, I think the result has been an improvement in the accuracy. Probably a bullet of that kind would be too expensive to manufacture, therefore it might not be introduced into the Government arms. But I do think it would be of some advantage if we could reduce the weight of the bullet, say 40 grains, that is, bring it down from the troy ounce to the avoirdupois ounce, and reduce the charge of powder in the same proportion, from 85 to 80 grains. The alteration would be small, but still it would be an advantage to be able to put four or five more cartridges into the soldier's pouch. The form of the grooving in the barrel has been very much dwelt upon, as if the Martini-Henry rifle was superior to all others that have been tried. Now, with all deference to those who hold that opinion, I must say that my experience, which extends over a period of certainly not less than ten years, in respect to the form of the rifling, does not go with them. I think the form of rifling in the Martini-Henry barrel is very complicated, and it certainly is not true in principle. It has been occasionally observed that it does not matter much what the form of rifling is, whether you take the French grooving, or the gouge grooving of the Americans, or the Whitworth grooving,

or the Martini-Henry grooving, or the Boileau grooving,—that it does not matter as long as you get a good pitch twist and a clean barrel. But I think if it can be shown that there is an advantage in one form of grooving over another, it is likely to result in practice that the better form of grooving will give a better range and a better trajectory than the other. My experience is that my own form of grooving is quite equal to the Martini-Henry, as far as the results which it produces: and it has this advantage in it, that it has no sharp-edged angles in which dirt can accumulate, and which, therefore, foul the rifle. As the question here this evening is limited to the Government adopted patterns of England, France, and Prussia, I think it would not be right to enter into the question of other forms of rifling. But as the Snider is still one of the Government rifles, and as there is still a small-bore Snider which is in my experience equal to anything that has been made, I do not think I shall be out of order if I draw attention to a form of Snider-rifle made by Mr. Newark, the inventor, of which there is a sample in the racks of this Institution, the last of Mr. Newark's improvements being a rifle of .450 calibre with eight grooves on my pattern, with his improved Snider action, which he has placed in my hands for experiment, and which I hope, before long, to try carefully and critically, although what we have heard this evening prevents all possibility of objection, for I am bound to confess that the arm which has been, after so much pains and care, manufactured under the superintendence of a Committee, composed of men eminently qualified to enter dispassionately into the question, is as little open to objection as it is possible for a gun to be. I will only say that I wish and believe that this beautiful piece, in the hands of the best soldiers in the world, will, when it comes to be tried, prove, as it has been described to-night, to be the best piece in existence; still, if it should be found hereafter, without prejudicing the manufacture of that weapon on a large scale, that another rifle may be found equally efficient and equally durable in action, public opinion will bear with sufficient force upon the Government to induce them to allow a few of these rifles to be tried, and to be either proved or condemned on their merits.

Captain DRAKE: With regard to muzzle-stoppers, a muzzle-stopper over the muzzle instead of in the muzzle, as I understand, has been already introduced into the service by Colonel Dixon, the Superintendent of the Small Arms Factory. I was not aware that the Werder and the Tabatière were on the same principle. I confessed, I believe, that I have never seen the Werder. The measurements of the Chassepôt cartridge, both bullet and powder I did not take myself,—I am therefore quite prepared to yield to General Boileau's accurate measurement of them. The question of alteration in the weight of powder and lead, as regards the trajectory, was, I believe, carefully gone into by experiment, not only by this Committee but also by previous Committees on Small Arms, forming part of the Ordnance Select Committee. As regards the grooving of the barrel and the success of the shooting of the Henry barrel, I may merely say that I have been purposely this evening confining myself to the fact that I had before me the actual results of the shooting of the Henry barrel against all other systems which were brought against it into competition. My point has rather been that the Committee was in the first place a good Committee; and that, in the second place, the Committee had no option but to decide as it did decide. Whether another system will be found that will produce better results hereafter I am not prepared to state, until the system has had the same trial as the present system has. As regards the Enfield system, it was tried with a .45 bore, and the results were not so good as those obtained by the Henry barrel. The Henry barrel was first made with nine grooves, then with seven, and the seven has beaten the nine. The Newark-Snider I have not seen as a small-bore. I have seen the large-bore in the armoury of this Institution; I have not carefully examined it, therefore I should not like to give an opinion of it. The present Snider differs materially from that, and I would point out that the complication is on the side of the Snider and not on the side of the Martini; there are far more parts in the Snider action than there is in the Martini, that is, in the Government Snider.

The CHAIRMAN: I think that what we have heard from Captain Drake, who is so well able to give us the details of all that has taken place, must convince us that the question of the best rifle for the Army has been most elaborately and

carefully considered. I am sure the country is indebted to the Committee, or rather Committees, presided over by Colonel Fletcher, who have gone very carefully and with great impartiality into the whole question. I cannot help thinking that the time has now arrived,—whatever may happen in the future, whether a better rifle may be invented or not,—for the whole Army to be armed with the weapon which has successfully undergone so severe a test. I will conclude by expressing your thanks, which I am sure you will authorise me to do, to Captain Drake for his very elaborate and valuable paper.
