Machine Guns: Their Tactics and Equipment

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MAJOR-GENERAL W. H. GOODENOUGH, C.B., R.A., Inspector-General of Artillery, in the Chair.

MACHINE GUNS: THEIR TACTICS AND EQUIPMENT.

By Lieutenant G. E. BENSON, R.A.

A GREAT deal has been written of late years about machine guns and the manner in which they may be employed, but unfortunately the opinions of the various writers vary to such an extent that it appears almost hopeless to arrive at any conclusion as to their use in civilized warfare without actual experience in the field.

It may, perhaps, be thought that the subject has been pretty well threshed out, as far as writing is concerned, by the various Officers who have delivered lectures in this Institution; and on that account it appears to be somewhat difficult to find any new suggestions to bring forward which may be worthy of discussion. In face of this difficulty I propose during the course of the lecture to repeat briefly the various suggestions that have been made for the use and equipment of these weapons, and give reasons for and against them, before bringing forward my own proposals. I think the great power of machine guns is too universally recognized to require any further illustrations by me, and I will therefore simply state that in practice with a 10- and 5-barrelled Nordenfelt carried on at Bangalore in August and September, 1884, before Sir Frederick Roberts, the following results were obtained:—

The 10-barrelled gun was found to fire about double the amount of ammunition in a given time (2 minutes), and obtain about the same number of hits, as fifty marksmen and first class shots at 1,200 yards range.

The 10- and 5-barrelled guns firing together for 2 minutes at 2,450 yards gave 192 hits on a horizontal target out of 855 rounds, while two 9-pr. H.A. guns which fired shrapnel for 9 minutes gave 394 hits. The striking velocity of the shrapnel bullets was much greater than that of the Nordenfelt. The angle of descent of the latter was about 20°, so that they would have reached troops behind earthworks. It was noted throughout the practice that the 5-barrelled gun did not hold its own in rapid long-range firing by reason of its want of weight and stability. This shows that apart from greater rapidity of fire greater accuracy is also obtained from the heavier

class of machine guns. In the above experiments the Nordenfelts were worked by unskilled men.

About a year ago a pamphlet on this subject was written by a M. Gustav Roos, at St. Petersburg, and he informs us that experiments in Russia have shown the following results:—

- (1.) One 5-barrelled Nordenfelt = 50 men.
- (2.) At 950 yards a single machine gun produced a greater effect than two field or mountain guns.
- (3.) From 950 to 1,700 yards a single machine gun produced the same effect as two field or mountain guns.

He lays great stress on the laying mechanism enabling fire to be continuous and effective when the front is obscured by smoke or darkness, and this I found to be of great importance in the Soudan, when laying these guns before nightfall, so as to sweep the ground in case of a night attack, thus making sure of the fire being effective in the darkness.

The two great questions on machine guns are these:—

1st. What should be their means of transport?

2nd. To which arm of the Service are they to be attached?

The answers to these two questions are dependent on each other. If they are to be attached to the mounted branches they must be able to get over the ground quickly enough to accompany them on service. For this purpose pack transport appears unsuitable, as it entails men marching on foot to lead the animals. Apart from this, pack transport has the following disadvantages:—

(1.) A long train of pack animals would be required to carry sufficient ammunition for one machine gun; for an animal can only carry on his back one-third of the weight he can draw at speed.

(2.) The heavier class of machine guns producing the best shooting (as shown by the Bangalore experiments) would be too heavy to mount on a pack animal.

(3.) The delay in coming into action and moving them short distances.

In my opinion one of the most important considerations in deciding on the method of transport of machine guns is the carriage of ammunition. Some men have urged that it is a mistake to imagine that such a large supply is required with machine guns, as they never have to fire rapidly for a long period, and in support of this theory it is pointed out that in the recent operations in the Soudan a comparatively small amount was expended. But it is forgotten that the most important fights where they have been used seldom lasted more than half an hour, which is very different from the duration of a battle between two civilized Powers. Suppose you have a machine gun on pack animals, as suggested by Major Anderson, R.H.A., in a lecture recently delivered here;¹ according to his plan, one mule is for the gun and the other for the ammunition, while a reserve of ammunition is to be provided for elsewhere. As this ammunition mule can only carry about 1,000 rounds the supply would be totally

¹ Journal, No. 139, p. 45.

inadequate, and the gun would be useless till the reserve ammunition succeeded in finding its way to the spot. On the other hand, if you have a string of ten mules to carry the 10,000 rounds per gun which are necessary even for the lighter natures, think of the number of men required to lead these mules, the size of the mark they would offer, and the space they would occupy on the line of march when this number is multiplied by the number of guns, in addition to which these long strings of pack animals are most unwieldy for manœuvring. With the gun and ammunition on wheels many of these disadvantages disappear, for (1) a heavier and therefore more powerful and accurate gun can be carried, (2) a larger amount of ammunition can be carried actually *with* the gun. (3) If drawn by horses, great rapidity of movement is attainable in such country as campaigns between civilized Powers generally take place in. (4) The limbers and axletrees afford seats for the men who with pack transport must march on foot. The principal advocate of this kind of equipment has hitherto been Lord Charles Beresford, who recommends it as combining great rapidity of movement and a plentiful supply of ammunition.

It has been suggested (notably by Captain Armit¹) that these weapons should be mounted on light carriages drawn by infantry. The arguments against this method are, I think, patent to everyone. The most obvious are:—

(1.) The enormous labour of dragging these guns in a campaign. Men usually have enough to do to drag themselves along without making them pull a gun as well, and their strength may be far more usefully applied than by turning them into draught animals.

(2.) Sufficient ammunition could not be carried with the gun.

(3.) This style of draught would give the machine guns the least possible mobility, while what is required for every arm is the greatest possible mobility.

Another system, which is now being tried in several cavalry regiments, is to mount the gun on a two-wheeled limber, with the ammunition underneath the gun. It is intended to be fired without unhooking the horses by two men on the limber. This system has certain points in its favour—notably its mobility and readiness in coming into action. But I think a good many will agree with me in urging the following objections to it:—

(1.) That sufficient ammunition cannot be carried, probably not more than 2,000 rounds at the outside, which would not last more than six or seven minutes in rapid firing.

(2.) The breathing and motion of the horses would impair the accuracy of the fire; anyone who has seen a battery of artillery after a gallop for half a mile will readily understand how the blown horses move the limbers.²

(3.) Supposing a horse were hit, the gun would be put out of action

¹ Journal, No. 133, p. 37.

² This objection has been met by Mr. Nordenfelt by taking the weight of the shafts off the horses by means of a prop on coming into action, but this does not affect the other objections in any way.

till the horse was extricated. The limber may act as some sort of protection from frontal fire, but not when fire becomes in the slightest degree oblique, and the gun might thus be put out of action at the moment when its fire is most wanted. Besides this, the mere falling of bullets or shell near the horses would cause them to become unsteady and spoil the shooting.

(4.) The gun cannot be detached from the limber to be run up into a position, either where horses cannot go on account of rough ground, or where it is desired to run the gun up the reverse slope of a hill just far enough to be able to fire over the top and not be seen by the enemy when coming into position. If the horses take them up under these circumstances they would form a large object with the limber and probably be seen at once.

(5.) Difficulty in getting cover for the gun thus mounted when used in the defence of positions, for the great height of the gun from the ground (nearly 6 feet), and the size of the limber would make a very large epaulement necessary to hide it. On the other hand, of course, the extra height would enable it to fire over a higher parapet which would give more cover to the men.

Now if we put the gun on an ordinary light gun-carriage with a trail hooking on a limber the above objections disappear, for an increased amount of ammunition can be carried by means of axletree boxes on the carriage, while the limber, no longer hampered by the gun on top of it, could carry an increased number of rounds. The gun would be fired with the trail resting on the ground, and could be one of the most powerful class. The importance of this latter consideration is sufficiently seen in comparing the practice of the 5- and 10-barrelled Nordenfelts at Bangalore in the experiments previously referred to, the 10-barrelled gun proving itself more than twice as powerful, and more accurate at long ranges than the 5-barrelled gun. It is also evident that the horses could be placed under better cover, and when one was struck it would not interfere with the fire of the gun, as in the case of the gun being mounted on the limber. The gun could also be detached from its limber and run up into positions required, say, up the steep reverse slope of a hill, while the horses and limber would remain under cover further down the slope in rear.

The chief objection urged against this method of mounting is the weight and consequent number of animals required to drag the gun, and the consequent expense in equipping them. But I will endeavour to show that though this method is apparently the most expensive, it is in reality the most economical. For the sake of argument we will take the Nordenfelt 10- and 3-barrelled guns, and assume that the heavier gun with its 10 barrels is only three times as powerful as the 3-barrelled gun, thus making three 3-barrelled guns capable of delivering the same amount of fire as the single 10-barrelled gun. The latter, weighing over 2 cwt., cannot be carried by pack animals, while from its breadth it cannot be mounted on a limber without taking up most of the room required for ammunition. The 3-barrelled gun is the weapon recommended for pack transport and for mounting on a limber. The 10-barrelled gun mounted

MACHINE GUN FOR ARTILLERY.
(NORDENFELT CARRIAGE.)

$\frac{1}{2}$ size.

MACHINE GUN FOR CAVALRY

MACHINE GUN FOR INFANTRY.

FROM PHOTOGRAPHS TAKEN AT ALDERSHOT.

on a field carriage with limber, the whole carrying 5,000 rounds and three men on the boxes, weighs about 25 cwt., and therefore can be drawn at speed by four horses. Add a horse for a N.C.O. in charge, and we have a total of five horses, one N.C.O., three men on the seats, and two drivers. A 3-barrelled gun mounted on a limber has with it 1,546 rounds and two men, takes two horses to drag it and one N.C.O. on another horse to look after it. Three guns mounted like this, having altogether 4,638 rounds, will therefore take—

9 horses,
3 N.C.O.'s,
6 men, and
3 drivers.

While in the former case we have—

5 horses,
1 N.C.O.,
3 men, and
2 drivers,

thus showing a saving of four horses, two N.C.O.'s, three men, and one driver. This is a very considerable saving, while as regards space occupied on the march, in camp and on the battle-field, and ease of control of fire, the single powerful 10-barrelled gun has an immense advantage over the more numerous but less powerful 3-barrelled guns. Comparing the same guns when the 3-barrelled gun is carried on mules, the advantage of the 10-barrel is still more decided, for four mules are required for the gun and carriage and about 1,500 rounds, thus making twelve mules necessary for three such guns, while at least six men per gun or eighteen in all would be required for mounting and dismounting the guns and looking after the mules. We thus have eighteen men and twelve mules against six men (two drivers) and five horses. Of course a much larger supply of ammunition than the amount above mentioned is necessary, and this *must* be brought up on wheels unless the country is impracticable, in which case the organization would be more that of a mountain battery. Yet another point in favour of the gun-carriage and limber principle is that you have a good supply of ammunition *close at hand*, the immense importance of which is fully brought out and impressed on us by Prince Hohenlohe in his letter on the supply of ammunition during the wars of 1866 and 1870-71, recently published in the R.A. Institution papers.

Having argued out the question of transport thus far, and fixed on a style of carriage (see Plate) which combines three great desiderata, viz., (1) extreme mobility; (2) considerable ammunition supply; (3) a steady platform from which to fire the gun, we now come to consider the tactical organization of these weapons. In order to do this properly, it will be necessary to, so to speak, *analyze* the fire of machine guns.

Without again going into the detail of any experiments, I will point out the following characteristics of their fire:—

(1.) The great power of concentration and rapidity of fire, which enables them to do a great deal of damage at a given point in the shortest possible time.

(2.) Power of turning the stream of fire at will in any direction required *during the actual firing*.

(3.) The continuity of their fire, *i.e.*, the fire goes on continuously without any stop for laying after every round as in the case of the infantry rifle and the field gun.

(4.) The great control of fire, owing to the whole of the firing in each gun being done by one man.

The first of these is equally characteristic of artillery, and is due, generally speaking, to the fact that in a battery, taking a gun as a unit, there are only six units to direct; while in a battalion there are 1,000 units or so, of which perhaps 300 are in the fighting line; and here the front over which they are extended is much greater than in a battery, thus making supervision still more difficult. No. 2 is a characteristic belonging to machine guns alone. No. 3 belongs only to a machine gun as a weapon, but this continuity of fire is of course also attainable by the other arms when there is a sufficient number of them. No. 4 applies equally to artillery and machine guns, and results from the small number of units in one command.

From the above we gather that there are some useful qualities pertaining to machine-gun fire which are not shared equally by that of the other arms, and it therefore behoves us to use these weapons in such a way as will bring out these qualities and make the utmost use of them. The effect of fire is said to depend on two things, *viz.*: (1) its suddenness; (2) its intensity. The latter is a quality evidently possessed by machine guns, but it has not necessarily the former, as the suddenness depends on the circumstances of the case, and whether it is expected or not. Clearly then to make this fire unexpected and sudden, it is necessary to make the weapons as mobile and as capable of rapid movement as possible, so that they may be *placed in the required spot at the required moment*, which means practically, if accomplished, that their fire will be *sudden* and *unexpected* by the enemy. For instance, they might be required to gallop off in order to check an attack at a threatened point, or seize a favourable opportunity for enfilading the line of the enemy, whether of guns or infantry. The *intensity* of their fire makes them capable of doing such an immense amount of damage in a short time that their power of rapid movement increases tenfold their power and moral effect. There is still another point about these weapons which I think is worth noting; it is the difficulty of distinguishing their position at long ranges when infantry are firing alongside of them. To illustrate this I may mention that at the Easter sham fight at Dover this year, I was with the attacking force, and when my battery came into action in the most advanced artillery position, about 800 yards from the defenders, I could distinctly hear the well known rattle of their Nordenfelts, but could not be certain where they were, as the smoke caused by them was the same as that caused by the musketry fire, whereas the smoke of artillery, even at a much longer range than this, at once betrays the position of

the guns. If smokeless gunpowder could be introduced, it is evident that the position of the machine-guns would be still more undistinguishable.

I think I may assume that the value of these weapons in the defence of fortresses and fortified positions is too universally recognized to require further comment. It is their use in the open field about which there is so much controversy.

No doubt in 1870-71 they were a failure, but their failure is attributable to the following defects:—

(1.) The imperfect nature of the weapon used.

(2.) Want of training on the part of the men. They took the guns direct from the arsenals to the field of battle without any previous training.

(3.) Misapprehension of their tactical use. They seem to have been placed in line of battle to contend with artillery at ranges at which their own fire was comparatively powerless, and were thus easily destroyed instead of being reserved under cover for ranges where their fire would be more effective. As in most of the battles in that war the French stood on the defensive, we have no example of their being used on the offensive.

The ranges at which machine gun fire is most decisive in its effects compared with that of other arms are probably those between 800 and 1,600 yards, and in future wars it appears that battles are not unlikely to be decided at those ranges. Under 800 yards the power of infantry fire increases very rapidly, and over 1,600 yards that of machine guns diminishes so much that they would be overwhelmed by artillery fire. Thus the machine gun cannot supply the place of skirmishers nor yet that of artillery, but would play a very special rôle when occasion required, *whenever it could be brought into the required position at the right moment.* M. Gustav Roos supports this theory and says that—"The machine gun constitutes a special arm, having its own definite sphere of action, within the limits of which the enemy is struck in the most advantageous manner by the weight of metal projected, and with a smaller loss of time and men than in the employment of any other arm whatever."

I think it is pretty plain that if I have correctly analyzed the fire of machine guns there are several very important differences between the conduct and control of that fire and that of infantry; in fact the only point in common appears to be that they both fire bullets of the same pattern; for I maintain that there is a very important difference in the effective ranges of the rifle and the machine gun when the former is handled by large bodies of men which are very difficult to control in extended order in the excitement of the battle. Machine guns can, from the control under which they may be held, open fire with effect at ranges where a very large proportion of the infantry ammunition would be wasted. In this control of fire and power of concentration on one object they resemble artillery, but have not sufficient range to contend successfully with that arm except under certain conditions. A point where they have the advantage of artillery is that there being no recoil, they can come into action on a steep

reverse slope where, if field guns were fired, the recoil would send them to the bottom of the hill. The fact that they can keep up an effective fire when the front is obscured by smoke or darkness, provided they have been previously laid, has already been noted. They also share with artillery the bad quality of powerlessness during movement, for anyone who has sat on a limber going at speed over rough ground will realize the impossibility of firing when in movement. The men have enough to do to hold on without having to fire a gun as well. Machine guns can, however, from the simplicity of their ammunition, come into action quicker than artillery.

With cavalry the machine gun has nothing in common except, perhaps, its power of rapid movement, for cavalry are supposed to act by shock while machine guns act by fire alone.

Since these weapons have so little in common with the other arms, it might appear that we are as far off as ever from settling the question as to which arm this weapon is to be attached. On the contrary, I think we are now near a solution of the problem.

Cavalry and artillery are generally recognized as the auxiliary arms, the use of the former being to gain information on which the infantry may act, to protect the flanks of the infantry when engaged, and to pursue the enemy when beaten by the infantry; the use of the latter being to prepare the way for the infantry by bombarding the enemy's position, and to follow up the enemy's retreat and convert it into a rout by the fire which is brought into play by means of their rapidity of movement. Therefore naturally we must look on machine guns as another auxiliary arm invented by modern ingenuity, just as cannon were invented by the ingenuity of men some centuries ago and made part of the fighting forces of the period.

Let us examine the different stages of a battle, and note the various rôles of the machine guns in each stage. As the two armies approach each other the hostile cavalry meet. This is the preliminary or reconnoitring stage, and one drives the other in till checked by the enemy's infantry. Machine guns can evidently be given the mobility necessary to accompany cavalry, and their rapidity of fire and readiness in coming into action would enable them to act with the greatest effect during the very short time the hostile bodies are in the act of approaching each other before charging. In conjunction with horse artillery and dismounted cavalry, they might even drive back the first infantry outposts of the enemy met with, the machine guns approaching to effective range, covered by the fire of the horse artillery.

During the preparatory stage of the battle, when the artillery are bombarding the enemy's position, the machine guns might be drawn up echeloned in rear of the flanks of the line of guns, themselves out of fire, but able to prevent by their fire any dashes made by bodies of the enemy's cavalry on the flank of the guns. When the enemy's attention was thoroughly engaged by the artillery duel, and the battlefield obscured by smoke, opportunities might occur for them to make a dash forward, accompanied by cavalry, to close range, if possible on a flank, and if successful the damage done to the enemy's gun teams and gunners in a very short space of time would probably

be enormous. However, they cannot well be used against artillery with success unless they can take it by surprise or in flank within 1,700 yards or so; but under these conditions the dismay and confusion this sudden hail of lead would cause can well be imagined.

Modern firearms and discipline have made it more than ever necessary to beat down the courage and reduce the numbers of the defenders of a position before the infantry can advance to the assault, and in this duty machine guns could render important services in the later stages of the bombardment when the artillery of the defence is more or less silenced. When this is accomplished, the machine guns might approach to a range of from 1,200 to 1,600 yards with comparative impunity, and from a position on the flank of the line of their advancing infantry, they could pour in a storm of bullets which would search out the defender's shelter trenches, and could not but cause many casualties. It is probable that the supporting fire of machine guns could be kept up longer than that of artillery, as there is no such variable quantity as a fuze to be taken into consideration with the former weapon, and thus the infantry would receive more support at the time it is most wanted. When their fire is masked, they would turn their attention to beat off counter-attacks, and fire on other supporting bodies of the enemy till a foothold was obtained in the position. Then they would advance, as the artillery do, to confirm the success of the infantry, and hold the position gained till the infantry had again been got into hand. Their rapidity of movement, readiness in coming into action, and continuous murderous fire would enable them to do this most effectively, and perhaps in no other rôle will their effect be more felt than in this. At this and other periods of the battle no doubt great opportunities would occur at times when machine guns could advance close up and sustain their wavering infantry at critical moments, just as the German artillery did in the war of 1870-71, by firing case and shrapnel with the fuze bored very short; but the superior man-killing power of the machine guns at these short ranges, and the fact of their being smaller marks to fire at—having a less number of horses and men for the same number of guns—would make them appear most suitable for such tactics.

In pursuit of the enemy, or retreat in face of the enemy, the above-mentioned qualities will serve in great stead the army which makes use of these weapons. At this last stage the defenders, whether retreating or being driven out of their position, or advancing after having repelled the attack, will generally be in fairly close formation, and thus make the close and concentrated fire of machine guns most deadly.

In the manner I have indicated, they might perform efficient service to all arms in turn. In order to be always on the spot for the carrying out of these duties, it might appear necessary to attach them to all three arms, or at any rate to the infantry and cavalry. But this would make it necessary to have too great a number of them altogether, and therefore for the sake of economy and simplicity it appears advisable to hold them under the hand of the General in

command of each Division, so that they might be told off to work with each arm as might be required. In fact they should act in conjunction with whatever arm happens to be playing the most important part in the different stages of the fight—with the cavalry in the preliminary stage, with the artillery to protect their flanks in the preparatory stage, with the infantry during their advance and assault, and again with the cavalry for the pursuit or retreat.

In order to use them in this way they would have to be organized in troops of say four guns each. I say "troop" in preference to the word "battery," because a "battery" expresses a force which batters or bombards material obstacles, whereas a machine gun is only a man-killing weapon. Each troop would consist of four guns and four ammunition wagons or carts, which should always accompany the guns on the line of march. Prince Hohenlohe in his letters lays great stress on this for artillery, and his reasoning will apply equally to machine guns. The guns would require four horses each, and if wagons similar to artillery ammunition wagons were employed they would require the same number, but probably a light S.A.A. cart drawn by two horses would be preferable, though of course the amount of ammunition carried would not be so great.

I have reckoned the war strength of a troop as above described to be as follows, allowing for store wagons, spare horses, &c.:—

With ammunition wagons.

Men.	Horses.
54	70

With ammunition carts.

Men.	Horses.
50	62

Three such troops might be attached to each Division, and perhaps two to the cavalry Division, making eleven troops per army corps.

The war strength of three troops, with ammunition carts, would be (allowing one forge and six horses per three troops)—

Men.	Horses.
153	192

For purposes of comparison I may say that the war strength of a battery of horse artillery is—

Men.	Horses.
182	183

Probably a peace strength of thirty horses per troop would be sufficient. Each troop would be capable of delivering a fire of 4,000 rounds per minute, though it would be seldom that this rate of fire would be required.

I don't know how many rounds the fighting line of a battalion of infantry could fire by volleys per minute without getting out of hand, but probably it would be about 1,500 rounds, allowing about five rounds per minute to every man in the fighting line.

Attached to the cavalry Division in front of an army, the value of

such troops of machine guns is undeniable for holding important points seized by the cavalry before the infantry come up, and for acting on the enemy's cavalry just before the charge as previously pointed out. They would furnish the fire power which no doubt is now necessary to accompany cavalry, and to provide which it is thought advisable to organize corps of mounted infantry, though, if the latter are also to be used for outpost duty and scouting, machine guns could not of course supplement their duties in that respect.

In support of the above views I will quote some of the remarks made by Colonel Andrewes, R.H.A., who was present at the experiments carried out at Bangalore previously referred to. Among other things he says:—

"That their power of mobility on carriage or pack transport would admit of their taking an important part on special occasions with cavalry or mounted infantry in holding bridges, fords, causeways, &c., &c., pending the support of infantry, and that they would also prove of good value on outpost.

"That they should have a distinct organization, each gun being under a well-approved warrant officer, and that they should take their place with any force in the field massed in battery under a Staff Officer, parked with the corps artillery, and held at the immediate disposal of the General Commanding, for distribution by him to regiments of infantry or cavalry as occasion might present, or for disposal at his discretion at any critical and suitable time or place.

"They would appear to have their greatest value on the defensive as a multiple of infantry fire, against assault of position, entrenched or otherwise. Their moral effect is great, and should it be ultimately decided to attach them more permanently to battalions, I think they would occasionally prove a valuable auxiliary to infantry and artillery in co-operation, by falling back to the positions taken up in succession by the latter arm to cover a retreat, and offer rallying points for the force."

With reference to the first part of this last paragraph, I may remark that it is an axiom laid down in all works on tactics that *all* firearms are more powerful on the defensive, and I don't see any reason why the value of machine guns on the defensive and offensive respectively should vary any more than that of other man-killing firearms.

The above sketch of the tactics of machine guns principally deals with their use on the offensive, about which perhaps there has been more controversy than on the defensive, for everyone, I think, recognizes their great value in the latter case.

Their tactics in a battle fought on the defensive would be somewhat as follows: In the preliminary stage the defender's cavalry would probably be weaker than the attacker's, but the presence of a few machine guns with the former used as before described might prevent the latter gaining much advantage. When the defender's cavalry fall back on their infantry outposts and advanced

posts the machine guns would certainly check the enemy's advance, the chief point to be observed being that they should remain as far as possible under cover until the enemy, whether infantry, cavalry, or artillery, should approach within effective machine-gun range, for if they fire at long ranges against the attacker's artillery they would be liable to be destroyed. If ordered to retire on the main position their services there would be rendered much in the same way. Further comments on their use on the defensive are perhaps unnecessary, but it may be expected that their great mobility would be turned to good account in making counter-attacks on the flanks of the attackers, and in enabling them to be held in central positions intact till it is absolutely certain on which points the enemy's main attacks will be delivered. If these weapons were drawn by infantry on light carriages these rapid changes of position would be quite impossible, and their sphere of action would therefore be very limited. Amid the dust and smoke of a battlefield these movements would not readily be noticed till a stream of bullets would suddenly appear from an unexpected quarter, and once the range is found, a few minutes' fire from these weapons means annihilation.

Long-range infantry fire has of late assumed an importance hitherto unthought of, but there are so many disadvantages connected with it, *e.g.*, in the men getting out of hand and the expenditure of ammunition when it is difficult to distribute a fresh supply among an extended line of men under fire, that the use of this fire is by no means an unmixed advantage. Perhaps machine-gun fire is the best sort of long-range infantry fire on account of its greater accuracy and the comparative ease with which the supply of ammunition can be renewed, as it has not to be distributed among so many units.

Proposals have frequently been made for making machine guns actually part of an infantry battalion and cavalry regiment. It is proposed to attach a certain number to every infantry battalion, in order to supplement the fire of the battalions, because a machine gun is called a cluster of rifles, but we have never yet heard of any sound scheme for their use in action when so attached. They cannot possibly accompany the shooting line of the attackers in action, for they would at once become a conspicuous mark for the defenders, as they cannot lie down and fire as infantry do. Moreover, if carried on mules and the mules be shot, the gun would be practically useless, as it could scarcely be expected that the men would bring it along, and then again comes the question of carrying a large amount of ammunition under close infantry fire. If mounted on wheels and drawn by mules or horses, it would soon be rendered stationary by the same fire; and the reasons why it cannot be drawn by infantry have already been given. On the other hand, if placed to a flank about 1,000 to 1,500 yards from the enemy to perform its functions as long-range infantry fire covering the advance it would be a long way from the battalion it belongs to, and therefore completely out of control of the Officer commanding the battalion. If worked thus away from the battalion, the Commanding Officer would have to detach from his

probably already too weak battalion a certain number of Officers and men to look after weapons over the service of which he would no longer have any control. This idea is simply a revival of the old battalion gun system which was proved long ago to be entirely vicious.

Again—suppose the battalion to be acting on the defensive—the machine guns would be placed to defend special points, such as salients, to sweep roads, &c. In this case is there any advantage in having them as part of the infantry battalion? I say certainly not, for they would perform those duties equally well if they did not belong to the infantry. Would it not rather be probable that if belonging to a battalion in a defensive position, and that battalion were to become unsteady, the same unsteadiness would affect their comrades with the machine guns, whereas if they were distinct from each other there would be a sort of rivalry between the riflemen and the machine gun men as to which would hold on to the position the longest. Much the same kind of reasoning applies to the case of their being attached to regiments of cavalry. If they are to be used with cavalry, as I saw the gun of the 10th Hussars used the other day at the Agricultural Hall, viz., to fire on the enemy's cavalry from a flank just before the charge of the two hostile bodies, why should not horse artillery be so attached, and yet if such a thing were proposed it would be received with ridicule.

Imagine a cavalry regiment sent off on reconnoitring duty over very rough country, which though passable for horses was so in a much less degree for wheeled carriages, or ordered on any duty where machine guns were not required. What would the regiment do with its machine guns? It must either leave them behind, in which case the regiment must be split up, or else they would hamper the movements of the rest of the regiment by causing it to wait for them in difficult places, or they would have to carry them on pack animals, in which case a total change of their equipment would be necessary, at the expense of having a greater number of animals than ever.

It was once proposed to attach them to batteries of artillery. But I believe this project has long ago been given up. In fact it was most probably this very proposal which led gunners in the first place to set their faces against these weapons.

Such organizations as these are opposed to all the lessons of war and to all ideas of that simplicity which is so essential in warfare. The Officers and men of such corps would be required to know everything about their arms, and thus their work would be doubled, or else the special Officers and men selected for the machine guns would be left to themselves, and practically constitute a separate unit.

In addition to this the principle of concentration of fire of several machine guns at once on certain localities must be kept in view, and it could not be managed if in order to do so it were necessary to collect the scattered little machine guns from the various battalions and regiments, for that would take up valuable time, and even when massed together (as suggested in Major Anderson's lecture) the want of previous practice in working together would make proper

regulation and control of fire an impossibility. It is easy enough to get forces to act separately which have been trained to act together, but it is a very different matter to get those to act together who have only been taught to act separately.

Their method of working when supporting their infantry would probably be something after the mode at present recommended for artillery, viz., to direct a concentrated annihilating fire in turn on the various portions of the line to be attacked. The necessary fire discipline to accomplish this would be absolutely unattainable with a heterogeneous mass of little machine guns from the various battalions without any organization in units or any chain of responsibility. The three powerful troops of divisional machine guns that I suggest would deliver a fire equal to that of three dozen of the light machine guns which could be carried on mules or pulled by infantry, while in the fire discipline of the two forces and the space of ground occupied, there would be no comparison. Again, after the action was over, imagine these unfortunate machine guns attempting to join their regiments and battalions again in the confusion of victory or defeat. Of course in thinking out these things we are obliged to bring such practical considerations as these to the front as well as theoretical ones. To those who have read the accounts of modern European wars, it appears quite possible that the poor little machine guns would not find their own battalions till some days afterwards.

In the foregoing pages I have been treating almost exclusively of warfare against civilized nations in the fairly open country where it is usual for campaigns to take place.

In fighting in uncivilized countries against savages these proposals would have to be largely modified according to the practicability of the country and the nature of the savage tactics. For instance, against such foes as fanatical Arabs or Zulus who almost invariably act on the offensive, thus causing us to act on the defensive, the offensive power of machine guns is not required to be made much use of. In addition to this the barren and impracticable nature of the country usually compels the number of transport animals to be cut down to the lowest possible limits, and the short duration of fights against charging savages renders it unnecessary to have so large a supply of ammunition with the gun. Therefore, we must have an equipment suitable to these changed conditions. If pack transport alone can be used something in the nature of mountain battery equipment would meet the case, and the guns would have to be lighter and less powerful. As the ranges at which these sort of fights takes place are usually short the inferior accuracy of these light weapons at the longer ranges would be of little consequence. It would be advisable, however, whenever the nature of the country permitted it to have the guns and ammunition drawn on wheels on account of the consequent saving in animals, and as they would usually be used on the defensive it would not be so necessary to give them the great rapidity of movement which is so useful in civilized warfare.

Captain W. N. Lloyd, R.A., organized a troop of four Gardner guns on the mountain battery principle during the recent operations in Burmah, and an interesting account of the equipment of this troop was sent by him to the Royal Artillery Institution papers some months ago. In it he recommends for the four guns an establishment of fifty-two Officers and men besides a native establishment for the mules. This, he remarks, is about half the establishment required for a 4-gun mountain battery. He points out the great value of the machine gun fire for searching out the position of the dacoits in the jungle and for playing on their line of retreat when driven from their stockades or villages, and I have General Sir G. White's word for it that these weapons did good service when called upon.

In conclusion, I would point out that it is of little use our writing and talking about machine guns and making proposals for their equipment and tactical use, unless we take measures to have these proposals tested by experiment as far as can be done in time of peace. It is also of little value trying one gun here and another there without any attempt at making them work together; what we want is to try their *combined* effect under service conditions and at targets representing such objects as would be fired at on service. Moreover, the N.C.O.'s and men must have some preliminary training before conducting any experiment, in order to make it a fair trial, and trained range-finders must be supplied, for without them there is considerable difficulty in finding the range on damp soil or turf, though on dry soil the dust knocked up by the bullets is sufficient guide. This difficulty in finding the range is no doubt the chief bar to the efficiency of machine-gun fire. To obviate it perhaps some small gun firing an explosive shell might be carried and used to find the range just as common shell are used with artillery. With the equipment and training of men complete we could compare the effect of machine-gun fire with that of infantry and artillery at the various ranges, and from the results obtained get a more correct idea of their value in the field whether used singly or working together. In order to accomplish this I have the following suggestions to make: There are a large number of 4-gun batteries in the artillery armed only with the obsolete 9-pr., which we may be pretty sure will never again be sent on service. Suppose these guns be taken away from one of these batteries for a time, and machine guns supplied in their places; there would be sufficient horses and men in one battery to fit out two machine gun troops for experimental purposes; after a little training a regular series of experiments might be carried out as far as possible under service conditions against targets representing troops of all arms and in various formations, men in shelter trenches, &c. This experiment would cost little beyond the fitting up of the guns and carriages and the expenditure of ammunition, and could not but be most interesting and valuable in its results.

In advocating the use of machine guns in the field, I wish it to be distinctly understood that I do not consider that they can supply the place of either infantry or artillery except under certain conditions, but that by their own peculiar power at certain ranges they may

decide a battle in favour of the army which possesses and *knows how to use them*. I, therefore, do not advocate their introduction at the expense of reducing any other arm, but am of opinion that they should be brought in *in addition* to the other arms.

I will now conclude by reading an extract from the official report by the District Inspector of Musketry on some Machine-gun Field Firing which has recently taken place at Aldershot. The first extract is from a report on the mounted competition at the Army Rifle Meeting, and is as follows:—

"In the mounted competition of this meeting a section of four men were required to ride over a course of about 800 yards over four fences, three men being required to dismount at points 600 and 400 yards from the target and fire four rounds, and each section was allowed seven minutes to complete the course. As the cavalry Nordenfält machine-gun has three barrels, and the gun is served by three men, it was thought that by putting the guns over the same course as the mounted sections an interesting and useful comparison could be made between the two descriptions of fire.

"The best mounted section recorded 21 hits on the target out of 24 rounds fired. The best machine-gun recorded 3 hits out of 80 rounds fired.

"The cavalry guns were fired from galloping carriages without removing the horses. The *very bad* results are attributable to the movement of the horses, and *prove very decidedly* that so long as horses are attached to the gun, effective fire cannot be produced.

"The infantry machine-guns were put over much the same course and allowed the same time; the result of their practice was very good, viz., 49 hits out of 80 rounds; in their case the mule was detached from the gun when brought into action.

"The cavalry gun-carriage is provided with a centre pole and the infantry gun with shafts which rest on the ground when the mule is removed, acting as a trail to steady the gun."

I think this report fully bears out my opinion of the cavalry galloping carriage. If the infantry had only to unhook the trail from the limber instead of unhooking the mule they would have had much more time for firing, and therefore made still better practice.

I will now read an extract from a letter from Colonel Ward Bennitt, commanding the 5th Lancers at Aldershot, to which regiment a 3-barrelled gun on a galloping carriage has been for some time attached. He says: "I disapprove of machine-guns being attached to cavalry regiments, for a Commanding Officer has quite enough to do to look after 400 men and horses when manœuvring in the field without the extra responsibility of the machine-gun." Then again he adds, "to fire a gun with panting horses attached is an *absurdity*, so that a proper carriage is *essential*, and the present two-wheeled one is useless." Here again I think my views are supported.

Colonel the HON. R. A. T. TALBOT, C.B. (1st Life Guards): I have been asked by Colonel Liddell, who until a few weeks ago was in command of the 10th Hussars, to read a paper which he has written upon this question.

The CHAIRMAN: I am afraid I must tell you that the Council of the Institution

do not think it desirable that papers from absent members should be read as contributions to a discussion. The idea is, that at any discussion the person who makes a statement shall be present, to give any explanation of that statement, and to receive the reply which it elicits. If, however, there is anything in the paper which you can state from your own knowledge, we shall be most happy to hear it.

Colonel TALBOT: I am very sorry I was not aware of that rule, or I should have prepared myself to have more perfectly given the views of Colonel Liddell upon the subject. It is probably well known that the only real and exhaustive trial of machine-guns that has taken place with cavalry is due to the exertions of Colonel Liddell, a gun having been attached to the 10th Hussars for the last two years. It is owing to those experiments that many improvements have been made in the present gun-carriage, and in various matters connected with the gun, which could not have been effected without a practical trial. I will endeavour, as briefly as I can, to give my views (which are mainly in accordance with those of Colonel Liddell) as to the lecture given to-day, confining my remarks chiefly to the use of these guns with cavalry, because I think there are many Officers present more competent than I am to discuss their use with other branches of the Service. I therefore turn at once to the remarks the lecturer has made as to the use of the gun with cavalry. He says first of all: "It is intended to be fired without unhooking the horses, by two men on the limber." Now, I think that is not altogether an accurate statement. It is not intended always to fire without unhooking the horses from the limber, but on occasions it might be so. Where there was time, undoubtedly the horses would be unhooked from the carriage, with the object of putting them under shelter, and also that the gun might not be affected by any movement on the part of the horses, although the disadvantage of such movement had been very much modified by the prop which Mr. Nordenfelt had added, which made the carriage almost steady, even if the horses were not motionless. I therefore think it ought to be considered that as a rule the horses would be unhooked from the gun. The first objection taken by the author to the two-wheeled carriage is, "That sufficient ammunition cannot be carried, probably not more than 2,000 rounds at the outside, which would not last more than six or seven minutes in rapid firing." In the first place, I do not see that it need be put at 2,000, because I can see no objection at all to having a subsidiary carriage for carrying the ammunition, and as much as 10,000 or 15,000 rounds might be so carried. But if it were so, I think there can be no dispute as to the enormous importance of being able to bring a very heavy fire to bear for six or seven minutes, even if it could not be prolonged. I have already touched upon the second objection, that "The motion of the horses would impair the accuracy of the fire," because, as I have said, the horses would not be as a rule attached to the gun when firing. The third objection raised is, that "Supposing the horse was hit, the gun would be put out of action till the horse was extricated." That also is met by the fact that the horse would probably not be in the carriage. Of course under every circumstance accidents may happen, even in field batteries, but if only one horse is hit and you have your other horse sound, he would be quite competent to take the carriage out of fire. There would also be the corporal's horse, no doubt provided with traces. Probably the regiment would not be very far off, and would be able to provide a trace horse or horses (with lasso equipment), and so you could take the gun away almost as quickly as if it had its complete team of horses. The fourth objection is, "The gun cannot be detached from the limber to be run up into a position." I cannot see the force of that objection at all. Two or three men can readily move one of those light guns, but the horses before they were detached, naturally would take it up to the position, and then if it was only a question of a few yards, the men could easily push it into its proper place. The fourth and fifth objections depend very much upon the lightness and mobility of gun and carriage, and with a light gun on a two-wheeled carriage almost disappear. The fifth objection is, "The difficulty in getting cover for the gun thus mounted, when it is used in defence of positions." I think the lecturer answers that himself by the later part of the paragraph, in which he says: "The extra height would enable it to fire over a higher parapet, which would give more cover to the men." My opinion about this gun is, that its most essential feature is its mobility, and anything that sacrifices or impairs that quality

reduces by so much the efficiency of the gun. I attribute greater value to mobility than to weight of fire, or even to extreme accuracy. The great thing is, that it should be able to keep up with cavalry, to go forward and take up its position, or to retire from that position with the same rapidity with which it took it up. Although I do not wish to go into the technical matter as to which particular pattern of gun is desirable, I think this feature ought to be borne in mind, that lightness of gun and carriage is one essential qualification. In a later part of the lecture, Lieutenant Benson says: "Imagine a cavalry regiment sent off on reconnoitring duty over very rough country, which, though passable for horses, was so in a much less degree for wheeled carriages." From what I have seen of machine-guns there are very few places indeed which the gun could not go over, and I think that objection is really not a very valid one. We all know the marvellous manner in which horse artillery guns are able to go over the country, and of course from their lightness and handiness, being between two wheels only, machine-guns would be enabled to go over places where certainly horse artillery guns could not go. The lecturer has so very fully gone into the various occasions upon which this gun could be most usefully employed, that I do not propose to go into that part of the question. I think his remarks are very exhaustive on this point. It is almost impossible to overrate the enormous importance of the position which these guns may take in future actions where cavalry are engaged, and my opinion is, that their part is with cavalry more perhaps than with infantry or artillery; although with the latter the necessity of a cavalry or infantry escort would often be obviated. I may say this, that I think in the case of infantry attack, machine-guns would be of very little use, but where cavalry is attacking, they might be of use. But with all arms, for covering retreats, and for protecting important positions, such as bridges, temporary entrenchments, and for detached duties, I think the value of these new weapons can hardly be overrated. There is, however, one point on which I must rather differ from the lecturer, and that is where he advocates the formation of these guns into troops. Those who heard what the Adjutant-General said this year as to the great difficulty he had in getting the War Office to sanction increased expenditure, even in matters of paramount importance, will see that that is a very considerable drawback to the idea of forming batteries or troops of these guns; but by attaching one or two, or more guns to each cavalry regiment, there would be absolutely, in times of peace, no additional expense, except that of the gun itself. That point should be taken into consideration, whether it would be ever possible to induce the War Office to establish what would be practically a new branch of the Service, with its attendant expenditure; but there would not be the same objection to allowing guns to be attached to each regiment. On active service these machine-guns would of course be at the disposition of the Corps or Divisional Commander for employment in any way that might be thought proper.

Major W. W. M. SMITH, R.A.: My only title for speaking on this subject is this—I have not had actual experience with machine-guns, as the lecturer has done, in the battlefield, but it is a subject to which I have given a great deal of consideration, and it so happened that last summer, when a great many miles away from here, about the same time that I suppose the lecturer was preparing his address, I was engaged in writing a paper of my own upon this very subject. I regret that the Council of the Institution have, as I understand, felt it right that this particular discussion should now be drawing to a close. They have undoubtedly assigned a great many days during this and previous years to the subject, but it would appear to me probable that among the many useful purposes which the Institution serves, a *thorough* discussion of problems of this kind, particularly when they are approaching an immediate solution, is perhaps the most urgent of all its duties; and therefore I think, until the subject has been probed to the bottom, it is very desirable that the controversy should still proceed, whether in the printed pages of the Journal, or in this theatre. I am very pleased to see, having examined the question, *a priori*, from an altogether independent point of view, that my conclusions are almost exactly identical on the more important points with those which Lieutenant Benson from his fuller and riper experience has been able to form. There are, however, one or two matters on which I am entirely at issue with him. In the first place I imagine his view is, that the future "batteries" or "troops"

are to be divisional units, just like the three batteries of divisional artillery at the present moment. Of course there is a great deal to be said for that view, if it is only as a protest against the view advocated by Major Anderson and others, that machine-guns ought to be regarded as an integral part of a battalion of infantry, even to the extent of posting them to individual companies. I think the lecturer's suggestion a good one, but that it has gone too far. In the future organization of the new arm (for it is little less), I believe there are a Scylla and a Charybdis to avoid; and if the Scylla is the attaching of a separate machine-gun to each company, the Charybdis is surely the attaching of separate units to the Division. In my opinion the machine-gun ought to act with the *brigade of infantry*. I differ entirely from the last speaker in his view, as I understood it, that the use of machine-guns is more strictly that of an auxiliary to the cavalry than to any other arm of the Service. I believe that they are more suitable to infantry; and that the better plan would be to put a certain number of these "troops" or "batteries" under the immediate orders of the Brigadier commanding the infantry brigade. The *immediate* support of the infantry is the most urgent of all the wants of our present tactical system. The infantry is the arm of the Service which is told off to carry an enemy's position or to defend one of its own; and the more closely our new organization subordinates the action of the new weapon to the urgent necessity of supporting the infantry in both the attack and the defence, the more useful and striking result we shall get. I am a little bit at issue with the lecturer as to machine-guns in the new organization being employed *in addition* to the other arms. I agree with the last speaker that we do not sufficiently realize the limiting conditions which are binding upon us with regard to the suggestions that we have to make, one of the most rigid of those being that we are not to propose anything which involves any very large amount of expenditure without indicating such financial compensations as would result from its adoption. Now, if every Officer who has any important innovation to propose, were to endeavour to show how its adoption would lead to economy in other directions, and how by its means certain other arms of the Service might be reduced within certain limits we should obtain, I believe, more certain and practical results. If we employed a certain number of machine-gun batteries with brigades or Divisions, I think it would not be a very difficult matter to show that a certain portion of the other arms might safely be reduced, and to such an extent, I firmly believe, as to show a very distinct economy, combined with a marked increase of efficiency. Next, with regard to the weight of the gun, and the number of horses, I think the lecturer has made possibly this mistake. He starts with the assumption, which is no doubt correct, that the ten-barrelled Nordenfelt is a very much more efficient weapon than the three or five-barrelled, and therefore that our future machine-gun is to approximate in power and weight to this standard, with the consequent deduction that with the ten-barrelled Nordenfelt, four horses will be required to draw it. I think that in doing this he has conceded a very great advantage to the enemies of machine-guns, but if he could draw up an equipment which will only require one pair of horses to each weapon, the gain would be very great indeed, and would go a long way towards conciliating those who are opposed to its introduction. I believe such a design to be perfectly practicable. I think it is quite possible to have a very efficient weapon on a four-wheeled trail and limber carriage drawn by two horses, weighing between 16 and 17 cwt., inclusive of the weight of two or three gunners, and capable of being manœuvred at a gallop. If you can achieve that it seems to me that the gun, in a tactical point of view, will be nearly perfect. The target which a two-horse four-wheeled carriage would present to the enemy's fire would be very much smaller than that which would be presented by the four-horse carriage which the lecturer has advocated. I think we ought to make the *tactical* desiderata the real basis of our future organization. The weight of our guns must be the consideration which governs all others, and therefore, if the lecturer had commenced with the future tactics of the new arm, and worked out, *a priori*, from that stand-point a suitable weight and number of horses, he would have arrived at a result which would have given us a more certain efficiency, and would have commended itself more fully to the minds of this audience, while making no extravagant demand on the adaptive power of the inventors. I will just mention the results that I have

arrived at. I estimate that for a nine machine-gun battery we should require something like 75 to 80 horses and 130 men. That is very much more economical than the scheme drawn up by Lieutenant Benson for the same number of guns, which would employ something like 130 to 140 horses.

Lieutenant BENSON: It is seventy horses for a four-gun battery.

Major SMITH: Mine is a nine-gun battery, and requires from 75 to 80 horses and 130 men. With all that Lieutenant Benson has said as to the value of the arm, or with the greater part, I most cordially agree. He spoke about the enormous value which the machine-gun would have, if suddenly brought up at the critical moment, but I think he had rather in view that if the infantry suddenly failed or met some unforeseen emergency, the machine-guns would come up to its support. I go a step beyond that and think that, even when the infantry which is engaged in the attack of a position is not immediately assailed, when the supreme critical moment of the engagement takes place, when it is a question of moments whether the attacking or the defending infantry is to retire, that is the very time when, under cover of the smoke, machine-guns may gallop up, place themselves, if necessary, even in the midst of the shooting alignments and render most overwhelming moral and material aid. I trust that the paper will give the *coup de grace* to certain proposals which have been previously discussed in this theatre, one of those being the idea of affiliating the new arm to any one of the existing arms. I believe that to be the greatest of all errors, and for that reason I rather deprecate the lecturer's proposal that a machine-gun battery should temporarily, for experimental purposes, be assigned to the officers and men of one of the existing 9-pr. four-gun batteries of artillery. The officers and men of my own corps, very much as I value their military qualities, after all have regimental traditions of their own like others have, and even if their tactics are not influenced by traditions, I think the experiments would to a certain extent be discredited by the mere fact that artillerymen conducted them exclusively. The way to initiate the experiment with the new arm would, I submit, be to form an altogether new School of the arm at Aldershot or elsewhere, with representatives of every existing arm in the Service on its list, and provided with a certain number of weapons and horses, and then to let them work the thing out from a totally independent standpoint. Such a school would be a nucleus from which the future corps of machine-guns could be formed.

Captain STONE, R.A.: I have very few remarks to offer, but they will rather bear upon what the last speaker has said with regard to the mistake which has previously been made—of course, I speak under correction—of attempting to affiliate the machine-gun to any particular branch of the Service. I agree with Lieutenant Benson as to the objections against mounting machine-guns and ammunition on mules; in fact, these objections have been already made sufficiently clear in the discussion which followed Major Anderson's paper. I think the system suggested by Captain Armit and others is equally open to objection, and I am sure that the idea of attaching them to the cavalry is opposed by many who have considered the question. I believe that the feeling at Aldershot, in the cavalry, is very much against the gun being attached to that branch of the Service. I cordially agree with Lieutenant Benson in his suggestion that machine-guns should be mounted on a light gun-carriage with a trail, in order to get the maximum mobility and steadiness, and I hope to strengthen his position by the remarks that I have to offer. Taking Lieutenant Benson's organization of a troop of four Nordenfält guns with small-arm ammunition carts, we have fifty men and sixty-two horses—a somewhat large number. However, it will be sufficient for my purpose if I consider a single ten-barrelled Nordenfält, mounted on a field-carriage carrying three men on the limber-boxes and 5,000 rounds of ammunition, and drawn by four horses, with a driver on each of the near horses, and one non-commissioned officer in charge (mounted), the gun being capable of delivering its fire at the rate of 1,000 rounds a minute. I hope to show that it would be far more economical to introduce troops of machine-guns, as Lieutenant Benson proposes, than even he imagines. The newest machine-gun, known as the Maxim Automatic gun, which has been so eagerly taken up on the Continent, and with which we are, I believe, experimenting, while other nations are arming themselves, is a one-barrelled gun weighing 50 lbs., in which the recoil of

the barrel does the whole of the work which is performed by hand in other machine-guns. It consequently requires only one man to manipulate it. The gun is mounted on a carriage with steel plate wheels and a vertical steel shield, the wheels being movable on a pivot, so that when in action they give, in conjunction with the shield, perfect cover to the man working the gun. The gun thus mounted can be wheeled along by two men, or, if attached to a limber containing 5,000 rounds of ammunition, can be manœuvred at a gallop by two horses with one driver on the near horse and two men on the limber-boxes. Then we come to the question of mobility, and, in order to have perfect mobility, that is to say, to be able to move at a gallop, you must have, so far as I can see, two horses, with the driver on the near horse, and to be able to manœuvre the gun just in the same way as with horse artillery. In working this out I find the following comparisons. A gun thus mounted, if attached to a limber containing 5,000 rounds of ammunition, which is the same amount given by Lieutenant Benson for his limber, can be manœuvred by two horses and one driver on the near horse, and two men on the limber-boxes. One of these men might be a non-commissioned officer; but that is a matter of detail. The gun only requiring one man to fire it, one man is really sufficient, but two men, a non-commissioned officer and a gunner, would be more than sufficient for all purposes. The gun fires from its one barrel 600 shots a minute, and can continue for any length of time without heating. We have, therefore, the following comparison:—With the Maxim gun, *i.e.*, without the ammunition cart (which will be the same in either case) the gun and limber, two horses, two gunners (one being a non-commissioned officer) and one driver, as against the Nordenfolt system which, according to Lieutenant Benson's propositions, has five horses, four men (including a non-commissioned officer), and two drivers.

Lieutenant BENSON: What is the total weight of the limber?

Captain STONE: I forget exactly. Curiously enough, I find that Mr. Maxim is sitting next to me, and he will be able to give you that. I have worked it out, and I find it is considerably less than two horses have been in the habit of drawing as their share of the weight in a field or horse artillery gun-carriage; so that I think I am justified in my conclusions. The amount of ammunition carried is the same, but the Nordenfolt fires 1,000 rounds in a minute from its ten barrels as against the 600 rounds from the one barrel of the Maxim. Now, without going into the entire personnel of a machine-gun troop, but taking only the strength of each subdivision—not taking the ammunition cart—and multiplying it by the number of subdivisions, let us compare a troop of six Maxims and a battery of four Nordenfelts. I find that for the Nordenfolt troop we have 20 horses, 16 men, 8 drivers, 4,000 rounds per minute, and 20,000 rounds carried on the limber. With the Maxim we should have 12 horses, 12 men, 6 drivers, 3,600 rounds per minute, and 30,000 rounds carried on the limber—a very much larger number of rounds carried, a difference only of 400 rounds that you have to deliver in a minute, which, I think, is unimportant, and a saving of very nearly half the horses—12 as against 20, 12 men as against 16, and 6 drivers as against 8. But perhaps the most important point of all is the very much larger amount of ammunition that would be carried with the smaller number of horses, owing, of course, to the very much greater lightness of the gun. I think this striking comparison of figures will much simplify Lieutenant Benson's scheme for organizing the machine-guns into troops as soon as we are in possession of a sufficient number of Maxim guns to make the experiment, as it appears to me that two of the principal difficulties which have confronted us hitherto can be swept aside, *viz.*, the apparently disproportionate amount of transport required for the results achieved, and the great cost of organizing such transport. There is one technical point which I should like to see settled, and that is the difficulty of getting the range by trial shots on certain natures of ground. In the Maxim gun this can be done approximately by a clever sighting invention; the sight consists of a pair of calipers so adjusted that when the object (say a man) is, so to speak, visually gripped, by lessening or increasing the interval between the calipers according as the range is less or greater, the elevation necessary for that range is given mechanically by an arrangement worked on a curve representing the trajectory of the gun, and set in motion by the screw which moves the calipers. So that the very fact of gripping your object gives the necessary elevation to the gun. With regard to the error, I

have worked that out most carefully, and, as Lieutenant Benson says, the most useful range for the machine-gun would be a sort of link between the artillery and the infantry; that is to say, between 1,000 and 1,500 yards. I find the error between the 1,000 and the 1,100 yards—a difference of 6 inches in the estimated height of the object—would only lead to an error of 20 yards in the range. At a range of from 1,400 to 1,500 yards an error of 7 inches in the estimated height of the object will give exactly the same error in the range—that is, 20 yards.

The CHAIRMAN: With regard to the calculation of weights which you have given, and which is rather important, do you derive it from a comparison with other carriages, or from what the horses can draw?

Captain STONE: It was derived from a comparison of the weight of the horse artillery and the light field artillery gun-carriage with limbers all ready for service, full of shell, with the men equipped in marching order, and drawn by six horses. I took one-third of that weight as being permissible for a pair of horses.

The CHAIRMAN: Did you take into consideration the necessity of the case that there are four wheels with a certain bulk of material necessary to enable it to withstand shock in going over ground? The method you have indicated seems to me so very likely to lead to disappointment in the end, that I mention it, because there are certain necessities of carriage which have to be considered.

Captain STONE: I have taken it as less than one-third of the weight of the ordinary Service carriage.¹ In conclusion, I may say I think Lieutenant Benson's suggestion to work the machine-guns as a separate arm is the first practical step in the solution of an obstinate problem, and, if not trespassing too much on his preserves, I would venture to add that the Officers should be specially selected from cavalry, artillery, and infantry, as well as from the Staff, in order that the varied requirements of the machine-gun troop may be intelligently met and its action in no way hampered by a too narrow appreciation of the tactical issues at stake.

Lord CHELMSFORD: Being the only military member belonging to the Council present, I should not like to allow this lecture and discussion to pass without saying a few words. I think that the Council has reason to congratulate itself upon the lecture which has been delivered to-day, and I am quite sure we all feel very much indebted to Lieutenant Benson for the very able manner in which he has dealt with this very important point. The way in which the advocate of the cavalry and the advocate of the infantry have both maintained that the weapon should be attached to their respective arms is, I think, a very strong argument in favour of Lieutenant Benson's idea that it should not be attached to either. I must say, speaking as a General Officer, that I think there would be a very great advantage in having this arm as a special unit attached either to a brigade or a Division, equipped and organized so as to be used to the best possible advantage, wherever the General Officer may think best. No doubt at times, I quite admit, the cavalry may require a weapon of this description, when it might do right good service. Lieutenant Benson forcibly points out the disadvantage of the weapon being attached permanently to any of the three arms, as except on particular occasions it would hamper instead of assist them. When not attached to any particular arm, the General Officer could keep these weapons in reserve, and would be able to use them in the

¹ On referring to the calculations which I made for the purpose of making the above comparisons, I find that I have really understated the case for the Maxim gun.

Taking the weight which six horses can draw, at a gallop, as 37 cwt. (weight behind team in 12-pr. gun), we have about 12 cwt. as the proportion for each pair of horses.

Weight of Maxim gun and carriage	1½ cwt.	} These weights are approximate.
1,336 cartridges in four boxes on gun-carriage	1½ "	
Weight of limber	1½ "	
4,008 cartridges in 12 boxes on limber	4½ "	

Giving a total of 5,344 rounds, and a weight behind the horses of 9 cwt. or three-fourths of the share of work which falls to each pair of horses in a gun-team. I think the margin is sufficient to meet the Chairman's interpolation. The wheels are of hickory; the axle and trail of tubular steel.

manner best suited to assist his general plan of operations. Lieutenant Benson has been obliged to use the word "Nordenfolt gun," because it is the one which he himself has seen in work. I trust that this will not lead to a discussion upon the relative merits of these guns. We are met here to discuss the broad question as to their organization and their use in the field, and it would be, I think, very injurious to the interests of the discussion if we were to diverge into the relative merits of machine-guns. There is one point which it is decidedly right should be discussed, and that is whether a heavy machine-gun has an advantage over a light one, and also with regard to its equipment. I think myself that Lieutenant Benson makes out a strong case for the heavy gun, because it can be taken at speed over much rougher ground than the lighter one, with less risk of being upset, and with less chance of injury to the weapon itself. With regard to the organization, I contend that it ought to be a separate unit. Of course, as one of the speakers has already remarked, there is the question of expense, but let us argue the matter merely from the abstract point of view, and let us believe that the War Office will be sufficiently patriotic to give us the best possible organization, provided we can prove that it really is the most efficient. Then with regard to the tactics, I do not think there is any necessity to discuss the use of the machine-gun in the defence of a position or of a fortified post. That is perfectly well established. But with regard to attack and how machine-guns are to be used, no doubt very important points are raised. The infantry now-a-days, with far-reaching and precise rifles opposed to them, have a very difficult task indeed when they have to advance and attack a position, and any assistance they might receive during that advance would no doubt be of enormous value. I do not see any reason why that assistance should not be given by machine-guns, although they are not attached absolutely to the infantry, quite as, if not more effectively than, by the artillery. The artillery take up a position at a considerable range, and having obtained that range are able to pour their fire into the enemy's line, and the machine-gun can be employed in the same way. But there is one important advantage which the machine-guns have over the artillery at one particular period of the attack, which has not been touched upon by the lecturer. When the infantry get within about 800 yards of the enemy's line, the artillery cannot assist them any longer without firing over their heads. Now I believe it has been perfectly well established by all writers on tactics that there is nothing that shakes infantry more than the fact that their own artillery are firing over their heads. It is a very disagreeable sensation; fuzes will not always burst the shell at the right moment, and any shell coming amongst infantry from their own side does more to shake their steadiness at the critical moment than any fire from the enemy. That disadvantage, however, does not apply to machine-guns. Supposing you can place your machine-guns in position at 1,200 yards from the enemy, having a good command, the bullets that go over the heads of your attacking infantry would not be distinguished from those coming from the enemy's side, and therefore the infantry would get efficient support without any disturbing influences. In such a case I think the machine-guns could give infantry most important support at a time when artillery would be quite unable to do so, without perhaps doing more harm than good. I would venture, in conclusion, to say that I believe artillery in position might often receive very effective assistance from machine-guns. Artillery have often to take up exposed positions to protect the flank of infantry advancing to the attack; they are consequently often exposed to attack from cavalry, or even from infantry. Machine-guns, temporarily attached to batteries so employed, might enable them to remain in action, and prevent them from being severely handled by a counter-attack. Such service would be certainly very much appreciated by that arm, and would add much to its efficiency.

Mr. MAXIM: I fully agree with the author in what he has said about the difficulty of accurate firing of machine-guns from "galloping carriages." You can make moderately good shooting from the back of a horse, provided the rifle is perfectly free, but if the rifle and the horse were fairly secured together, and the relative position of rifle to horse were regulated by screws and gearing, it would be exceedingly difficult to make good shooting. So with a gun mounted on a platform, one end supported by wheels and the other by a frantic horse, I can conceive it

would be an exceedingly difficult matter for a man to shoot well with the gun firmly screwed down to its platform as it must be if it is operated by hand. If a gun is operated by hand it necessarily requires some considerable force to operate it; it, therefore, cannot be free to turn in every direction, as it would participate in the action of the handle. It has to be screwed down to something and aimed with gearing; in order for the gun to be pointed screws must be turned, and it would, therefore, be exceedingly hard to do any kind of shooting from a platform which is constantly moving, the relation between the platform and the gun having to be constantly changed to counteract the movements of the horse. The machine-gun which I have made, and which has had many competitive trials, weighs but 50 lbs., and does not even require screws or training-gear. Some speakers have referred to the necessity of a heavy mounting. I may say that the automatic gun being self-contained, requiring no external power to operate it, has very little tendency to move while firing. A man can lie down on the ground and fire it in the same manner that he can fire a rifle. He can have a box containing several hundred rounds of ammunition beside the gun, and by once pulling the trigger he can fire the entire box without any mounting at all. There being only one barrel there can be but one shot fired at the same time; the strain is, therefore, very light, and a very light carriage can be used, and absolutely without training-gear, except you wish to fire at a target at a long range. I find that the gun being light and requiring an exceedingly light mounting, I can afford to use a shield, the weight of the shield attached above the gun being about 60 lbs. My two shields combined weigh less than 100 lbs., and this carriage with both shields weighs no more than 200 lbs., so that one is able to carry into action 1,300 rounds of cartridges attached to the carriage itself. I find that the weight of the cartridges and the shields steadies the gun and enables one to do most extraordinary shooting. For example, in France the weight of the cartridges and shield together so steadied the gun that 80 per cent. of the shots went into a target 2 feet square at 800 metres, and the French Officers said at the time they were unable to account for the extraordinary accuracy of fire. If any of you would like to see this exceedingly light carriage I would say that I believe both it and the gun are on the premises.

Lieutenant-Colonel ALT: The paper we have heard read is, I consider, an excellent and exhaustive one; but I cannot concur in the conclusions the lecturer arrives at. Being an artillery Officer he naturally thinks on horseback, and considers that machine-guns are not capable of being worked with advantage by infantry, but should be mounted on horse carriages organized in troops of four guns each, and be attached to each division of an army corps. He gives his reasons against their use by infantry under three heads, to which I propose briefly to reply. With regard to the enormous labour of dragging these guns in a campaign, I can only point to what the men of my own battalion have done regularly with the Easter marching column, and at the Aldershot drills, for several years past. The 5-barrel Nordenfelt guns mounted on our magazine carriage have been dragged from Petersfield to Portsmouth, from Canterbury to Dover, from East Grinstead to Brighton, from Aldershot to Pirbright, and back on a bee-line across the Fox Hills, and the Long Valley, with its ruts and dust, is as familiar to our gun detachments as Oxford Street to a London cab-driver; no high-roads, bye-roads, country paths, hills, or downs encountered on the way, have checked their march. Our men never complain, except at the indignity of it being proposed to relieve them, and only accept assistance when breasting a slippery slope, impracticable for artillery, or a steep incline on a heavy or newly-metalled country road. Any loss of distance under such circumstances is more than picked up at the double on the down grade, and by the time the battalion is in attack formation the guns are always in position to take part in the fighting line. If we can do this in the Volunteer Service, Tommy Atkins is not the man I take him to be if he mutinies against being called upon for similar work in the regular Service. With regard to ammunition, our magazine carries 5,000 rounds, and each man of the gun detachment 100 rounds, making 6,000 rounds available for each gun the moment it comes into action. The replenishment of this supply in action is a simple matter of detail. With regard to hand draught giving the least possible mobility, I have already shown that our guns keep up with the battalion under all circumstances, which is all that should be required of

them ; but if additional proof were wanting of their mobility, I may mention that one of the guns, with the usual detachment, has occupied a bridge two miles to its front, and come into action in nineteen minutes ; and for getting across difficult country for a similar distance, I would like to back one of my hand-drawn carriages against one of Lieutenant Benson's horsed wagons with limber. What I mean is going straight across country by-paths, fields, over banks, ditches, hedges, anything that came in the way. I claim for the hand-drawn gun all the advantages of machine-guns so ably pointed out by the lecturer, with the additional advantage that they form a much smaller and more difficult to be distinguished mark for the enemy's artillery and infantry than any other system ; it being very hard to distinguish them at any distance, on certain grounds and in the smoke of action, from a cluster of skirmishers. With two guns attached to each battalion a Brigadier or Divisional General could mass his machine-guns if occasion called for it. I do not think that my battalion is weakened by the detailing of the necessary detachments to work the guns, but that confidence is rather imparted to it by having its flanks covered by those weapons, and by the general feeling of security their presence imparts to the rest of the line ; and I do not find they get any more out of my control in practice than the companies of a battalion in extended order or detached for outpost work. I should be pleased to see machine-guns attached to each branch of the Service, but I contend that as they are but clusters of rifles their proper place is with the infantry. I contend also that they should be mounted upon a single magazine-carriage to be drawn by hand without being encumbered with shafts or separate limbers, which are impediments which I found to interfere altogether with the effective working of the guns, and which might with reason be complained of by Tommy Atkins, if he were given machinery of that sort to manipulate. It appears to be the general feeling of the meeting that these guns should be horsed and worked in batteries. And with reference to Lord Chelmsford's remarks as to the firing of machine-guns over the heads of infantry not resulting, as with artillery, in shells sometimes dropping upon your own men, I may suggest that there are such things as defective cartridges, which sometimes fall short, as I have found to be the case with field-firing experiments at Aldershot, and it would be just as startling to men advancing across country to find a few bullets coming into their rear as it would be to have shell bursting short over their heads. I was glad to hear Major Smith admit that these mounted guns might gallop up at a given moment and take part in the fighting line, but it appears to me that if I can sneak up my machine-guns with the fighting line my non-commissioned officers or Subalterns attached to them can judge much better as to the best position to be occupied than one of these flying batteries, dashing up in the heat of action to take up a position ; and I think my guns would be much better able to produce the effect which it is desired to demonstrate could be obtained by the flying battery. Time prevents my touching upon statistics with regard to weights, number of men and horses, &c., and I therefore conclude by tendering my personal thanks to the lecturer for his valuable contribution to the subject of machine-guns.

THE CHAIRMAN : Do I rightly understand you to advocate machine-guns being galloped up ?

Lieutenant-Colonel ALT : No ; I say I can get across an ordinary enclosed country on a bee-line as fast, for a mile or a couple of miles, as a horsed battery of machine-guns would be able to do by having to keep to road or clear away banks and ditches to get through.

THE CHAIRMAN : I only interpolated because I thought you spoke with approval of what Major Smith said as to their being galloped up in front.

Lieutenant-Colonel ALT : It has been objected to machine-guns that they could not take part in the fighting line, but I have always so worked my guns when necessary, both at Easter reviews and on field-days at Aldershot. I do not consider they would be likely to suffer more in that way than the individual men would be which formed the fighting line.

Mr. C. FREDERICK LOWE : At the lecture given on this subject in January of last year, when Lord Charles Beresford was in the chair, I called attention to the fact that General Gordon, in his diary written at Khartoum, in December, 1884, a few days before his death, said, " Against a good mitrailleuse, and a sharp operator

with a good telescopic sight, no gun could be served with impunity at 2,000 yards range, although it could be served against artillery fire, for at that range there is plenty of time to dodge under cover after seeing the flash ere the shell arrives." Now I am in a position to say that this very practical suggestion of General Gordon is fully endorsed by a distinguished and gallant Officer occupying a very high position, and it would be interesting to learn whether the makers of machine-guns have taken any practical measures to carry out this idea. Of course the theory formed by General Gordon as to the effect of these telescopic sights was founded on the experience of the American Civil War. Since the date of that lecture I have been favoured by letters from Officers and soldiers who took part in that war with telescope rifles which were manufactured in this country, and ran the blockade. The other day I got a letter from a Colonel in the Confederate Army, in which he said that when General Longstreet's corps was approaching Suffolk, in Virginia, in the early part of 1863, by one of the level roads leading to that place, the advance of the corps was discovered by a Federal signaller, perched on a barrel erected on the top of a high pole, like the crow's nest used by the Arctic voyagers, and who was seen signalling the Confederate movements to the Federal troops in his rear. Several of the sharpshooters of Longstreet's corps were armed with Whitworth telescope-sighted rifles, and one of them being called to the front was told to try a shot at the occupant of the crow's nest. This he did, and the man immediately disappeared below the edge of the barrel, and no more signals were given by him. In the advance then made the Federal skirmishers were driven back beyond the crow's nest, which was found to contain the dead body of a soldier shot through the upper part of the body. The great distance at which he had been killed induced General Longstreet to have it measured, when it was found to have been 1,300 yards. I have other letters from other Officers in the Confederate service, and also from one of the men who carried one of these rifles through the whole war, giving similar details, and on the other hand there is a letter from an Officer in the Federal service.

The CHAIRMAN: I think this is rather wide of the mark.

Mr. LOWE: Then I will venture to draw attention to the fact that the sights of rifles, machine-guns, and cannon are all alike. I venture to say that the sights of all the present firearms in use are very defective. I was told by a gentleman whose business it is to make and sell machine-guns, that he once shot—

The CHAIRMAN: I am afraid it is not relevant; there are many gentlemen anxious to speak, and our time is extremely short. We have had ample evidence that the desire of the meeting is that the discussion should be directed to the question of machine-guns.

Mr. LOWE: May I suggest the application of the principle of the aperture sight to machine-guns?

The CHAIRMAN: No. What we have to deal with is the general question.

Colonel TALBOT COKE: I wish to say one or two words with regard to what the lecturer has said, namely, that it is during the time of peace that we should make experiments for war. During the two years that the battalion under my command has been at Aldershot, we have fully tested the machine-guns, both on ordinary field-days and in the usual peace manœuvres. The first gun we had was mounted on pack mules, and I quite agree with what has been said, that it was useless when so carried. This year we have the sailor's carriage (such as is used by the Naval Brigade), drawn by one mule, and that carriage is also very faulty. I firmly believe that there is only one class of carriage that will ever really meet our military requirements, and that is the limber with the trail. I will not enter into the subject of weight, but I think it is a mistake to go from one mule to four horses. One mule has hitherto done our work with ammunition and gun on one carriage, and to jump from that to four horses is rather too long a step to be taken all at once. I should like to see the infantry gun with a limber and two horses. As to the concentration of guns in the field, I think that might be carried out by the Brigadiers, even if the guns are with the various infantry battalions, and I quite agree with the lecturer, that for practical purposes they should be concentrated in the field.

Captain WALTER H. JAMES, late R.E.: Having some years ago advocated the

question of a carriage from which the machine-gun could be fired without unlimbering, I would ask permission to say one or two words on that subject. I am perfectly prepared to admit that the idea of a gun firing while retiring is somewhat of a Utopian character, but if you concede that the machine-gun is chiefly a horse artillery weapon, I think there are moments in the collision of hostile cavalry when a machine-gun which can be fired, even though the horse do disturb its aim somewhat, will be of the greatest utility. The only other point to which I would like to draw attention is one which has not yet been alluded to by the lecturer, and that is the position that the machine-gun occupies at the present moment, when a small-bore rifle is about to be introduced. The great object sought to be gained by using a cartridge of the same bore as the rifle was that it prevented the introduction of another kind of ammunition in the field, with all its attendant disadvantages. Granted, but when you come to this, that in a very short space of time you will find your infantry armed with a weapon, if I may judge from a recent General Order, of 0.298 calibre, it will be a very grave question whether for your machine-guns you will retain the same cartridge, or whether you will not be able to get a much more efficient weapon by introducing a different kind of machine-gun altogether. When the French introduced their mitrailleuse they used a much heavier cartridge than that for the rifle, and I do not know that there is any instance in the record of the 1870-71 War of failure of the ammunition supply. Therefore it may be conceded that it is possible to supply your mitrailleuse with whatever cartridge you determine shall be employed in it. This being the case, we have to consider what will be the best cartridge to give the machine-gun in the future. One difficulty with the machine-gun is undoubtedly range-finding, but Lieutenant Benson proposes to attach a gun which shall be used for no other purpose than range-finding.

Lieutenant BENSON: And to be carried on the limber.

Captain JAMES: I will go further. I would propose the introduction of a weapon which can be used for range-finding and for fighting purposes in addition. We are all of us aware of the great stride made in rapid-firing guns of late, and it seems to me that the future best form of mitrailleuse will be something of this kind; firing a shell which shall exceed the General Convention weight, i.e., over 1 lb., probably 2 lbs. or 3 lbs., which shall contain a high explosive fired with smokeless powder, with a muzzle velocity of 2,000 feet. You would obtain a very different effect from a battery of these weapons to what could be got from a battery of rifle-calibre mitrailleuses; they would not only possess man-killing power, but also battering power, because even the small charge, of say gun-cotton, contained in those shells, which would probably be of steel, would have a fairly efficient battering character.

The CHAIRMAN: Would they explode on impact?

Captain JAMES: Yes, of course, with percussion fuzes. I have come to this conclusion, therefore, that the new rifle cartridge is not adapted to the machine-gun, because it is so very difficult to find out what it is doing; that the advantages to be obtained from machine-guns can be very much better obtained from a quick-firing than from an ordinary machine-gun as accepted at the present moment; and then I come to the point as to how these batteries are to be organized. I am distinctly of opinion that the cobbler should stick to his last. If you attach the machine-gun to infantry or to cavalry, or to anybody but themselves, I think they will always occupy a secondary position. I am convinced that you ought to organize your machine-guns in special batteries. Various propositions have been made of this kind. Some years ago a gentleman was good enough to suggest that they should be attached to the branch of the Service to which I belong; but I do not think that is a practical suggestion. I think they should be organized in batteries, such as have been suggested by Lieutenant Benson, or as was suggested in this theatre a great many years ago, just after a Committee enquired into the use of machine-guns in the field. What should these batteries be attached to? I think they should form special reserves under the Divisional Commander. I should be almost inclined to go even higher in European warfare, and say the corps Commander; that a corps Commander, taking our present Army Corps, should have perhaps twelve of these rapid-firing guns attached as one battery, and in addition

to that I think it should form the main weapon of the horse artillery attached to the cavalry. It would take too long for me to go into the special tactical uses of these guns; a heavy, rapid, and continuous fire from such a battery as I suggest would, I think, be much more efficacious than that from any mitrailleuse merely firing the infantry bullet of the future.

Mr. NORDENFELT: I wish to be allowed to protest in a gentle way against one remark of Lieutenant Benson's, viz., the last remark he made about the firing at Aldershot. It is quite true that on one particular day the guns did not hit well, although on the previous days they had done very well. Major Mechem, the Musketry Instructor at Aldershot, and the Officers of the regiment, had trained the men very perfectly with dummy cartridges, but before that trial I believe they had not fired any ball cartridges, except a small number on one day previously. It is necessary for men to be trained for machine-guns almost as much as for rifles, and I do not believe that any man who has only fired 300 rounds can suddenly set to work and hit targets at long ranges, indeed Lieutenant Benson admits that himself. The infantry carriage and the cavalry carriage have been made with a view to mobility. When Lord Charles Beresford came back from Alexandria, he told me that he did not see why we could not arrange guns to act like torpedo-boats ashore, and it was entirely due to Lord Charles Beresford that I commenced to push forward these galloping carriages. Since then Colonel Liddell, Major Wilson, and Captain Baden-Powell have been working for months with these carriages, and have gained a great deal of experience. At Aldershot the results of target firing have been sometimes good, and sometimes bad. Amusingly enough, some of my own men went down the other day, and fired very badly; in their great anxiety to fire quickly, they did not hit at all, whereas the disciplined men trained by the three infantry regiments made uncommonly good practice, in some instances at 400 yards making from 80 to 90 per cent. of hits. Although it is not for me to decide in what manner the guns should be employed, I hold with the lecturer that the mule can only be used in mountain warfare, but for this purpose I fully believe that the mule will be used, because there are many occasions when a light gun in mountain service will be found to be exceedingly useful; but it will have to be on a separate mounting, in the same way as in the case of other guns for mountain service. Next, as to the infantry and cavalry, whether the gun is to be used as part of a regiment, or as a tactical unit of a brigade or a Division, I do not pretend to understand; but guns actually following the regiments or brigades on certain opportunities must be exceedingly useful, and must come into the armies. The guns will have in some way to be attached and organized so that the Colonel and the Brigadier-Commander who needs them will not have to send a messenger half a mile to the Divisional General to ask for them, because then they may never find one another again. The gun must be exceedingly handy; the opportunities given for its use may not last more than a minute or two, and if it takes five minutes to go and ask for the guns they may lose their chance, which might have been invaluable. That is the point on which I strongly urge the value of mobility. Mobility is a relative term. With an infantry regiment it means the speed with which the infantry can move at the double; with cavalry or artillery it means the speed at which they can go; therefore, I believe that the galloping carriage, with perhaps alterations such as have been described, or some other carriage, must be used for the machine-gun. Lieutenant Benson has misunderstood one point. He says the horses are not taken out. The idea is that the horses should be taken out at longish ranges, when you are not under immediate and close fire, but that the horses should be left in the shafts at short ranges, when you suddenly come upon your enemy at anything between 200 and 800 yards. For that purpose, when your target is not a small target but a large one, I believe it will be found on extended practice that the movements of the horses do not seriously affect the gun. I say this distinctly, because if you take a target representing a squadron of cavalry, it will be about 9 feet high by 50 feet wide, and that target will be hit by a very large percentage of shots fired at these ranges, whereas if you fire at the Wimbledon target with a bullseye, you may not hit it with any large percentage of the bullets fired. The machine-gun is intended to fire a rain of bullets falling for a short time, but the moment you begin to calculate mean deflections measured in inches, you may not have good targets. If you keep before your

mind that the machine-gun is not meant for that purpose, except possibly firing at a General and his staff at long range, you will never use it for accurate firing, but simply in order to throw a sudden and unexpected rain of bullets on your enemy, he not knowing where on earth they come from. Captain James spoke about the small-bore cartridge. This cartridge can only affect the machine-gun in the same way as the rifle. If the cartridge is only two-thirds of the weight, that means that you can carry 50 per cent. more ammunition within the same weight. As to quick-firing guns moving rapidly, I am entirely of Captain James's opinion, but it has nothing to do with rifle-calibre machine-guns at all. Machine-guns are separate things firing rifle cartridges, and I am certain that the machine-gun must be adopted into the Service in connection with cavalry and infantry. I do not care whether it is a separate tactical unit or attached to regiments, but if clever gunners like Lieutenant Benson can possibly work up an interest in favour of having heavy guns with artillery mounting, I for one shall have no objection, but I have not very great hopes of it. On the other hand, I fully believe in the 6- or 8-pr. Shrapnel guns which I am making. Those guns, I believe, will and must go wherever light artillery goes, but heavy field artillery cannot move quickly enough, and cannot advance so close to an enemy as these quick-firing guns protected by their shields are able to do.

Major-General ARBUTHNOT: I have had a great deal to do with experimental guns, and all the machine-guns in the Service have passed through my hands. Perhaps, therefore, I may be allowed to say a few words. I am not going to touch so much upon the question of tactics as on that of equipment, but I think that there ought to be two separate equipments, one for cavalry and one for infantry. With regard to whether the gun should be attached to a regiment of infantry or cavalry, or whether it should form an independent unit, is I think a matter of minor importance, provided you have a separate equipment for the two arms with which it is to be used. The galloper carriage first introduced two years ago was got up on Lord Charles Beresford's suggestion, and has been worked out since by Colonel Liddell, Mr. Nordenfolt, and myself, and I believe the last carriages which have been issued have given general satisfaction to the 10th Hussars, which regiment has carried through all the experimental work. Although one of the regiments at Aldershot made three hits out of seven rounds, the 10th Hussars certainly made much better practice than that. I have seen them practising with the guns on the galloper carriages with the horses in the shafts, and they certainly made many more hits than three out of seven, or whatever it was. I think if the horses are trained and the men are trained and understand the working of the guns, with the aid of the prop which has been introduced by Mr. Nordenfolt, very steady firing can be obtained, even without taking the horses out.

The CHAIRMAN: At what kind of target and at what range?

General ARBUTHNOT: At ranges below 600 yards and the horses left in; beyond 600 yards the horses may be taken out, and then the fire will be just as steady as on any other kind of carriage on which the gun might be mounted. There is one great advantage in the two-wheeled carriage for cavalry, namely, that it can be brought into action pretty quickly, whereas if you have a limber, and you have to unlimber your gun before you go into action, you cannot fire half so rapidly as if you carried the ammunition with the gun itself. With regard to the infantry mounting, there are two equipments for infantry, one being with mules, which is intended for mountainous countries. It is never intended that the mule equipment shall be for the ordinary service of the machine-gun working with infantry, but just as you have two equipments for artillery, the mountain equipment and the general equipment, so with the machine-gun. Therefore, to say it is useless is only to say it is useless if you are in a country where a superior carriage can move, but it will not be useless in a hilly country where you cannot use the ordinary carriage. The mule equipment of the machine-gun is a very good one for the purpose for which it is intended, namely, for use in mountainous countries. With regard to the two-wheeled equipment of machine-guns to be used in conjunction with infantry, the mounting is based on the same lines as the landing carriage for the Navy. That landing carriage for the Navy was got up after the campaign in the Soudan. The Naval Brigade there had a Gatling equipment converted to take the Gardner gun

with a limber, but it was found so heavy and so inconvenient, and in every way so objectionable, that Captain Wilson, R.N., who had the working of these guns in the Soudan, wrote a report on the subject, in which report he advocated the adoption of a two-wheeled in preference to a limber carriage. A Committee was formed, of which Captain Wilson was a member, and which recommended the two-wheeled landing carriage which was subsequently adopted, and which I believe gives general satisfaction in the Navy; it has entirely overcome the objection which was found with regard to the use of the limber carriage. When it was desired to get up an equipment for the infantry the naval landing carriage was taken as the line on which to build the infantry carriage, in consequence of its having proved so successful. I am speaking under the correction of Mr. Nordenfelt, but I believe the landing carriage which was used for the infantry as far as regards the mounting was on the same lines as the landing carriage for the Navy.

Mr. NORDENFELT: Entirely.

General ARBUTHNOT: That carriage was two-wheeled; two horses can be put in it if necessary, a man riding on the near horse. That is considered preferable to having one horse and leading it. There is no objection to a man riding and driving the carriage. The gun can be fired with perfect steadiness. The horse can be either taken out, or the gun can be fired with perfect steadiness by propping up the shaft if the horse is left in. I have seen most excellent practice made with a gun mounted on a carriage of that sort, and considering that it can carry 2,000 rounds of ammunition that gives it an immense advantage over the limber carriage, which should not be forgotten. With regard to the weight of the gun, I think no gun issued to infantry or cavalry should exceed 100 lbs. in weight at the very outside; anything beyond that to my mind necessitates a very much heavier carriage and wants more strength. A gun under that weight could be carried on a comparatively light carriage, because there is not the same wear and tear as with a heavier gun. Another advantage is that it carries very much more ammunition for the same weight. I do not agree with Captain James, that the small-bore cartridge is unsuitable for the machine-guns. I think if a cartridge is efficient out of a rifle it is equally efficient out of a machine-gun, and to my mind the great advantage of the machine-gun acting with cavalry and infantry is that it should fire the same ammunition as rifles, because then every reserve of ammunition would supply both machine-guns and the rifles.

Captain JAMES: May I be allowed to explain? I do not deny the use of the new cartridge with a machine-gun, but I believe you will get a very much better effect, quite worth all the additional complication of ammunition, out of my proposal.

General ARBUTHNOT: That is a point I should hardly touch on to-night. The question of the ammunition of machine-guns is somewhat departing from the subject of this discussion; I think, however, being able to carry more ammunition is another advantage of having the light cartridge. If the gun is, say, 90 lbs. in weight, you can carry 2,500 rounds of ammunition without its being too much for one pair of horses, and you can have a carriage strong enough to carry that weight of ammunition with a light gun. I think the 10-barrelled Nordenfelt is altogether out of the question for field work. If you go into that great weight of gun, you may at once have field artillery, it is altogether beyond the question of musketry, it is too heavy a gun for field purposes. There is one point that has not been touched upon, and that is with regard to the uses of machine-guns. I think it will be found in warfare that they are more useful for defensive purposes than for offensive. For defending a bridge, or a defile, or for street firing, the machine-gun will, I think, be invaluable. You can by its means fire a rain of bullets concentrated on one spot, down a narrow lane, which no number of men could ever attempt to compete with. I think myself, a large number of guns of a few barrels each would be more efficient than one gun with several barrels, because the fire can be spread over a larger surface. You cannot kill a man more than once, and if you fire your 10-barrelled Nordenfelt, ten bullets may hit one man, which is not the service that is wanted. What is wanted is to spread the fire over as large a surface as possible with a few barrels. I will not detain you longer.

Lieutenant-Colonel J. P. BRADAZON, 10th Royal Hussars: Sir, I rise to make a few observations on this important subject, and do so with the greatest diffidence,

as, unlike most of the speakers whom we have heard this afternoon, I have not had the advantage of reading or knowing the contents of the very able paper by Lieutenant Benson, until it was read to us by him a few minutes ago. When I entered this hall I had no intention (as I was utterly unprepared) of taking part in the discussion, but with your permission I should like to make a few remarks on what I have heard fall from the speakers who have preceded me. As to the description of machine-gun, and its various scientific technicalities, I leave to cleverer men than myself to determine, but for cavalry it is absolutely necessary that it should be of a light and handy description. That attached to my regiment, and horsed with two horses, has in my opinion proved itself a very light, handy, and suitable weapon. But one detail I think common-sense points out to us to be absolutely necessary to its utility, and that is that it should be of the same calibre, and carry the same cartridge as used by our infantry. Lord Chelmsford, in his remarks, said that the great anxiety shown by both infantry and cavalry to have this machine-gun attached to them was a reason, in his opinion, that neither should have it. I beg to differ most entirely with his lordship. English soldiers are very conservative and look with distrust on any change of armament and equipment, and the very fact that these two branches of the Service are so anxious to get it is, in my opinion, a strong reason not that neither should have it, but that both should. When I mentioned two arms of the Service I ought to have included the third, for artillerymen seem as anxious to have it as an adjunct, as do the infantry and cavalry. I have heard during this discussion the machine-gun frequently alluded to as a "gun" and talked of as being in "battery." I protest against this. It is not a gun in the popular military acceptance of the term. It is a "rifle," *pur et simple*, a machine rifle, and a rifle that in my opinion ought to be permanently attached to every cavalry regiment, whatever its best position may be for the other branches. Mr. Benson I believe favours, and Lord Chelmsford supported the idea, that these machine-rifles should always be attached to the artillery, and in action some of them placed under the immediate command of Brigadiers and Generals of Division, to be sent for when wanted; this would in my opinion never answer, especially as far as cavalry is concerned. It is essentially a weapon of "opportunity," to be used on the spur of the moment, and if that chance is allowed to slip by, the whole *raison d'être* of the gun disappears. Napoleon, when he advanced on the Danube in 1805, had his cavalry from 80 to 100 miles ahead of his main body. In the Franco-Prussian War, the German cavalry, whenever possible, was from 20 to 30 miles ahead of the infantry. The rôle of cavalry is to be as far as possible in advance, and act as a screen to the main body. Imagine cavalry not 80 or 100 miles, nor even 20 or 30 miles ahead, but say only 4 or 5 miles ahead, and suddenly finding a splendid opportunity for using these guns, and having to send back miles to get them, it is a thousand to one the opportunity when they might have been of the utmost utility would have fled long before they could come up. I am surprised, from an extract read out of a letter from Colonel Ward Bennitt, to find so distinguished a cavalry soldier an opponent to having this weapon attached to his regiment. I cannot conceive a cavalry soldier not receiving it with open arms, for I foresee that their introduction as part of cavalry armament will be of immense service, and tend to keep the cavalry soldier where a cavalry soldier ought to be, *viz.*, in his saddle. Englishmen understand the horse better than any other European nation, I think I may say better than any other nation in the world. We breed the best horses, our men ride better, are better dressed, and better equipped. We have everything in our favour to make our cavalry, if small in number, the most splendid body of horsemen in the world, and we throw all these advantages to the winds and worry ourselves with trying to turn what ought to be, and could be, the most magnificent cavalry into indifferent infantry; just as on the same principle we are turning our best infantry into execrable cavalry under the name of "mounted infantry." It is lamentable to me to see the rôle of cavalry so completely misunderstood, and I know nothing more ridiculous and heartbreaking than the sight of a dismounted dragoon, encumbered with sword, sabretache, and spurs, carbine in hand, dodging about bushes like a rabbit. I foresee that these guns may possibly save us from all this, and once more put our splendid cavalry in its proper place. But then some people are very narrow-minded about changes of any sort, and I am afraid lancers are

ultra-conservative about their armament, for I remember there was just as strenuous an opposition on their part to the introduction of carbines as there now appears to be to the machine-guns. I remember, at the time I allude to, an Officer of lancers who was about to exchange into a hussar regiment telling me that his old troop sergeant-major asked him if the report he heard of his intended exchange was true; on being told it was, said sadly: "Well, Sir, of course you know best, but personally I shouldn't like to be found drowned in the same parish with a carbine regiment." Evidently he feared that his friends might think he had passed his last hours on this earth in the disreputable company of anyone who could use a carbine as a weapon of offence or defence, and apparently the old conservative sergeant-major is not singular, and there are some of the opinion that any regiment who can advance the utility of the machine-gun must be as utterly disreputable as the carbine regiment referred to by the old lancer. Referring to the Germans, the most practical and scientific soldiers of the day, and their estimate of the machine-gun, I may remind you that they were opposed in 1870 and 1871 to an enemy that had machine-guns (*mitrailleuses*) attached to their infantry, but they apparently did so little damage and were so little thought of by the Germans, that though seventeen years elapsed since that war, I have never heard of their adopting machine-guns as adjuncts to their infantry battalions or artillery batteries. Last summer, however, Prince William of Prussia, accompanied by some of the most distinguished cavalry Officers of the German Army, who were over here for the Jubilee rejoicing, did my regiment the honour of paying us a visit at Hounslow, and were so impressed with our two-horse Nordenfolt gun, its handiness and applicability to cavalry movements, and the ease with which it kept up and manoeuvred with us during a galloping field-day, that Prince William immediately ordered a facsimile gun to be sent over to Germany, and we sent over one of our men to Potsdam, to show them how to work it; and so taken by it are they, that I believe I am right in saying that it is going to be adopted for their cavalry. Lord Charles Beresford is anxious for me to repeat what I told him a few minutes ago as to the confidence it inspired and the popularity of this gun among the men of my regiment. I was much surprised to hear from one of the gentlemen who preceded me that he found the consensus of opinion among cavalry Officers at Aldershot to be adverse to this gun, and that it was unpopular with soldiers; all I can say is that such is not the case in my regiment, where the gun is very popular, as I confidently believe it will in time become with the remainder of our Army. Great stress has been laid by those whom I may call the opponents to the gun on the danger of its being put out of action through horses being shot, or from being upset going over rough ground. There seems to be much misapprehension about the way these guns are to be used. On only the rarest occasions have I seen them fired with horses attached, and then never against infantry. But there may arise occasions, when you want to get a few rounds in against cavalry advancing in close formation, when it would be necessary to use them with the horses attached, so that they may continue firing till the very last second and then gallop away out of action or under cover of their own cavalry. As regards the horses being shot, that is of course an accident that equally obtains with artillery, and a gun with its lead horses shot is equally out of action until they are replaced by others. In every troop there are five or six horses trained to harness, and if one or even both horses were shot they could be easily and speedily replaced. As regards their upsetting, they can go anywhere where cavalry can go. I have seen our gun worked over the Fox Hills (which I think everyone will allow is bad ground for cavalry; at all events, I have never seen a field-day there without both men and horses going head over heels, through galloping into the heather-hidden holes and ruts), and yet the gun working at a gallop has never come to grief. But suppose it did. Suppose all the horses trained to harness were shot. Suppose the gun went head over heels, and was so damaged as to become useless. It would be bad luck, but not an irretrievable disaster. Knock out a linchpin and leave it, say I. One thing I would not do. I would not sacrifice a single life to save it, out of pure sentiment. Neither would I sacrifice a single life to save *any* gun, out of pure sentiment. I have often, at Aldershot, had our gun attached to my squadron; have often asked for it, if sent out to watch or oppose a superior force, feeling the great advantage which its presence

must give me, and have never yet seen a field-day when I should not have had an opportunity of using it with extraordinary effect. In conclusion, I may say that it is my firm conviction that a cavalry regiment armed with these guns as they should be, viz., four guns, one to each squadron, would be more than a match for any two regiments not similarly armed.

Captain R. S. BADEN-POWELL, 13th Hussars: After what Colonel Brabazon has said, there is not much left for me to add. In selecting our tools for any kind of work, we usually look to the particular sort of work we are going to do, and if we want to use a sledge-hammer or a tin-tack driver, we do not go and select a farrier's hammer that will do the work of both—equally badly. Lieutenant Benson has selected a very nice kind of machine-gun for general purposes, but I do not think he has fully considered the very different nature of the work that the various arms have to carry out. I do not think, for instance, that he has noticed the great difference between cavalry work and that of the other arms. To my mind there is as much difference between the action of cavalry and that of other arms as there is between an Englishman's way of fighting and a Frenchman's. The infantry and artillery fight the good old English way; they square up to each other and have i out hammer and tongs, but cavalry fight more in the manner of the Frenchman, who comes up to you, looks you straight in the face, clenches his teeth, and then suddenly lets you have a kick on the shins before you expect it. The success of cavalry fighting lies in sudden attacks from a most unexpected quarter, and for this kind of fighting I think the present cavalry machine-gun is the most efficient weapon that could be devised. It comes up almost unseen by the enemy, especially if it has an escort of six or eight men, who can mask it completely until they arrive within close range. With scarcely a pause, it can commence firing, pour in a rapid, deadly fire, and go on until the last moment with safety, and then bolt away for its life, if it likes. All the effect of this sudden and rapid action would be lost in the case of a gun that had to move with a limber and four horses attracting attention, and which, when it came up, had to unlimber before it could commence firing, and then to limber up again in good time to get away, if the enemy came after it. I think the infantry ought to have a gun of altogether another kind from that of cavalry. They ought to have tools adapted for their special work. Let cavalry have a cavalry galloping gun, and let infantry have an infantry gun, and, if necessary, have a general utility gun for the artillery if you like; but do not have one to act for all. The lecturer says that "with cavalry the machine-gun has nothing in common, except perhaps its power of rapid movement, for cavalry are supposed to act by shock, while machine-guns act by fire alone." Cavalry do not always act by shock. I suppose throughout the Franco-Prussian campaign any regiment you like to take, hardly acted by shock more than half-a-dozen times in the whole campaign; whereas pretty nearly every day they would be engaged in holding and seizing defiles, in occupying advanced posts, on outpost duty, in harassing the enemy's flank, in attacking convoys, in holding defiles when on the rear-guard in retreat. This is the usual sort of work which cavalry have to carry out on service, and for it the cavalry machine-gun would be the most powerful aid that could be devised.

Captain PALLISER: There is one part of the subject on which I wish to say a word, as it has only just been touched upon. That is, the wonderful shooting of the Maxim machine-gun. My opinion is, and it is a coming question, that this machine-gun gives the best shooting known, shooting that cannot be beaten even by picked marksmen in bodies. There has been some remarkable shooting going on lately, which is new to this meeting, and about which I must be reticent to some extent, because it is under Government supervision, and is carried out before the Committee. This shooting has been made not only at fixed marks, but in traversing from one mark to another at ranges of from 600 to 975 yards. In one case an Officer who had never fired the gun before in 75 rounds made 72 hits at 600 yards. I say that the admirable shooting of the machine-gun is the coming question, and I do not agree with Mr. Nordenfelt in the great merit of scattering fire. These weapons, when used in large numbers, whether made by Mr. Nordenfelt or Mr. Maxim, or other machine-gun makers, must be brought to this perfection; and then the conditions of war will be changed, because by their use ordinary soldiers will be able to

shoot as well and better, and in far greater volume, than even picked marksmen in numbers.

LORD CHARLES BERESFORD: It seems perhaps rather impertinent for a sailor to rise to speak on a subject so entirely connected with the sister Service, and particularly in the presence of so many distinguished artillerymen; but I have always taken such very keen interest in this question that I hope I may say a few words. There is one expression that I think ought to be altered in discussing this question, and it is one which has evoked a certain amount of discussion to-night, namely, the name that it is given to these weapons. I think they ought to be called "machine-rifles," because, directly you get into the question of "machine-guns," you have a discussion as to how they are to be mounted. On two occasions, at Alexandria, if I had had a machine-rifle that could have galloped, I could have sent a certain amount of help, and it struck me whether it might not be possible to mount the machine-rifles, so that a horse or horses could gallop with them. Directly the question of "guns" and "batteries" is produced, the limber and trail is discussed, but keep this machine as a "rifle," and it might be able to be put into action at a moment's notice. That is what passed through Captain Wilson, V.C.'s brain in the Soudan, because the time he lost in having to "Unlimber" and "Action right," "Action front," or "Action rear," the amount of time he so lost probably lost him a good many men, and prevented his being able to fight his gun at all. The object of the two wheels, either with infantry or cavalry, is to have the gun always in action. It should be able to train over its own wheels, and the mere dropping of the trail or the word "Halt," "Right" or "Left reverse," should put the gun immediately in action. I think it would be a very wise thing if the authorities would get rid of the expression "machine-gun," and as soon as possible use "machine-rifle;" for really, after all, this weapon is simply a cluster of long-range rifles. I must congratulate the lecturer on one of his suggestions, to the effect that something more practical should be done with this. It is very gratifying to us who have agitated for this arm for so many years to find an artillery Officer working out a paper of this description, coming as it does from his branch of the Service, which we have generally thought has been opposed to the machine-gun, principally, I believe, because it has been called a gun. I say it is very gratifying to find an artillery Officer who has brought the question so prominently before the public. The practical suggestion is, either that the obsolete 9-pounder batteries should be formed into machine-rifle batteries, or something of that character should be done, or that a Committee should be appointed in order to thresh this question actually out, because at present there are so many different opinions on the matter; although I think generally the Officers in the sister Service acknowledge that machine-guns have a very useful part to play in future wars. Of one thing I am perfectly certain, that directly we produce smokeless powder, they will have a most important part to play. I think the suggestion is very wise, that this weapon should not supersede any arm of the Service. Why should it? It is a new arm; it has capabilities that other arms have not got. As far as rifle-firing goes—as a cluster of rifles—it should no more supersede any arm in the Service than should our torpedo-boats or our submarine-boats supersede ironclads or cruisers. It is something else that has got to be counted on when you go into action, and as far as you can utilize it to knock your enemies into a cocked hat the better for you, but take care that they do not utilize it against you. You must be prepared to meet like with like, which is so important in all warfare. It would be a very serious thing if the German or any other army were to take up the machine-gun question, and we with all our practical experience, having found it so useful on so many occasions, were not to take it up and thresh it out as has been proposed. There is one thing more, in my humble opinion, and I hope I shall not be considered presumptuous in giving my opinion as a sailor; but I have commanded these guns on shore as well as afloat, and I think one of the principal points to realize about the machine-gun is, that it should be a unit. If you put it into batteries, if you put it into troops or into any section, or where the guns have got to work together under an Officer as a battery or similar formation, you would make a mistake. They should be essentially skirmishing clusters of rifles, and with each gun should be its own Officer. If you like to call them a "battery" or "troops," for marching in peace-time, do so, but the moment

they are put into action they should work in separate units; one man might go to a clump of trees or a bridge and hold them, and another man to another place, an Officer with each unit, and do something equally good; but directly you put them into a "battery," you will have a battery firing against them possibly. What is the result? You get hit on the flank and you are knocked out of action, as the French mitrailleuses were by the Prussians in 1870. The Germans had a holy horror of the mitrailleuses instilled into them, and what did they tell their artillery to do? They said: "Never mind what else you do, but as long as you see the mitrailleuse battery, devote all your attention to it;" and as these mitrailleuses all drew up in line and were worked as batteries, they were generally taken on the flank, and two or three shells put them out of action. I think the lecturer has given a most useful and instructive lecture, and I sincerely hope much good may come of it, and the machine-rifle introduced into the Service, as a new arm, to be utilized as the General commanding a brigade may think fit.

THE CHAIRMAN: I am very glad of the opportunity of following Lord Charles Beresford. I think he needs no apology whatever for addressing us on this subject, because we know the connection which he has had with machine-guns all along. The suggestion that he has made as to the change of term and the use of the guns in very small units are, I think, most valuable. I should like to make a remark upon my own appearance here, as an Officer of artillery, in the chair. Seeing that the lecturer also belongs to that branch of the Service, it might appear as if the artillery had something specially to do with the machine-gun. But, in point of fact, except that the artillery administration—that is to say, the Director of Artillery—has to do with the bringing out of the gun, the artillery arm has nothing further to do with what are called machine-guns; neither have they any jealousy whatever with regard to them, as Lord Charles Beresford seemed to suggest just now. I think they have no jealousy whatever as against them; on the contrary, at one time I think they rather claimed, or were anxious to have more to do with them—to have more share in their management than has been subsequently accorded to them. I confess, at first my own feeling was that the artillery could very conveniently take them over; but I have come away from that way of thinking. I do not think there was sufficient ground for it. The weapon is an entirely different one from the artillery weapon proper; its aims and its powers are entirely different. I think the observations that have been made show that the action of the military authorities in putting these weapons in charge of the infantry and in charge of cavalry regiments has done an enormous deal to popularize the weapon; and I cannot conceive that in any other way could Officers, non-commissioned officers, and men have had the opportunity of making such intimate acquaintance with the weapon, than by making it for the time being an integral portion of their regiments at Aldershot. I do not think it necessarily follows that we should look to that as the end of all things as regards the organization of such weapons. I think in a campaign it must remain a rule, that an infantry regiment or battalion, or a cavalry regiment, will not always require to have a machine-gun with it. It might go over ground where such a gun could be absolutely of very little use, and therefore, I think, a General would wish to be able to attach a machine-gun to an infantry regiment or to any body of troops for a time. In order to enable him to do this, he should have a train of machine-guns, each gun as a single unit, and ready to go by itself, to be detached for any number of days to any point where its services were required. As regards the officering, it should be officered much in the same way as the mounted infantry are officered. So far as the infantry branch is concerned, it should be officered and manned in the same way as mounted infantry; that is to say, by men taken from the infantry. Similarly, you would require a body of machine-guns equipped to accompany cavalry, and that might be officered and manned by men taken specially from the cavalry, ready to be attached to any regiment which required its services, and in that way we should be able to get the greatest value out of the arm. In the meantime I think we have every reason to congratulate ourselves on the direction which has been given to affairs, and be assured that we are in a very good way, and in advance of most other countries.

Lieutenant BENSON: There appears to be considerable difference of opinion among cavalry Officers about these galloping carriages, as to whether they are to be

attached to cavalry regiments or not. Cavalry Officers present, I think, are in favour of attaching them to cavalry permanently. With regard to the two-wheeled carriage, there is a good deal of opinion here in favour of it, as well as against it. Its readiness in coming into action is certainly in its favour; but some gentlemen have said that the horses are intended to be unhooked, because if they are not unhooked the firing will become bad over 600 yards. If they are to be unhooked at all they might as well have the limber, because they can come into action very much more quickly with a limber and trail hooking on the limber than by unhooking the horses. [Captain BADEN POWELL: They can unhook it in about ten seconds.] I think the unlimbering can be done in two seconds. The horse artillery sometimes manage to get a round off within about five seconds from the word "Halt," if they are asked to do so. There was another objection made to having the guns in "batteries" or "troops," as I call them. I think, if for no other reason, they must be formed into troops for administrative purposes alone. I have said in my lecture it is easy enough to get forces to act separately which have been trained to act together, but it is a very different matter to get those to act together which have only been taught to act separately. Several gentlemen here think they ought to act together, and others separately. Probably the truth lies between the two: sometimes they will have to act together, and at other times separately; therefore have them in troops by all means, but have them able to act separately, if necessary. Major Smith, I think, got wrong about the weight of his carriage. He proposed that the carriage should be drawn by two horses, and said the weight was 17 cwt. The most a horse can draw at speed is about 6 cwt.; two horses would therefore draw about 12 cwt. The carriage that I propose weighs 25 cwt., and therefore can be drawn by four horses. In horse artillery the weight of the carriage complete is 36 cwt., which is actually 6 cwt. per horse. General Arbuthnot said the ammunition was separated from the gun when the gun was unlimbered. I do not see that that holds. The limber is 10 yards in rear of the gun, or nearer if desirable, and there is also a considerable amount of ammunition, about 1,000 rounds, in the axletree boxes. The total amount of ammunition carried in the galloping carriage is 1,546 rounds. Against that you have, in the carriage I propose, nearly 5,000 rounds in the limber and 800 in the axletree boxes, and you have your 10-barrelled gun, which is very much more powerful. General Arbuthnot also says that with the 10-barrelled gun ten bullets will hit one man. If the man chose to stand a yard off in front probably they would; but at all ordinary ranges the bullets would scatter themselves, and not go within two feet of each other. Mr. Nordenfelt will tell us how much ten bullets will scatter at 500 yards.

Mr. NORDENFELT: About six feet the 10-barrel; the smaller gun scatters more.

Lieutenant BENSON: I tried the 3-barrelled gun the other day, and found that at 30 yards' range it scattered over 5 feet during a few seconds of rapid fire from the light carriage.

Mr. NORDENFELT: The smaller guns scatter the most.

Lieutenant BENSON: At any rate, the ten bullets cannot hit one man. They might hit ten men, perhaps, standing up together.

General ARBUTHNOT: Ten barrels fired ten times would hit ten men ten times.

Lieutenant BENSON: They would probably hit the men in rear after those in front had been killed. I think that is all I have to say.

The CHAIRMAN: Gentlemen, we have listened to a very carefully drawn-up lecture, for which I think Lieutenant Benson deserves our very hearty thanks. We have also had a very interesting discussion which will not be without its value. I am sure I shall only be carrying out your wishes in thanking Lieutenant Benson very much for the good entertainment which he has given.

¹ Mr. Nordenfelt has since corrected this statement as follows:—"When the scattering gear is not used the 10-barrelled gun spreads over 10 feet at 500 yards, and 20 feet at 1,000 yards. With scattering gear the spread can be adjusted up to a maximum of 100 feet at 1,000 yards' range."—G. B.