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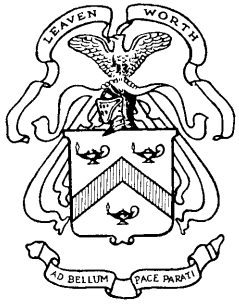
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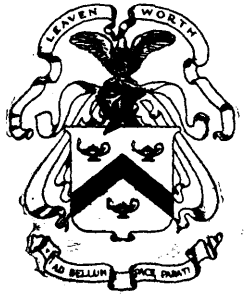
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WAR DEPARTMENT,
WASHINGTON, *12th February, 1918.*

The following pamphlet "Machine Gun Notes No. 2" is published for the information of all concerned.

[062.1 A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

JOHN BIDDLE,
Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

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LECTURE ON
MACHINE GUNS AND THEIR TACTICAL EMPLOYMENT.

By Colonel Applin, of the British Army.

Delivered at the U. S. Army War College, Washington, D. C., Tuesday, November 20, 1917.

My lecture this morning has usually taken seven lectures of forty-five minutes each when delivered at ———, and I do not see how it is possible to condense so large a subject into one lecture. I shall, therefore, have to leave out a very large number of things I should like to tell you. I shall have to skip, and I shall have to be very general. I make these remarks beforehand so that you will realize that I am not giving you anything more than really an outline of the subject.

The machine gun is the great life-taker; and our enemy realized that before the war. We only partially realized it. We relied more on our rifle, and the power of our men to develop that wonderfully accurate and rapid fire which was the great feature in the retreat from Mons, and which I do not think I am exaggerating when I say, probably saved the British army during that retreat. Then we discovered that we were up against masses of machine guns in the hands of the Germans. We discovered that they had learned how to use them tactically, how to group them, and we found that their machine gunners were not amateurs, but extremely expert and highly trained men; and we realized that the machine gun was what I have just told you, the great life-taker. I do not think I shall be contradicted if I say that the greatest number of our casualties in this war have been created by the machine gun.

This morning I hope not only to show you that the machine gun is a great life-taker, but I hope to show you also that the machine gun is a great life-saver; and it is in this category that I want you to look at it. If you will develop a very highly trained and organized body of machine gunners, if you have a discipline such as the Germans had in their machine guns, an iron discipline, men who can act

instantly, quickly, accurately, I have no hesitation in saying that you will find that my words are true—that the machine gun is a great life-saver.

All tactics are based on the characteristics of the arm with which we are dealing. I think that is quite obvious. Take the case of the cavalry: The tactics of the cavalry are based upon the fact that a man is mounted on a horse, that a horse moves at a certain speed, that he is capable of maneuvering with other horses in a certain method, and that the man is armed with a sword or a lance. The whole of the tactics are based on those facts, and nothing else. To take a better case, that of the artillery. Obviously, the tactics of each branch of the artillery are based on the weapon with which they are armed. It would be absurd to try to bombard a distant strong point, perhaps one of those huge dugouts, with an 18-pounder. It would be equally absurd to bring up your 15-inch Howitzer to repel an infantry attack, because you would be using the weapons against their characteristics. One is a high-velocity weapon which fires shrapnel; the other fires a heavy shell of low velocity, with a high-explosive; and they have to be used accordingly.

The machine gun is not peculiar in this respect, and we must base the tactics of our machine gun upon the characteristics of the weapon. That is the mistake which we all made at the beginning of the war. We left out the characteristics of the weapon. We said: "Here is a gun with a rifle caliber barrel. It fires the .303 British infantry cartridge. All right; then it is an infantry weapon. Stick it in the firing line and count it as 120 rifles, or whatever we chose to consider it. But there are certain characteristics of the machine gun which I shall tell you briefly this morning, and upon which the whole of its tactics are based.

Before I go into the question of characteristics, however, I want to impress upon you, as emphatically as possible, the difference between a machine gun and an automatic weapon.

By a machine gun or mitrailleuse, we mean an automatic weapon of rifle calibre capable of firing a great number of shots from one barrel with great rapidity—in our service it is 420 rounds, 420 bullets a minute; that is the rate of fire.—

Mounted on a fixed tripod from which it is fired with little effort on the part of the firer.

I wish to impress that, gentlemen, very strongly, because that is the main characteristic of the machine gun, and the way it differs from all ordinary automatic weapons. It is fired from a fixed mounting which holds it firmly without any effort on the part of the firer.

Secondly, the machine gun is a water-cooled weapon. That may seem trivial, but it is very important. If you own a motor-car I think you prefer the water-coolod motor-car to the air-cooled motor-car, because it is more efficient. In precisely the same way the machine gun is vastly more efficient when water-cooled than when air-cooled. It gives you sustained fire action. It does not heat. It will fire an almost unlimited number of rounds without cessation of fire.

To prove my point, at ——— we made that statement some twelve or eighteen months ago, and our General Staff did not agree. They said: "We cannot agree, until you prove that this weapon is capable of long continuous fire action. It may jam. When you fire a great number of rounds it may heat. We want proof of this." So we arranged for a test, and we got an ordinary Vickers gun, took it on to the short range, and we piled up ammunition to the ceiling behind. We had an expert firer and a No. 2, and they were not allowed to be changed. They had to fire right away through. We had two men to feed the ammunition to the gun. We had a table with three staff officers at it recording the result, and a stop-watch. The test was for the gun to open fire at zero and fire for exactly one hour. It was not to cease fire, except, of course, if it did so automatically.

The fire was opened and kept up continuously for one hour and five seconds, the five seconds being due to the fact that the firer was very nearly deaf by that time. The gun fired 13,728 rounds in that time, or about 228 rounds per minute, continuously. No allowance was made for any stoppage. There were several stoppages, small ones. The longest was on account of a broken lock spring, when the lock required changing. Possibly the longest stoppage was not a stoppage at all within the meaning of the machine gunner's vocabu-

lary, because it was due to refilling the barrel casing with water; and owing to firing 4,000 rounds without refilling, there was so much steam developed, that when the barrel casing was opened, the steam blew up, and it was a few moments before they dared pour the water in. That, I think, was the longest stoppage made.

The most interesting part of the experiment was the fact that at the end, the last shots were as accurately in the center of the target as the first. The target then had a hole about a foot in circumference cut out by the bullets. The last shots were as true in the center of that target as the first; and on examining the gun, with the exception of the muzzle-cup, which was practically blown away, the barrel was in perfect condition. It was nickeled slightly, it was somewhat worn, but it was in perfect condition, and could have gone on firing many thousands more rounds.

I have given that experiment at length because I want to emphasize the fact that the machine gun proper is capable of long-sustained fire action, and in the hands of an expert you can rely on it in war to cover your own advance or to protect you against the advance of the enemy.

Now, we must just look at the characteristics of this weapon as far as the fire is concerned. I am afraid this will bore you a little, but I hope you will bear with me while I discuss these few points, because the whole tactics are based on the firing of the weapon.

As you know, in the case of any weapon, any rifle, any small arm firing perfectly accurately, with perfect sights, from a vise, at a bull's-eye, if the first shot strikes the bull's-eye plumb in the center, the second, third, and fourth shots will not necessarily do the same. They will be "there or thereabouts," as we say; but we get what we call the "cone of dispersion," which I think you call the bullet sheaf here; and that dispersion alters with the range.

With the rifle, that dispersion is very big, because you have the idiosyncrasy of the man, the firer. The rifle is dependent entirely on the firer. It is dependent first of all on his power of aiming, which is really mechanical. If he can aim well, he always aims well. What it really depends

upon, however, is (1) his nervous system, (2) his muscles; that is to say, his physique.

A man who is tired, however great his energy may be, who is utterly weary, worn out with hard work, running, or whatever it may be, cannot hold his weapon sufficiently still to make accurate shooting. A man who is nervous, of course, will make no shooting at all. That is why I draw this great distinction between the machine gun proper, mounted on its fixed tripod, and the automatic weapon, which is dependent entirely on the firer for its accuracy.

With the machine gun mounted on its fixed tripod, given a man capable of aiming—and that, as I said before, is purely mechanical in a trained man—any trained gun-layer can always lay a gun equally well. Given the power to lay the gun, the fire will be just as accurate under the stress of war as it will be on the range in peace. You will get the same effect from a man who is nerve shaken, provided he can still see to aim, or a man who is completely fatigued and can barely lift his gun, provided he can still see to aim—you will get the same fire effect from him as you would from the fresh man, practically speaking. That is the great value of the machine gun over the automatic weapon in war, and that is due to its fixed mount.

There is one other point in the characteristics of this weapon, and that is the fact that the machine gun is recoil-operated. It is operated by the recoil, and not by using the gases, as in other automatic weapons. To this recoil action is due the reliability of the machine gun, with the water-cooling, which enables the gun to fire continuously without stoppages.

If you are firing at a target in an ordinary way, a bull's-eye target with the ordinary bull's-eye on it, and theoretically, your machine gun is aimed exactly at the bull's-eye, here, at 6 o'clock, as we call it in our service, and provided that you open fire at that spot with perfect aim, so that the first bullet will go through the center of the bull's eye, if you fire one hundred rounds, they will not all be in the center of the bull's-eye. The one hundred bullets will be more or less dispersed, according to the range, and will be dotted about in that sort of way (indicating on blackboard),

in which the nucleus of the shots will be in the center of the target, but there will be odd shots sprinkled high and low, and an odd shot to the right and to the left; but you will find that the cone of fire is dispersed more up and down than to the right and the left. You will find your target struck at the top or the bottom. You probably will not find shots on the outer edge, in that way (indicating).

Now, supposing we turn that target sidewise, and we imagine that the gun is firing at that target in that way. You have got your gun here. Here is your machine gun, and here is your bull's-eye. The cone of fire does something like that (indicating on blackboard), and the bullet sheaf strikes the ground between two points in which you get the nucleus of the fire.

We have found that if we take ninety per cent. of the bullets fired, that ninety per cent. is effective fire. I dare say with the rifle, in your service, 75 per cent. is considered to be the effective zone of fire; but owing to this fixed mounting which I spoke of just now, owing to the closeness of the grouping of the machine gun, we can take ninety per cent. as our effective zone. So we reckon on a ninety per cent. effective zone treatment by fire, and if we are firing at a range over 600 yards we have to consider that cone of fire, and not the actual target itself. In other words, we have not got to try to hit the target so much as to try to place the target somewhere within that effective zone. If the target is anywhere within that effective zone—that is to say, if we can play that effective zone, either the inner edge or the far edge or the center—it does not matter—on the enemy's line or trench or body of men, that body of men will be under an effective fire, and will be soqner or later wiped out.

If you look at it, you will find that that cone, as it strikes the ground, is very long and very narrow. It forms a much elongated vertical elipse. It is very long, but it is very, very narrow.

It is obvious that this gives us a certain characteristic which we must take into consideration when firing at the enemy. If, for instance, you wish to place machine guns for the defense of a trench line, and the enemy is likely to attack from this direction, supposing this to be roughly

your trench line here, and supposing you place your machine guns, however many you may have, in a line like this with a view of firing at the enemy, it is obvious that when the enemy attacks here, in this way, and when you fire those guns, you have only got a number of these very narrow cones in front of each gunner, and those cones are so narrow that they will only practically cover one man at a time; so that in order to get an effective fire on a line attacking you would have to traverse—in other words, move your gun so as to make this cone travel along in that way; and even then the cone can obviously only be hitting one or two men at a time. In other words, you would waste many thousands of rounds of ammunition to get a single hit. Furthermore, owing to traversing in that way, it is almost certain that a large number of those men will get home on your line.

The cone of fire or sheaf of fire of a machine gun has this peculiarity: It never rises above the plane to a greater height than that of a man, (six feet,) at ranges of six hundred yards and under. Of course, in your service I do not know the trajectory;—with your weapon possibly you may get eight hundred yards; I do not know; but with our gun the bullet never rises above the height of a man, above the plane, at six hundred yards and under. In other words, if we site our gun so as to insure that there are no dips in the ground, we may be perfectly certain that anywhere between the muzzle of the gun and six hundred yards, no living man standing on his feet, can cross. He must walk through at least 300 bullets a minute, which is about five bullets a second, in order to cross that zone.

Making use of this characteristic, instead of placing your guns as I showed you just now to defend a position, be it trench or anything else, supposing you place your guns in the salients, in this way (indicating) and instead of firing at the enemy at all, you take an aiming mark, under six hundred yards away. You ignore the enemy. Select an aiming mark under six hundred yards away, on the flanks, and order these guns to aim at these aiming marks.

What happens? If the enemy attacks—whether he is in mass or in open order, or in whatever way he attacks—every

gun at once opens fire, not at the enemy, gentlemen, but at its own aiming mark; and the result is you get a band of fire, 300 bullets a minute, from here on to this aiming mark, and in the same way you get a band of fire from here, and from here. Now, it is very obvious that when the enemy's men reach this point they have got to walk through this band of fire, and in almost every place they have got two bands of fire to walk through, and they must pass through these bands of fire at some period or another in order to reach your trench. We call these bands of fire, and we have found that that is the most effective way of using the characteristics of the machine gun, for a defensive purpose at ranges under six hundred yards.

Of course, as I pointed out to you, you have to be careful that you have no dead ground. If you happen to have a bit of dead ground here, where a man can go into the dip and escape the cone of fire, you have to fill up that bit of dead ground by one of our other weapons—either an automatic rifle, a Lewis gun, or whatever it may be, or a group of bombers. You have got to make good that dead ground.

Those bands of fire have been used by our allies, the French, with most extrordinary effect, and by going a step further they have solved the problem of how to use these bands of fire to the greatest effect. Those bands of fire originated with the Germans. That was the German method of defending his line, and it cost us many thousands of men; but with that military genius for which the French have always been celebrated, they took that idea and improved on it. In order to insure getting the enemy under these bands of fire, they ran out a light line of wire entanglement,—so very thin that it could not be seen easily, along the line of fire of each gun. When the enemy attacked he was held up by this wire, and then fire was opened while he was being held up in the wire. From every gun for five or six hundred yards ran this tactical wire, from the muzzle of one gun to here, and then back again to the muzzle of another gun. They withdrew their infantry altogether from the scene of action, behind, where they could rest in safety, away from shells; so that if the machine guns failed to hold up the attack, if the attack managed to break through, after severe losses, the enemy met a counter-attack from fresh troops, not in a line of trenches

—oh, no!—in the open, where it was most powerful and where it got the greatest effect.

According to the old way, if you will remember, the counter-attack always took place, against the enemy, after he had taken your trench. The only advantage you had was that perhaps he had not been able to turn the trench, and did not get quite as good shelter as he might have gotten; but there he was, in a trench. He had something to hold, and you had to attack him. With the French system of which I have spoken, you counter-attack him in the open, and it has proved to be most successful.

I have one little word of warning with reference to that tactical wire: Do not let it be seen. If the wire is seen, either from an airplane or by scouts or by intelligence men with telescopes, that wire will give away the exact position of your machine gun. The enemy has only to follow the wire down with his eye to know that at the end of the wire somewhere is the machine gun. When the French found that out, they did not begin the wire close to the machine gun; they began it somewhere away, and they ran it behind the machine gun, where there was nothing at all, so that you could not tell where the wire began or where it ended, with the result that the enemy bombarded the wire up and down, and generally managed to miss the concrete emplacement in which the gun was concealed.

These guns, four miles south of Ambarakoy, in Macedonia, were arranged in pairs—a very old system come back again,—in pairs, in concrete dugouts at least thirty feet underground; and the French made these concrete dugouts on one system. That is to say, they had boxes or frames made the size and shape of the dugout, and they very rapidly sunk these down, poured in the concrete, took out the frames again, and used them to make another one. They were all on one pattern, and very rapidly made. The gunners and the gun lived down in these concrete dugouts, and they had a concrete emplacement, a double emplacement for the two guns, on the top, from which the guns fired. In addition to that they had alternative positions outside, from which they could use their guns if they wanted to fire them at some minor attack and did not want to give away the position of the concrete emplacement.

I told you that the effective zone of the sheaf of fire from a machine gun, is very narrow and very long. The greater the

range, practically speaking, the shorter the depth of that effective zone. That being so, is that any use to us at all?

We found that it is, and we found that by using the guns in a certain method we can get effect. We have found that the dispersion laterally can be computed by a very simple rule of thumb. That is to say, the angle of descent in yards, of the bullet, multiplied arbitrarily by the figure 4, gives you the number of yards frontage which one gun can cover effectually. It averages about thirty-five yards per gun at medium range; and by working on that, we are able to put sufficient guns down to use distant fire effectively in that way. Of course, each gun traverses a little tiny bit, just a shade, to spread its fire and overlap the next gun. Usually the method of doing it is this: If you have a thirty-five yard front per gun, we let each gun traverse seventy yards, so that two guns are covering the same ground, then there is no space between unbeaten by fire.

I mentioned the fact that the fixed mounting gave you the enormous advantage that the gun had no nerves in action, that its fire was always reliable, no matter what happened. You may be heavily shelled; you may have everything around blown to pieces; but so long as the gun is intact and the gunner is still alive and able to fire, that fire will be almost as accurate when it opens, as if nothing had happened. This is a very important matter.

That being so, we are able to use our guns defensively to enormous advantage. I shall show you presently, through battle actions, an example of how they were used in that way. The fixed mounting enables the machine gun to do several other things which cannot be done with any automatic weapon, but only with a mitrailleuse or machine gun.

First, we can cover the advance of our own infantry by firing over their heads, with perfect safety. So we can do what we used to do in the past with our rifles in a different way: We can support an attack by covering fire.

Secondly, we can use indirect fire. We can fire over a hill or from behind a hill; and if we use certain rules, observe certain laws, we can fire as accurately by night as by day,—a very important thing in modern war. I cannot go into the details of that this morning; it would take too long; but it will be obvious to you, I think, that if you have a lantern, a light of any

sort, or even a luminous mark, placed ten yards from your gun on the ground, and if you get the ordinate between that mark and a certain range on your gun—perhaps an arbitrary range between 2,000 or 3,000 yards on your back sight,—you have only to aim at that mark at night, and you know that your gun is accurately aimed on a bridge or a road for any range you may wish. Another way is by compass, laying your gun with a compass bearing with a white mark to direct you at night. There are many ways of doing it; but the point I wish to bring out is that you can fire as accurately by night as you can by day. Now, you cannot do that with an automatic rifle. You may put it in a rest, you may do all sorts of things with it, but it is unreliable, while the machine gun is absolutely reliable because of its fixed mounting.

Having given you those points, we will come on to the tactics. How should a machine gun be used tactically?

The main principle of using machine guns may be summed up in three words: *Concealment; Flanks; Surprise.* It is essentially a weapon of surprise.

Concealment may be obtained in several ways. Originally, early in the war, in the trench warfare, we took the most elaborate pains to camouflage our emplacements. Emplacements were painted; emplacements were concealed with bushes; emplacements were concealed with chicken-wire and earth and all sorts of things. Everything possible was done to conceal the position of the machine gun, and in order to further conceal it, we used *"alternative positions."* That is to say, each machine gun had three or more positions, so that it could move from place to place and never fire twice in the same spot. That was concealment.

Now that we have given up trench warfare, now that we are attacking and moving forward over the open, the machine gun is even easier to conceal than it was in trench warfare. It is a very small weapon. It only occupies about five feet of space on the ground. I shall show you tomorrow, in my lecture on the Battle of Messines, how easily we concealed it from the Hun, although he was within fifteen hundred yards of it, and had powerful telescopes, and had been there for two years watching us most carefully,—how we concealed it on the front slopes of the hill facing him, while he was looking at us, and how we

had 166 machine guns in full view of him, absolutely in full view of him, within fifteen hundred yards, and he never saw one and never knocked out one. That is camouflage combined with use of the ground. The machine gun in the open is a most difficult weapon to locate; and having located it, as I shall show you when I come to the battle actions, it is a most difficult thing to knock it out.

In an emplacement it is a different matter. In an emplacement, probably the artillery have the range on it exactly. Once discovered, you cannot move a concrete emplacement; there it is; it is obvious, and it will be knocked out sooner or later.

I shall begin with defensive war, because we began with defensive war. I will end with the offensive,—the attack,—because we shall end this war with the offensive.

In defensive warfare, machine guns may be divided into two categories: The forward guns, using direct fire, bands of fire, as I showed you on the board, and the barrage guns, guns using indirect fire in the way I showed you, with such a frontage for each gun as to insure that there is no space along the front they are covering which is not swept by effective fire.

You may wonder why such an effective weapon should be used from a long range in this way. There are many reasons, but I think the principal reason is this: That at night, in particular, if the enemy can get through that short four or five hundred yards of ground, if by chance he gets through, there he is, with nothing to stop him. On the other hand, if you have placed your barrage guns correctly, you can bring down that fire exactly like a hailstorm, on a rocket being thrown up by the people who are attacked, and that fire will and can come down almost before the rocket has burst. Then, instead of having your guns " scuppered," as we say in English, if the enemy gets through that barrage your guns are still eight to fifteen hundred yards behind, and if properly sited in depth they turn inwards on aiming marks, as I explained before, and the enemy still has to meet their direct fire under six hundred yards, their bands of cross-fire. I hope I have made that quite clear.

That is what we mean by defense in depth—strong points, guns crossing each other, bands of fire, and each strong point checker-wise behind the other.

Gentlemen, that is impregnable. At the first battle for Passchaendale Ridge, on the 4th of October, I was in command of the Corps machine guns, and our troops were so successful in their advance that the New Zealanders and the Australians raced into Passchaendale, which was nearly a thousand yards beyond their objective—and had to retire again. I do not mean they were compelled to retire; they simply had to retire because we did not want them there. That was not the objective; but there was no enemy at all to be seen, except prisoners coming in by hundreds with their hands up. There was apparently complete and absolute disorganization of the German army behind. Officers commanding supports told me that they were astonished that within five minutes of the infantry going over they found masses of Germans coming back with their hands up. They could not understand it, they said—how these fellows were coming back so soon, utterly demoralized.

That was the 4th of October. We fought another battle on the 9th, and the third battle on the 12th, and we only had fifteen hundred yards to go to get that ridge. On the 12th a half-dozen German machine guns in concealed emplacements, which we had failed to locate and failed to knock out,—completely and absolutely held up two divisions, stopped the attack, and caused us the most appalling losses—twelve thousand casualties. I began by telling you that the machine gun is a great life-taker. Only a few days ago we read the good news that the Canadians had taken Passchaendale.

I want to emphasize the point that a single machine gun can hold up an unlimited number of troops on its front provided it is properly sited,—tactically correctly sited, and you have got men of iron discipline who will die rather than leave that position.

Now let us take a battle action or two, and see by example—because time is going very rapidly—what these guns can do.

Take one very early action in the war—October, 1914. I have chosen early actions in the war because they will be more interesting to you, who are going to have your early actions, than perhaps the later ones, which I deal with tomorrow. Here was an attack by the Black Watch. The Black Watch were marching on in

this direction at Vendresse (see chart with Appendix No. 24). This is the Vendresse road. There was a large wood here full of German troops. The Germans had guns somewhere back on the ridge, and when the advance guard of the Black Watch reached a point somewhere here, they were fired on from the wood, and artillery opened fire on them from the hill. They decided to attack. The advance guard, two companies, deployed for the attack, and they sent their two regimental machine guns, evidently in charge of an officer who had studied tactics, to support the attack.

How did he support the attack? This was before the days of overhead fire. His aim was to get to the flank. He pushed up this road, which was concealed, a sunken road, and he reconnoitered it himself, gentlemen. The first principle of tactical handling of a machine gun is *personal reconnaissance.* When I am lecturing to students, I always write a large "P. R." on the blackboard. I start on my lecture, and I never say anything about that "P. R." until everybody is talking about it. Then I tell them what it means, and they never forget it. That means "Personal Reconnaissance." That is your first and last duty before you attempt to go into action with a machine gun: See with your own eyes, hear with your own ears, trust no man.

This officer personally reconnoitered, and he found here a dip down into a quarry, and he said: "That is the place for me"; so he took his guns, and he placed the two guns in the quarry, like that (indicating), concealed in this quarry, on the flank. The attack then took place; and finding that he was in this quarry, and realizing that he was on an exposed flank, he did the next correct thing. We did not often do correct things in those days. He did the next correct thing, which was to send an escort of scouts, a small body of riflemen, half a dozen men with rifles, into this bit of a furze-brake here to protect the flank. He did the right thing, because a few shots were fired, and out of the furze-break ran fifty Germans and made for the woods. He opened fire with one gun, and as you see it was very oblique, almost flanking fire, and he killed practically the whole of those fifty Germans. Hardly one reached the woods.

Heavy fire was opened from the artillery on the advance, and the attack entirely held up. A very heavy artillery bar-

rage put down from the hill, and they could not move; and as soon as the artillery had become effective and held up our attack, the Germans advanced in masses out of the wood. They attacked in masses. An officer present described it as "masses of Germans coming out of the wood at the double," and they attacked these two small companies.

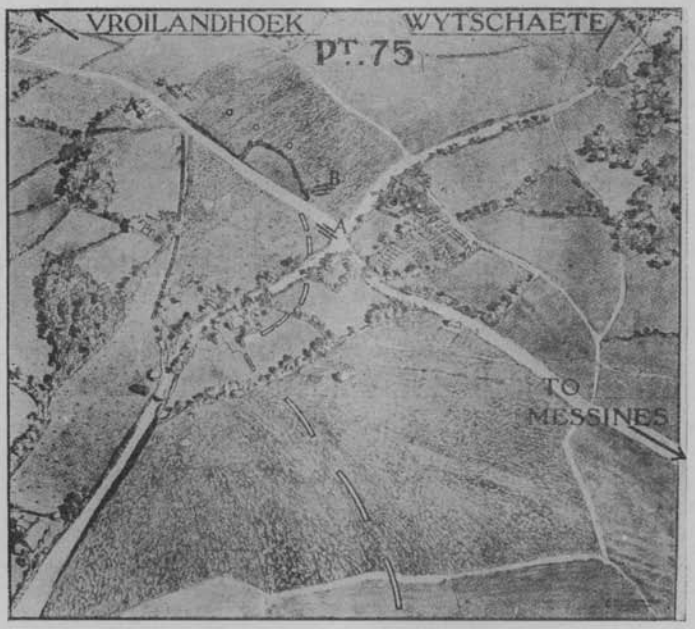
Did this officer with the machine guns open fire? No. He kept quiet, and he waited until the enemy had reached this fence; and when the enemy reached the fence he opened fire with both his guns, and he got them very nearly in enfilade. He searched back from 900 yards range with both guns to 1,200 yards as they fled back to the wood, leaving heaps of dead on the ground; and then, gentlemen, he searched the wood from end to end with his two guns, knowing that it was full of troops. The result was that from the wood debouched a stream of men making for this road. In the meantime, fearing that the artillery might find him, he moved the guns round into the cover here, into the furze-brake, with the result that when the Germans fled out of this wood, he got them in true enfilade.

That was an early but very successful action; and the lesson is that he did everything tactically correctly. He had *concealed* his guns so that the artillery could not find him and did not find him; otherwise they would have been knocked out at once. He got to a place on the *flank,* where he could support the advance. He could not have supported it from anywhere else. He got back on a flank, where he was in the best position to take on the Germans. He realized that being on a flank he must *protect* it, so he sent his scouts into that furze-break and drove out fifty Germans—otherwise, his guns would have been "scuppered" by those fifty Germans before he ever came into action—and he *reserved* his fire. I want to rub that in, if I may use such an expression to such an august assembly. I want to make that sink in very deeply. He *reserved his fire to the right moment.*

I think I may say that our failures in the past with machine guns have been very largely due to our anxiety to loose off our weapons on the enemy, instead of holding our fire. There is one moment when the fire will be more effective than at any other moment. That is the moment to fire;

and it takes a highly trained, highly disciplined man, to be able to keep his finger off that double button when he sees a good target, because he knows, or he thinks he knows, he is going to get a better one.

Here we have another case of concealment. This was a small action, early in the war, between Wyschaete and Messines. (See accompanying plate.) Messines is down here—that is the main road to Messines—and Wyschaete



is somewhere up here. A squadron of cavalry in our army, consisting of only four troops of thirty men each, 120 men with two machine guns, were ordered to cover a retirement of our main body, which was moving down the Messines road; and the officer in charge was told: "You have got to hold the cross-roads here at all costs until evening." He was put down there at night, and he had to hold it until the next evening at all costs.

Well, he disposed his troops, and he placed the two machine guns, one on the cross-roads, because it was night and he could command these roads, and troops are more or less confined to roads, as you know at night. He put the other gun in a turnip field—in the middle of the turnips—concealment! Now, he made a huge tactical mistake, and he did the right thing, both; and, as is always the case, they both came off. In other words, he suffered for his sins, and he was rewarded for his correct action.

His sin was that he had an excellent position for his gun by night, but he left it there during the next day; and as soon as the Germans attacked—and they did attack—and tried to get down this road, they came down on this hill here, and he opened fire at 1,800 yards and completely held them up. They went back; the staff came down, mounted, and they stood somewhere down here, and he opened fire on them, and they scattered; and then there was a pause in the day's occupations, and in about two minutes that gun, the unfortunate subaltern commanding it, and the gun-team, were no more. They rained shells on it, and they hit it almost the first time, and they blew it and the men and the officer away.

Why did they hit it the first time? Because it was in the one place that the artillery always has the range on, the cross-roads, and the one place that artillery always fire at if they have nothing better to shoot at. You ask a gunner what he is going to fire at. He says: "I think I will fire at the cross-roads," because he thinks there must be something coming along.

Now, that is the lesson. He went out minus a gun, with one gun lost; and the Germans, in attack, came down the hill, and the gun in the turnips opened fire and got them in enfilade, knocked them out and stopped the attack. Then every gun the enemy had opened fire on that turnip field, and almost every turnip was blown up, but the gun was not. It was never hit; and that, gentlemen, is another peculiarity about the machine gun. If you conceal a machine gun really well, you can hit every single thing in the neighborhood, but it is only through very bad luck that you get hit yourself. That gun lasted out the whole day; and, to make a

long story short, the Hun was unable to move down the Messines road until the evening, when the cavalry withdrew.

I have told you about the enormous effect of direct fire at close range, and here at the beginning of the war, before we knew a great deal about it, is an incident of the enormous effect of direct fire.

The illustration was furnished by Coldstream Guards at Landrecies. (See diagram with Appendix No. 22.) They were ordered to hold the bridge-head. The village was one of those little, long, narrow French villages with all the houses on the main street, and just where the last houses came were the two main roads leading away. The officer who had to defend that had two machine guns and a company of infantry. He dug two trenches where you see the mark here in white, a trench there and a trench across the road; he put a gun behind each one, filled them up with men, put his sentries out and all the rest of it, and was perfectly happy—felt that he had mastered the situation. But presently he heard a sound of singing and marching feet, and a regiment came down the road singing a French song. So the officer said: "Hello! These are our Allies coming;" and he got out of his trench, and the others got out of their trenches, and an officer dressed as a French officer came up, and spoke French, "Bon jour, Monsieur," and put his sword through him. At the same moment two men dressed in French uniform on either side of him bayonetted the men opposite them, and the corporal in charge of the gun leaped back into the trench and opened fire. Well, unfortunately, the rest of the enemy were massed on the road, and it took a long time to clear the road afterwards.

That stopped the first attack. Night fell, and after many severe attacks he had to withdraw; so he decided to withdraw from these cross-roads and put his guns, one in the main street of the village, beyond the houses, and the other one here at the side, to prevent the enemy coming down here, as they threatened to attack from there. This gun was knocked out early in the day. They rushed the gun and shot the gunners. One gun remained; and the lesson was, that he concealed his gun, although it was in the middle of a single road, the main street of the village, and he concealed it in this way:—

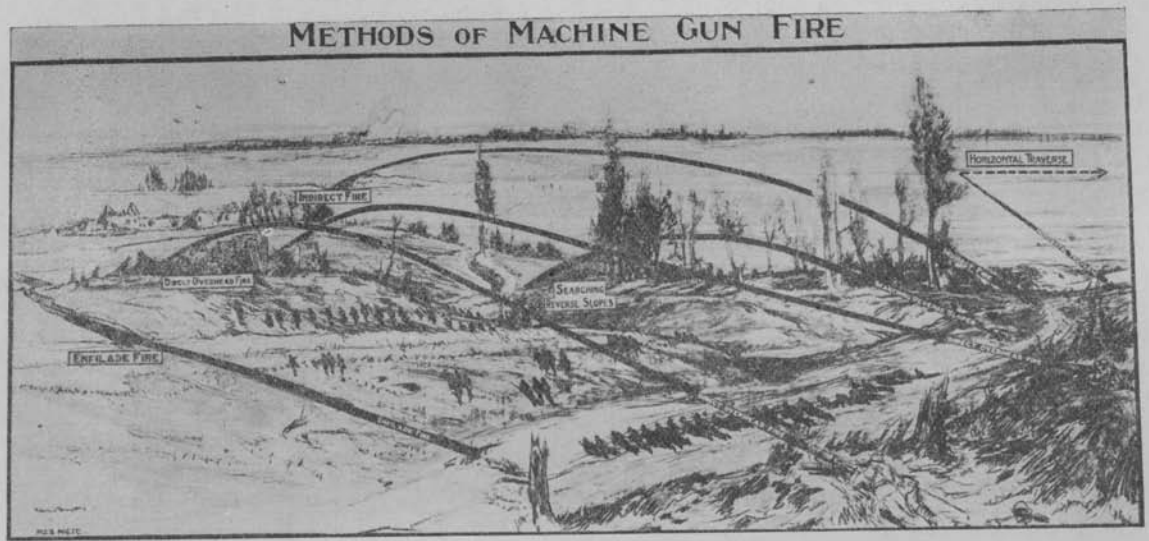
He put his men into a hastily constructed trench in the road, and he put the gun back, behind the trench, about 100 yards, and his orders were, "The gun is never to fire except when the men are firing:" and whenever the attack took place down that street, whenever anybody attempted to attack that barricade, the men opened rapid fire, and when they opened rapid fire the machine gun opened, and the machine gun ceased fire when the men ceased fire, with the result that the enemy were unable to locate the gun. They brought field guns up and they fired down the main street of the village, and they blew houses down on the right and on the left; they made an awful mess of things, but they never hit that gun, because they did not know where it was. Afterwards, later in the day, I think the Grenadiers—I am not sure—brought up another gun across the bridge; and under cover of the fire from that gun the party withdrew across the bridge in due time.

Now, gentlemen, I have been very, very long; but I hope you will bear with me for one moment more. I just want to show you this diagram, because it shows so very clearly the various methods of fire. It is not intended for an institute of this kind. It is intended for teaching the young idea in the machine-gun school.

Here we have a picture of France, "somewhere in France," and we have machine guns and troops attacking, showing the various kinds of fire which the machine gun does, diagramatically.

For instance, we say enfilade is the most effective kind of fire. There is a machine gunner lying down nicely concealed, who is enfilading a company. Now, the enemy had to come up from the farm and occupy this cutting, with our troops behind this hill thinking that they are safe. This gun that is pushed round on the flank fires enfilade fire along this line, and you see it goes down the cutting, and will kill everybody in that cutting. That is enfilade fire.

The next is direct overhead fire. Here is the gunner on a little bit of a hill. Here is the valley between where the men are, and he is on a bit of a hill. The gun is firing over the heads of his own men in the valley, and also the men going up the next hill, and it has direct fire, because from this position he can see all his troops. He can also see his target—the target he is firing


METHODS OF MACHINE GUN FIRE
INDIRECT FIRE
HORIZONTAL TRAVERSE
SEARCHING
REVERSE SLOPES
ENFILADE FIRE

at. That is what we call direct overhead fire. It is over the heads of his attacking troops. Here are the front men, here. He can see them. He can see when it is safe and when it is not safe, and he can see the target he is firing at. That is direct overhead fire.

Here we have another example of the same thing—direct overhead fire. The gunner is on a hill, where he gets full observation, and directs his fire down into that building.

Then we get searching a reverse slope. Here is a gun laid with a clinometer. He cannot see his target. He has laid it by the map. He wants to search the slope of this hill leading down to the yellow area here, and he has laid his gun for a range which will enable that fire to sweep that reverse slope.

Now we come to indirect fire—firing on a target the gunner cannot see, with the clinometer. Here is a gun behind the wood. The gunner cannot see anything. He is going to shoot over the top of the wood, and the fire goes over the top of the wood and comes down behind a hill on this side here, into a trench or something that he has spotted on the map.

Here we have traversing fire. Here is a road, and the gunner wants to traverse that road. Perhaps the enemy are going to pass along it, and you see the "taps." Each "tap" of the gun gives you the group of fire shown on the dotted line.

Of course, gentlemen, that is only intended to illustrate the methods of fire to recruits.

Finally, I am sure you will allow me to say a word on the subject of the machine gunner. We cannot do any good with machine guns, and we did not do any good—that is the lesson I want to impress upon you—we did not do any good; we failed, until we realized that you must organize these gunners, and they must be commanded by a senior trained officer, and they must be used collectively for a collective purpose. To-morrow, in my lecture, I shall give you the details of that.

We realize at the training center at home that the best, and nothing but the best, is necessary for machine gunners. It is a very difficult thing to create a new arm, if I may say so, and make it the *corps d'elite* from the beginning. It is a very difficult thing to get the *esprit d'corps* which we of the old army have for our own regiments. The authorities decided that

the main thing to be desired above everything else, the main qualification, should be discipline. We found at the front that without the most perfect barracks square discipline, unless our men polish their buttons, unless our men spring to attention, unless they march like Guardsmen marching to Buckingham Palace, unless they do all those things, they cannot fight well, they cannot fight so well as we are doing. Really, they cannot. So when the officer or man arrived at Grantham, he was gone over by a surgeon who saw that he was physically, and as far as he could tell mentally, fit. If there was any physical or mental disability found, he never got farther than that doctor's room. If he passed that, he went up, and he was placed in a drill school which we specially created. We got a Guard's officer, we got Guards sergeants, and we had Guards methods; and people used to be astonished, and say: "We can't tell why your machine gunners want to do all this clicking of heels and saluting and presenting arms, and all this sort of thing."

Well, a man went into that school, and he was there for anywhere from a week to three weeks; but he never left that school until he was as smart as his instructor in every detail. I have seen officers with two medals on them doing right-hand salute, left-hand salute, all around that drill-field, and going on doing it until they could do it like a Guardsman. It was necessary, gentlemen, and it has made the Machine Gun Corps what it is; and it was not until that was done that they went on to the other branches of the machine gun education.

I tell you that because I am convinced myself, and I am quite sure I am speaking for every one of us who has been through what we have been through, that if a trench has to be taken it is the best disciplined regiment that takes it with the least loss and with the most prisoners; and if a trench has to be defended, it is the best disciplined regiment that holds that trench with the least loss and the least number of prisoners lost. I can prove that to you, not once, but a dozen times. When we see an undisciplined regiment slouching into the trenches, we say: "Well, the Huns will have some out of them," and they do. They come over, and they take them away in bunches. We put in a very smart

regiment, and you see them marching out, and you say: "By George, that is a smart body of men," and you hear that the Hun has raided them, and you hear that he has gone back very badly beaten, perhaps with one prisoner.

I hope you will forgive me for pointing this out—that if a machine-gun corps or a machine-gun company or whatever you like to call it is going to be formed, if it is not formed of those men, I have no hesitation in saying that it will be a failure. When the machine gunner has to do something, he has to do it very quickly, very smartly, and above all very accurately. If he is not smart enough to keep himself clean, if he cannot clean his buttons, if he cannot put his boots in proper position under his bed-cot, if he cannot salute in the proper manner, you may be perfectly certain that he will not be able to manage that gun smartly when the psychological moment comes. In one case it merely means a slight reprimand; in the other case it may mean the loss of hundreds of lives.

With that I finish my lecture this morning.

LECTURE ON THE MACHINE GUNS AT THE BATTLE OF MESSINES.

By Colonel Applin, of the British Army.

Delivered at the U. S. Army War College, Washington, D. C., November 21, 1917.

My lecture this morning is on the subject of "The Machine Guns at the Battle of Messines." Before I come to the question of the use of machine guns at that battle, I want to describe, just briefly, the strategical situation that led up to that battle. (See plates accompanying Appendixes Nos. 27 and 28.)

In 1915 and the spring of 1916 it was found that the deep salient was becoming a nuisance to the British Army. In other words, we found that the continual hammering of heavy guns by the Hun into our positions there was more than we could stand, and we decided to push him back and straighten out that salient. All preparations were made for an attack on the Messines-Ypres ridge—to be more correct

I should say the Messines-Wytschate ridge, because the ridge ends almost at Wytschate, and it goes back to Ypres practically on a level plain. There is only one little bump on the level plain, which is the hill known as Hill 60, with a little thing in front of it called "The Caterpillar."

The strategical situation did not permit of that battle taking place, however, and the straightening out of the salient was postponed until a later date. Early in 1917 the Germans decided to withdraw to the Hindenburg Line, and they did not give us any notice of their intention, with the result that the plans which we had made had to be altered; and it was decided by the great general staff of the French Army in conjunction with our own, that we should make a united effort to put a final end to the occupation of Belgium by a concerted attack. The plan was for us, the British, to attack the Hindenburg Line from the front, roughly on the line from Arras to Vimy, while our French Allies made the real attack. Ours was to be a holding attack. We were only going to thrust into the line and hold them, fight hard, strike hard, and compel the Germans to concentrate all their troops and prevent them from moving, while the French came up from the south and came in behind the Hindenburg Line and cut off the German Army from the Rhine.

Had that plan succeeded, gentlemen, I probably should not be talking to you this morning. The plan, however, did not succeed. Circumstances were too strong for us; and, to make a long story short, the British took the Vimy ridge, they pushed the enemy back from Arras and held the ridge in front of Arras. I was in Arras in January, February and March, and at that time we were under very severe shell fire night and day. We had shells falling in the garden of my billet while I was there, and we were so close to the front line that we even had a machine-gun bullet from the enemy come into the mess through where the windows ought to have been while we were sitting there one evening after dinner. I mention that to show you how near we were to the front line.

That push pushed the Hun back practically out of range, and he now can no longer shell Arras except with a long naval

gun, and it is not worth his while. He practically does not shell Arras at all. It is shell-free, and the population have returned. You all know the heroic story of the taking of Vimy Ridge by the Canadians; and that success undoubtedly did much to console us for our disappointment in not finishing the war.

After this the great general staff decided to straighten out the Ypres salient; and we had notice of this intention as early as April, so that we had two months of preparation. The Germans knew for twelve months that we were going to straighten out this salient; and the position of the Germans on that ridge was such that they looked straight down from a really big ridge into our trenches. We looked straight up at them on the ridge. It was a most impossible situation, and it appeared that Messines would be impregnable. They had fortified it for over two years; and Messines itself lent itself particularly to fortification, because it contained some wonderful old buildings—an Institute and a Cathedral or church—which had most wonderful cellars, cellars forty feet underground, made of concrete, and, with the big building on top, practically shell-proof to anything. Tunnelling out from these into the hillside, the enemy was able to push out machine guns and observation posts. On our side, our jumping-off point was our little Hill 63, in front of Plugstreet Wood. It is really Ploeugsterdt Wood, but our soldiers corrupted it into "Plugstreet," and it has been shelled until the wood is nothing but matchwood. The whole place, the village of Ploeugsterdt, is simply a pile of ruined masonry. All the villages in the neighborhood are simply piles of masonry, merely indications that they had been human habitations once. That, as I say, was our jumping-off point; and, as you may see, the problem was an extraordinarily difficult one.

I had two months for preparation. I was Corps machine-gun officer of the Second Anzac Corps, and the Second Anzac Corps had the task of taking the Messines Ridge itself; and as Corps machine-gun officer it fell to me to advise, and finally, under instructions from my Corps Commander, to issue the orders for the use of the machine guns in that battle.

I had the privilege of being at Arras when the preparations for the Battle of Arras took place, in February and March; and there we had one of our crack machine-gun officers, who had decided to try a barrage fire of machine guns to support the attack. I had the privilege of hearing what went on at all his meetings with his divisional machine-gun officers and his company commanders; I had the privilege of seeing all his plans drawn up for that. It was on a comparatively small scale, and it was quite a new thing. It had only been tried originally on the Somme, and had been more or less successful—this form of barrage fire with machine guns. It was really put into practice for the first time at Arras on a small scale; but even there they were afraid to do what we call a creeping barrage. They were afraid to creep right in front of our infantry, all the way, slowly, in front of them, and it was done by lifts. The fire was put five hundred yards in front of the infantry line, and when they went over the top the fire was lifted by perhaps two hundred yards at a time until it reached the final protective barrage. That was in its simplest form.

At Vimy, the Canadian Corps machine-gun officer, perhaps one of the greatest machine gunners to-day, arranged an elaborate and probably the first really great barrage, in his attack on the Vimy Ridge; and after the Battle of Vimy, rumors reached me of the success of this. There was great talk of the tremendous support it gave the infantry. They said that it saved thousands of lives by beating down the enemy's small-arm fire after the big bombardment had passed. The Hun was in the habit of placing his men not in the front-line trench or even in the supporting trench, but in switch trenches and reserve trenches, and they lay there in deep dugouts, free from shell-fire; and then, when the heavy stuff had passed over, when the eight-inch and the five-inch shell barrage had passed over, and the eighteen-pounder barrage, the small stuff, had not yet reached it, they popped up out of their dugouts, lined the trench, and fired rapid-fire both with machine-guns and with rifles through the eighteen-pounder barrage, knowing full well that up against the eighteen-pounder barrage was a line of our lads, bayonets fixed, charging forward to meet them. In

that way they wiped out large numbers of our men, caused enormous casualties to the line, and then, when we arrived, "Kamerad! Kamerad!" They lined up and held up their hands and pretended that they had not been fighting at all.

That is what we were up against. This machine-gun barrage just met them, just came down on to their heads at the moment when they popped them over the parapet to shoot; and the result at Vimy was that trench after trench, back trenches, switch trenches, communicating trenches, were found full of dead Germans, and those dead Germans were found with rifle bullets in the breast, nothing down by their feet, always in the breast, showing that they were breast-high over their intrenchments when hit. Now, not a single rifle was fired by our men in the attack; they go over the top in silence with the bayonet; so that that was all done by machine gun fire.

Knowing that in two months hence I was to command the machine guns at Messines, I went and saw my Army commander, commanding the Second Army, and I asked him if it would be possible for me to go down to Vimy, to go over the battlefield, and particularly to consult the Canadian Corps Machine Gun Officer. He allowed me to do so. I went down there for three days, and I went all over Vimy Ridge, and I came back absolutely convinced of the potency of this barrage. But he told me something more: He told me that he did not bother much about creeping barrage. What he was convinced of, was that the real role of the machine gun was the protective or S. O. S. barrage, over the heads of his own infantry, while they were consolidating, to meet the immediate counter-attack; and he pinned everything on this. He worked everything to get his guns in position to put down an impenetrable, impassable screen of machine-gun fire right along his whole front on the S. O. S. signal going up. He told me how successful it had been, how attack after attack had been beaten back. I spoke to other officers, infantry officers, and they were all talking of absolutely nothing but this machine-gun barrage, and how the Huns melted away before it; and I came back convinced that I had two great tasks to do at Messines: (1) To support the attack by covering the advance of my infantry from the moment they left the trench until they reached their objective; (2) to put down a protective barrage when they had

reached their objective, and prevent the counter-attack pushing them out again.

I have gone into that rather at length because I want to make it quite clear.

Incidentally, while I am talking of this barrage, I should like to mention the fact that after the Battle of Messines every one was absolutely convinced throughout the British Army of the importance, the vital importance, of this barrage fire—so much so that Sir Douglas Haig himself, the Commander in Chief, asked Colonel C———, who is with you here today, to arrange a demonstration for himself; and he ordered all his Army commanders, all his corps commanders, and as many divisional generals as possible, to be present at that demonstration. It was held down on the coast; and when my Corps commander got that order to go over he sent for me and said: "Applin, I want you to come down with me." I went down with him, although I ought not to have gone there, because it was intended only for the senior officers. There were only two other corps machine-gun officers there; but I was very glad indeed that I was included, because I had an ocular demonstration of what I had done at Messines but what I had not seen, because you canont see a barrage in a battle. You can see nothing but dust. You can see nothing but bursting shells.

There I saw the guns laid out, I saw the drill, I saw the methods which they had improved. Mine were very rough and ready at Messines, but the school at ——— took it up and improved it; they turned what was a rough-and-ready way of doing it into a drill; they made actual rules for this barrage; they evolved scientifically all the principles of what we had done roughly, roughly hewn; and I saw what I had done at Messines carried out as it ought to have been carried out. Then I had the privilege of going down and sitting in a dugout on the beach; my feet were just outside, and I was asked to take them in, because the bullets would drop very close to my toes; and Sir Douglas Haig and all these great generals were there sitting in these dugouts, and then the guns that we had seen already laid, opened fire; and on the wet sand of the beach in front of us we heard the soft patter of hail—for that is what it sounded like—and we saw the sand go up in little spurts, like this, in a line all the way along, deep—a very deep, long line—the whole

sand going up in little spurts as though there were a heavy shower of hail, a heavy hail-storm, only each one of those hail-stones was a .303 bullet. When that demonstration was over, there was not a General there, however prejudiced he may have been before, that was not convinced of one thing, and that was that he himself under no circumstances would have dashed across that space.

After the Battle of Messines, gentlemen, the French, who had heard of the success of this barrage fire, approached our General Staff and asked if all their school commandants could come to ——— to learn the barrage work, see it done and learn it; and they had the same demonstration given them. Thereupon they said: "That is what we will do," and they went away.

Gentlemen, the proof of the pudding is always the eating. What did the French General Staff do? On the report of those officers, who had seen that demonstration, they themselves at once set up a school, and they set up that school within a few miles of ———, so as to be in touch with it and near it, and they have set up that school for the purpose of teaching machine-gun barrage fire to the French Army. Now, there we have, perhaps, the closest touch of comradeship in Arms between the two allies that we have had yet in the war. They have come and sat down with us, and they are adopting that method; and not only did they adopt it, but they rapidly put it in practice. On the 20th of August, when the Morocco division attacked on both banks of the Meuse, they attacked under cover of barrage fire done by French machine-gunners "on their own"; and the report was that it was a complete and absolute success.

Now to return to our "muttons":—

The problem of the Battle of Messines was the problem of (1) how to get our infantry out of a trench which they had been in for two years, up the side of a very steep hill, a very steep ridge, crowned by the ruins of Messines, crowded with machine guns, with batteries of every calibre of artillery, knowing the range to an inch, with fortifications in depth, great, big, deep dugouts that no gun in the world could knock out, miles and miles of the most elaborate trenches, and the whole thing looking down on us and watching our preparation. The problem was how to get our infantry up into Messines to take that ridge with a minimum of loss.

My Corps commander sent for me and said: "Applin, how do you propose that the machine-gun shall be used at the Battle of Messines?" I said: "Sir, I propose that we shall do a barrage, a creeping barrage, in front of our infantry from the moment they leave the trench until the moment they occupy the position."

Now, gentlemen, that was not done in a day. I had highly trained machine-gun companies. Every officer, every man, had graduated at the training-school at ———, and had probably gone through a second tactical course at the machine-gun school at ———, and was in every sense of the word an expert. You must remember that the men who fired those guns were in every way experts; and yet how did I begin?

I began by pulling those companies out of the line and sending them ten, fifteen or twenty miles behind the line to train; and they trained in the following ways: First, physical training. Every man of those companies did a hard course of physical training until his muscles were iron, because I realized the fact that we were not going to put those guns in a wagon and jump on the horses and wheel that wagon up the Messines' Ridge. I realized the fact that those guns and that ammunition, every round of it, would have to be carried on a man's back. I realized the fact that by the time we had done with our artillery fire the Messines Ridge would be a honeycomb of deep shell-holes, and that the whole of the bottoms, the Steenbeck valley, where there was a straggling river, a stream overflowing its banks in mud, would be a huge bog up to the waist; and so I physically trained my men.

Next, I trained my officers and non-commissioned officers in the methods that they were going to adopt for this battle. They practiced barrage fire, as I say, a very rough-and-ready drill; I issued orders as to how the thing was to be done, and they practiced it continuously. Every single gunner—not "No. 1" only, but every single man in the team —fired the actual barrage that he was going to fire on the short range, over and over again until he was sick of it, and could do it in the dark; he practiced his lifts on a map of Messines made to scale, and he went over the actual lifts

on this short range that he would do in the battle, with aiming marks, until he was tired of it, and knew it backward.

Then came the question of material. I found that we had one hundred spare barrels, and I said I wanted two spare barrels per gun, and I had two hundred and sixty guns; and I was told that it was quite unnecessary; the spare barrels were not required. I ventured to differ. I pointed out that we were going to fire rather more rounds than we were accustomed to fire. They asked me how many rounds I proposed to fire. I said: "About five million rounds."

The life of a barrel for overhead indirect fire is about fifteen thousand rounds. The life of a barrel altogether is about twenty-five thousand rounds—that is, in our Service. So you will see the necessity for having those barrels. Well, gentlemen, I dreamed of those barrels. Those barrels got on my brain; and it was not until the evening before the battle that I got the last of those barrels up by special train.

I wanted clinometers. I was told that clinometers were no longer an issue for machine guns, and I again had the same up-hill fight to get those clinometers. The reason I am giving you all of this is that we want to save you, if possible, from what we have gone through ourselves. We fought for those clinometers, and we finally got, not what I asked for, but we got one clinometer to two guns. We got those just in time for the battle.

Then, in order to make it absolutely safe, foolproof—because, mind you, this was the very first time that a creeping barrage had been used, it was the very first time of my doing a thing of this kind at all, and I was naturally a little bit nervous about it—I decided to put stops on every gun; and I got stops made in the Second Army workshops for every gun, to put on the gun, to prevent the gunner from elevating or depressing his gun when doing the S. O. S. barrage. We put that stop on the gun, and there it was, locked on the barrage line, so that nothing short of kicking the thing over could make the gunner fire at his own people.

Now for the details of how we do a barrage. It will be impossible for me this morning, in a tactical lecture on a

big battle like this, to do more than very briefly explain how the thing is done. It is done in the following way:

In the first place, you have to decide by personal reconnaissance the position for your guns; and it is very obvious that as I proposed to have about one hundred and sixty-six guns in the first barrage firing over the heads of my own people—that was the number required for the frontage; my frontage of the barrage was roughly about three thousand yards—I wanted one hundred and forty-four guns to do that creeping barrage; and it took some reconnoitering to find the positions for each of those guns, as you may imagine.

I decided, first of all, that I would go on the top of Hill 63, or even the reverse slope. This is Hill 63. (See large map in back.) I thought I would come up a good distance back, because if you went over the top you looked straight into the telescope of a Hun sitting in Messines. He looked straight at you. When I got up there and looked at them, I found the range was too great. It could not be done. Also, I met an officer who said: "My dear fellow, you don't think you are going to put your beastly little machine-guns there, do you? There is where the eighteen-pounders are going;" and so that was knocked on the head. So we went on down over the slope; and after a great deal of reconnoitering all along the bottom slope I decided that the best place was to go a bit down the slope into the valley. I will tell you that while reconnoitering there we were very constantly harassed by our friends the enemy, who used to fire at us with everything they possibly could.

One of my divisional officers one day went down; I wanted him to go and have a look and see if he could not alter a position I had chosen. He went down there, and he got outside a bit of barbed wire put there and was walking along when a "whiz-bang" came and pitched three or four hundred yards away—"whiz-bang" being a soldier's term for a high-velocity field-gun shell that comes with a whiz, and you do not hear the whiz much before you hear or feel the bang, so they call it a "whiz-bang." They are very nasty things; they scatter the stuff about all over the place. The man who was with him said: "Look out"—they were in full view—"We had better get out;" so the other fellow

doubled away, found a gap, and jumped into the trench. This fellow ran the wrong way, and the "whiz-bangs" followed him all the way, until presently one plumped up close to him and knocked him over. He saw a tub of water standing by this place, and he crawled under the tub of water, and he remained there for about two minutes until it got so very hot—he was covered with mud and stuff—that he felt he was bound to be hit, so he leaped up, and as he ran they pitched one into the tub of water and blew it to pieces. He luckily found the trench, and as he jumped into the trench, another one burst on the parapet of the trench.

I saw him, I think, four hours afterwards, with his report. He was a very brave and gallant officer, who got the D. S. O. at Messines, but I can assure you, gentlemen, that that officer was still trembling from the shock, when he came to me four hours afterwards. It was a very nerve-shaking experience, and it is not realized by people who have not gone through it what strain it throws on the nerves.

To show you how close we were, and how difficult it was to conceal one hundred and forty-four machine guns on the face of that hill, one day when I was up there with a general commanding one of our divisions; he was looking over the parapet on the top of this hill here, from one of these communication trenches. It was a very beautiful day. He was looking over the parapet, as I say, and I was standing by the side of him, when I heard a vicious little spit, and I looked down, and I saw the earth knocked up about twenty or thirty yards away. I did not say anything; I thought I might have been mistaken. I waited, and again, presently, there was another one; so I got down on the bottom of the trench, and I said: "You had better get down, sir; they are sniping you." He said: "Look here, I am busy now; don't talk to me; I want to finish my reconnaissance," and he finished it; but it shows you that even a man showing his head and shoulders over the top of a communication trench there, was fired at with a rifle from Messines. I mention this to show you the difficulties we had in arranging where those guns were to be.

We finally decided on our gun positions, gentlemen. I personally, as corps machine-gun officer, reconnoitered the

areas, and I allotted those areas to my gunners. Then I found a new difficulty, and that was that the organization of the British company did not suit barrage fire. A company consists of sixteen guns under a Major or a Captain, and no man can command sixteen guns at once. It is an impossibility. He can direct them, possibly, but command them he cannot. For barrage fire you want direct command of your guns; I had not had any experience, but I decided that eight guns would be the most one man could command, and so we were forced to break our companies up into batteries of eight guns.

There was another reason for that, as well, and that is that a certain number of machine guns have to go forward with the brigades to consolidate, and perhaps in the first instance to assist in breaking down resistance at strong points with the attackers; and the number of guns had to be decided.

Well, we had a battle royal over that, as to the number of guns. Naturally a Brigadier wanted all his sixteen guns, and a few more if he could get them, and a Divisional General naturally wanted to support his Brigadier, and the Corps Commander naturally did not want to interfere with his Divisional Generals, and so it met with a great deal of discussion. The end of the thing was that the Corps Commander laid down definitely the rule that four machine guns per brigade should accompany the attack. Now, when I say, "accompany the attack," I do not mean in the firing-line, gentlemen, or with the firing-line, but I mean in such a position that they can arrive at the point and consolidate at the right moment. They were to be under the Brigadiers—four guns per brigade. Four guns per brigade were to be held in Divisional Reserve, in the hands of the Divisional Commander, and the Divisional Commander was at full liberty to give those four guns to his brigades if he liked.

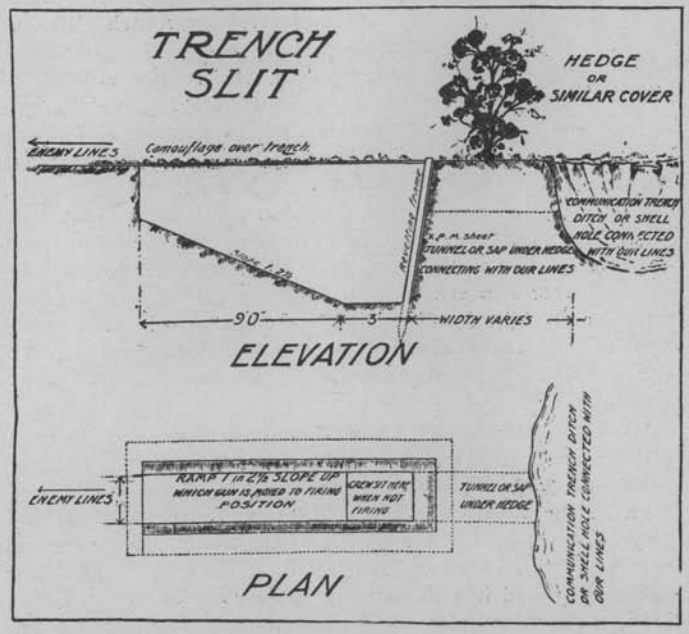
Now, one Brigadier demanded all eight guns—I shall tell you what happened to him presently—and the Divisional General gave him the whole eight. I bagged the rest for the barrage, and we had one Division in Reserve; so that I was able to have the Divisional guns, the guns of the Reserve Division, more or less to play with.

The problem of concealing those guns in full view of the enemy was, as you may imagine, a difficult one. We had trained our men before hand to dig the kind of trenches in which I proposed to conceal the guns, in their training area, and the whole of the gun-teams had practiced digging these things at night, in the dark, so that they could do them on the ground; and they dug what we call a trench slit, which is not my invention, but the invention of another corps machine gun officer. I got it from him. We used these trench slits, and I had one hundred and forty-six trench slits on the face of Messines Hill 63 in full view of the Germans, right away round to Wulverghem, the ruined village of Wulverghem, which is on a continuation of this hill, but goes down into the valley there where you see the river, and then runs up against a steep hill on this side; and the trench slit is what you see here. It is a slit, a narrow slit, cut in the ground, five feet deep by five feet to eight feet long. Some of them made them longer; some of them went to ten and even twelve feet. We left it to the idiosyncrasy of the officer concerned as to what he wanted, but we recommended eight feet long, with a slope one in two and a half, up like that, to the level, which enabled you to place the gun there with the muzzle of the gun just above the ground.

When this trench was dug we improved it, and we put up a platform on which the gun could rest. During the bombardment, and when the gun was not in action, the men sat down here. They pulled their gun a little way down the slope, and they sat down here in the bottom of the trench. The trench is very narrow; and we camouflaged it. This is the camouflage. We camouflaged it with ordinary chicken-netting, covered with stuff to represent grass, which was originally made brown, and then gradually green as the summer came on, until it was bright green, the color of the grass; and that was unrolled and rolled over this trench, so that there was not the faintest sign, with the best telescopes they had in Messines, of anything on the ground. The whole thing looked like grass.

Twenty-four hours before the attack our men had to get into that trench slit. Now, here is a point: If you were asked to sit for twenty-four hours in a beastly little slit like that, and

you were asked not to smoke, and you were asked not to stand up, you probably would not do it; but if you have got the iron discipline that the machine-gunner in the British Army has, and you say to him: "You are not to do that," it is a point of honor with them not to do it, and they did not. When the battle was over it was my pleasure to go round and see as many of those machine-gunners as I could, and thank them for the magnificent way in which they had behaved in those trench slits. Not one



single gun was discovered, and those guns opened fire at zero an absolute and complete surprise to the Hun. Not one single trench slit was knocked out with the intense barrage that the Hun put down on them, and the casualties in those particular trench slits were extraordinarily light. I cannot tell you exactly what they were, because it was difficult to find out, after the battle, who had been hit in the trench slits and who had been hit going forward; but I do not think the casualties were more

than ten out of a hundred and forty-four guns—ten killed and wounded in those trench slits—and practically the whole of the Hun's barrage came down, more or less in their area.

In other words, a trench slit will absolutely protect you against the high explosive shell if you do not get a direct hit. There was one case of a team being buried. They were quite unhurt, however, and they were dug out in a few minutes. Later on, on Messines Ridge, when the guns moved forward for the second barrage, there was a case, two days afterwards or three days afterwards, of a direct hit in a trench slit; and when the officer reported it to me. an Australian officer, he told me that this was a direct hit, and he had lost his gun. I said: "Well, I am sorry. How many of the poor chaps went West?" He said: "Well, nobody was hurt, sir." I said: "How is that possible?" He said: "Well, you know, the boys had gone out of the trench slit into another one to have a pipe and the trench slit got hit while they were away."

Of course, that is neither here nor there.

Now, to come to the details of this battle:

When the infantry left the trench, we were to open fire over their heads—that is, at zero—and in order to insure the safety of the infantry, certain elaborate precautions had to be taken; and they were, roughly, as follows:

In the first place, we had to convince the infantry that we were not going to shoot them; because if you have ever had a machine gun fired over your head, you will know that there is what we call the "crack" of the bullet. That is to say, every bullet as it passes over your head, even if it is three hundred feet up above you, makes a loud, a most alarming, crack, and it sounds exactly as if it had struck the ground or a rock close beside you. In fact, a man hearing that for the first time will make you a bet—you can win money on it—that the bullet hit a rock close to him, whereas really it was merely the crack of the bullet in the air, perhaps three hundred feet over his head. The reason for that crack is a very simple one. It is exactly the same as thunder. It is a momentary vacuum caused in the air by the passing of the bullet, and you only hear it at the exact place where that vacuum is filled up when it is in a certain relation to your ear. That is why you hear it as a crack. If you could get in an airplane and follow the bullet at the

same muzzle velocity, you would hear a continuous crack all the way along—at least, so I am told.

Another thing we had in this battle was what we called the "baby elephant" emplacement. This was used on the Wulverghem ridge, where we were on the reverse slope of the ridge, and would have been in full view of the enemy on the top, and it was not a suitable place to put the guns on the top. The Twenty-fifth Division of the British Army were on that ridge, and the ground was so unsuitable for a creeping barrage that it was decided not to do a creeping barrage for the Twenty-fifth Division at all. They put down a standing barrage, and no creeping barrage at all; and their infantry were hidden from the Hun for the greatest part of their advance, until they got really almost up to the ridge itself; so there was not the same reason for the creeping barrage there. So the Twenty-fifth Division did not have a creeping barrage; they had a direct and indirect barrage on to the points which they were going to take, and they pushed forward a large majority of their guns behind the front wave. They followed the front wave at about five minutes' interval, got over just before the Hun barrage came down, and used their guns forward.

Now, the reason for that was, first, they could not do the barrage; secondly, they had a very peculiar ground, with a series of ridges, and they wanted to make each ridge good, and the system was that of "leap-frog." They sent thirty guns forward under cover of the fire of thirty guns, putting a barrage over the first ridge. When those guns had gotten forward and were ready to put a barrage on the next ridge, the other guns ceased fire and leap-frogged through them while they put their barrage on the ridge, so that the ground in front of the infantry was always covered by a barrage.

Incidentally, their flank was in the air. The Ninth Corps, on our left flank, had something like two or three thousand more yards to go. They were further back, as I shall show you on the map in a moment, so that it was a case of a wheel. Consequently, the outer edge of the wheel had much farther to go than the inner edge; so that the Ninth Corps had much farther to go than our corps. For that reason they wanted to have guns which could not only barrage the ridge in front but which could instantly swing around like that (indicating) and protect their flank in the event of the Ninth Corps being held up.

I want to point that out because it shows you what a tremendous lot of things you have to consider before you can arrange machine-gun co-operation with infantry.

This "baby elephant" (see accompanying diagram) of which I spoke, consists merely of a double piece of bent steel, locked in the middle, which is more or less shrapnel-proof. I say "more or less": Anyway, it is some protection, and by putting a layer of sandbags on the top it is absolutely shrapnel-proof. A pit is sunk in the ground, and this device is laid on the ground, camouflaged, so that it cannot be seen from the air. The gun is in the pit here, and fires through that little slit. The reason for that was that on the reverse slope of Wulverghem Ridge the Hun was always bursting high shrapnel, so that it was one of the most unpleasant places to visit. There was not very much doing, barring that, but that was nearly always doing, and it is a very unpleasant thing; and, therefore, we gave them head-cover because they wanted head-cover. At another point they did not want head-cover; there was no shrapnel.

I have here a reproduction of the map of Messines Ridge. (See large map in back.) It is really a reproduction of my original tracing on a larger scale, so that you can see it. I submitted this for my Corps Commander's approval, and then this was sent to every Brigade and Divisional Commander, with a copy of the orders.

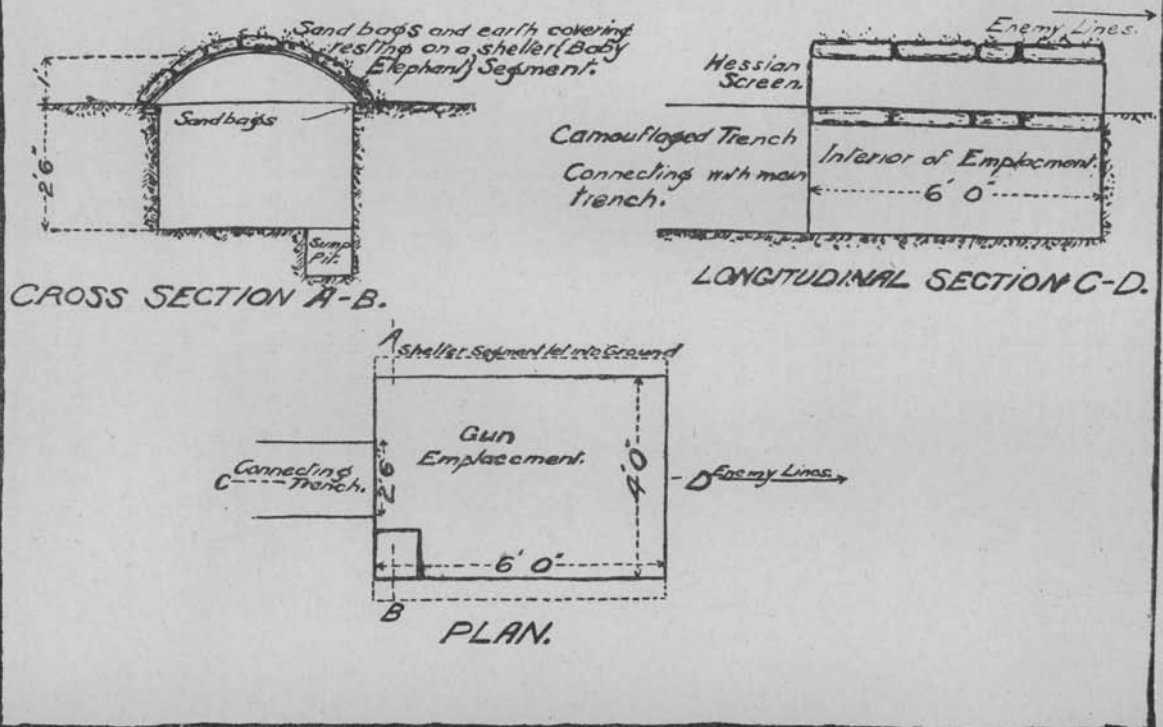
Now I want to describe this as briefly as possible, because I could lecture here for a week on this subject.

Here is the front-line British trench. The blue irregular line is the front-line British trench; and by the look of the river—it is the Steenbeck River—you will be able to realize the fact that this hill runs down to the river, which is in a deep valley, and then the ridge runs up again to the Messines Ridge. Messines is right on the top of the ridge, absolutely on the top or pinnacle of the ridge, here, and is higher than the top of Hill 63. It looks down on to the top of Hill 63, so that when you are on the top of Hill 63 the first thing you realize is that you are looking up at the Hun.

The divisions went over the top in the following way:

On the left was the Twenty-fifth Division, with a very short front, narrowed out to a still narrower front. The front there was barely one thousand yards across, about eight hundred yards

M.G. EMPLACEMENT.



across, and their final objective was barely one thousand yards away, and the lay of the ground was such that they could not do a creeping barrage, so they put down a standing barrage. Their barrage is shown in blue. The guns were arranged in batteries of eight, each battery under a battery commander, and each group of batteries under a group commander, and each division under the divisional machine-gun officer, and the whole show under the Corps machine-gun officer. I want to make that clear first.

You will see here that the guns are lettered A, B, C, D, E, F, G, H, down to W, each one representing a battery. In some cases batteries of eight were not required or could not be put in, owing to the narrowness of the ground, and there we reduced them, either to two fours, or in one case to two sixes, with a four back here. We could not make arbitrary eight-gun batteries because of the peculiar nature of the ground; but you will see there is nothing over eight guns. That is the biggest unit we could manage, and it is the biggest unit that ought to exist in any formation of machine guns, in my opinion; and that opinion is the result of practical experience in the field.

You can see here, on this, exactly where each battery was. Here are the batteries, shown in this way. You can see each battery, where they were situated, how they were broken up according to the ground; and those were up on the high reverse slope of Wulverghem Ridge in those "baby elephants."

Communication was arranged by buried cable from the Divisional officers to their headquarters, and from the Divisional officers to the Group Commanders; and from the Group Commanders to the Battery Commanders, armored wire was used—a word about our armored wire in a minute,—and in certain cases forward, when the guns went forward for the second barrage, ordinary telephone wire was used.

The buried cables were successful, and were never cut. The armored wire was partially successful, but was often cut. The telephone wire was an entire failure, and was always cut. But we foresaw all that, and we arranged two other forms of communication: One, signallers with "Flappers"—that is, the shutter signaller; it is a little shutter which shows red and white, and he operates it and does the Morse code—and the other, and the most successful of all, was runners. Now, gentlemen, runners

have to be trained, and very highly trained. It is a very dangerous game, and you want a man of very high discipline and very highly trained as an athlete to be able to run over shell-swept ground, and particularly over mud and shell-holes.

The plan for doing this creeping barrage for the safety of the infantry was as follows:

In the first place, you cannot see a machine-gun barrage, so your infantry may run into it. To prevent the possibility of your infantry running into the barrage, the barrage was placed four hundred yards beyond the eighteen-pounder barrage, and worked with the artillery. First, note that the machine-gunner must know something of artillery, and must work with the artillery commander. I worked with our Corps Artillery General, the general commanding the artillery of the Army Corps. I used to go to his office and get his plans, his timings, his lifts, his gun positions, and I used to go and make up mine and submit them to him and say: "That is what I propose to do," and we worked together, the two kinds of guns, the machine guns and the big guns; and the place for the barrage is four hundred yards in front of the eighteen-pounder barrage.

When the infantry go over the top, their job is to get up as close as possible, fifty yards, to the shells of our eighteen-pounder barrage, and they have got to sit down under that eighteen-pounder barrage until it starts to creep forward, and when it creeps forward they have got to run forward or march forward—it may be a fast walk; it is usually a fast walk—underneath that barrage. They have always got to keep up to that barrage, because their safety depends upon their being under our barrage.

Four hundred yards beyond that was the machine-gun barrage. Now, when the Hun pushed up his machine-guns and his rifles to fire through the eighteen-pounder barrage, knowing that our men were fifty yards behind that barrage, walking in a line, he was met with the machine-gun barrage that came down and blotted him out. That is the protection that was given to our infantry as they advanced. That barrage crept forward at the same rate as the eighteen-pounder barrage, always keeping four hundred yards in front, until the final objective was reached.

The peculiarity of this battle was that we were on the

right flank, and we did not advance one single pace on this flank. It ended here. We pivoted. We pivoted in that way, forward. Of course the people away over here came forward a great deal farther than that. They were still farther back. It was a pivot movement, because it was a salient, and we were one arc of the salient. Therefore the problem was a different one for each of these Divisions.

The Third Australian Division was the pivot division. Their machine-gun barrage is represented on this map by yellow. These yellow bands represent to the exact scale of this map, to the right scale, the effective zone of fire when the guns were first fired. That is the effective zone of fire, in depth and range, in that way.

Those represent zones of fire placed one on another for a special purpose. There, again, is the zone, in depth, to scale. The depth of that zone is about one hundred and twenty yards, something of that kind—one hundred and twenty to one hundred and eighty.

Here, you see, the zones are one over the other, and double, and an arrow indicates that they were moved back and forth. There is a special reason for that. That was our extreme flank, and naturally the most dangerous place, because if the Hun wanted to counter-attack, he probably would have counter-attacked from here, and would have tried to push up that way; so we put down a double protective barrage on that flank.

Gentlemen, since I have been to ——— and seen that flank barrage put down on the sand and looked at it, I said to myself: "I believe that I could get through that," and I do not think it is really effective. When I did it at Messines, however, we thought it was effective. As the result of the experiment, we find it is not as effective as we thought; and personally I shall never do one again. Next time I shall concentrate eight guns on one point, when I shall get a complete and impenetrable barrage two hundred and sixty yards long by sixty yards broad, that nothing can get through. I point that out because Messines only happened on the seventh of June, and we have learned that much since.

The green represents the frontage and the barrage of the New Zealand division who had the honor of actually taking

Messines itself. Owing to the 25th Division being unable to do a creeping barrage, we put down a barrage on a very bad piece of ground here. I want you to look at that, because that was co-operation. It was not on our ground. Here is our ground. It was not on our front, but on somebody else's front. That is co-operation with the Corps or the Divisions or the Brigades on your right and left—the old story, co-operation. If you do not co-operate, you cannot operate.

Here is the standing barrage of the 25th Division themselves, and you will notice a red barrage overlapping, coming away from the distance up here. That is the co-operation of the Ninth Corps with my Corps. I personally arranged that with the Ninth Corps officer, and I took mine down to overlap his by fifty yards, and he overlapped me by fifty yards, making a total of one hundred yards that we overlapped to insure there being no gap.

Now, you will see several curious barrages here. Here is a double enfilade barrage behind Messines, the zones being put one over another, and covering a depth of about one thousand yards, and doubled.

Behind Messines there was a deep and long communication trench which branched off into switch trenches all down here. All these red lines are communication trenches. Those were the main entrances into Messines. I put that barrage down on that, to block Messines to the enemy. He could not reinforce Messines, nor could he leave Messines, without passing through this barrage. Two days after the battle I went up and I walked over those trenches. Some hundreds of bodies had been buried, but it was very soft walking, because there was only about an inch of soil on most of them. There were quite a large number, quite a good bag, there alone. The "Morning Post" correspondent was up in these trenches a few days afterwards, and there was an article in the "Morning Post" on the enfilading machine guns. Some officer or other gave it away to him, evidently, and he described these trenches as being full of dead Germans; and a group of officers who had evidently run out of the trench and run up the hill here, trying to get away, were lying in a circle, all killed by machine-gun bullets.

This is a very interesting thing, because this battery of eight guns are concentrated, one over the other, and they tapped down here. There ought to be eight, but the man has only drawn four. There were eight guns overlapping, and they "tapped" in "five-minute" taps. The times were written down—45 to 50, 50 to 55, 55 to 60, and so on. They tapped on those times right across these trenches and back again, with the result that they swept the trenches for five minutes on each aim, which meant that a complete, heavy hail-storm for a duration of five minutes from each gun swept the whole of these trenches from end to end. I have no hesitation in saying that the majority of the enemy killed at Messines were killed in those trenches.

Now, gentlemen, I did not do that. That is the only bit of work in the whole thing that I did not do. That was done by an Australian divisional machine-gun officer who drew that up and put it in under my barrage. I sent for him, and I said: "What the —— do you mean by interfering with my barrage and putting that in?" He said: "Sir, that is going to be a splendid thing. You had better leave it in.'" I said: "Certainly not; I won't have it in my barrage." He was one of those persistent people, and he kept coming in to talk about this, and finally I said: "Oh, well, very well, then; let it stand." Well, gentlemen, that was the most skillful thing we had done in the whole barrage.

On taking the black line, which was our first objective, we rested there and consolidated. We rested there for four hours and dug in and consolidated, and then we went on to this green dotted line; the idea being that we were not going to get Messines very easily, and that if we had had a pretty tough fight to get this, and lost very heavily, as we expected to do—we expected to lose a great many thousands of men in taking that ridge—if that had happened, we probably should not have gone on to the green line. We probably should have stayed where we were, and been happy. But if we were successful, in four hours we were to go on to the green line; and, as you can see by the map, we can reach the black line all right from back here, but we cannot reach the green line. So we had the problem of having to move guns forward during the battle.

With the first barrage, for the first twenty-four hours, we did harassing fire. We did harassing fire for a week on the Hun. We fired at him all night and nearly all day. That required an immense amount of organization alone; and the result of it was—I cannot read it to you; I have not time—but the result of it was that the prisoners who came in stated that in Messines for forty-eight hours they had not had a bite to eat except their "iron ration." They had been unable to get the rations up. They said: "Every road and every trench we tried was blocked with machine-gun fire, and the carriers refused to go forward." They would not go up. The artillery kept certain places under fire, and we kept the other places under fire, and that harassing fire came down at odd moments, a half hour at a time and a quarter hour at a time, in odd moments, so as to terrify the drivers and prevent them from moving up.

The second barrage, 130 minutes fire, was the creeping barrage.

The third barrage was the most important of all. I am going to show you next the S. O. S. barrage, to meet the enemy's counter-attack when consolidating. There were ninety-two guns firing, forty-six guns supporting. It is necessary, for an S. O. S. barrage, always to have one in two guns supporting—not firing, but laid, aimed, ready to press the double button, so that should a stoppage, a prolonged stoppage, occur in any gun, there is always a gun waiting to press the buttons and take up that fire. That is a very important point. You have always got to reserve one gun in two, not in reserve in cotton-wool behind, but actually on the ground, laid, loaded, aimed, ready to fire.

Those guns for forty-eight hours remained in position, ready to press the double buttons at any moment, laid on their objective. That was one of the objects of having your one-in-two guns in reserve. You could always haul one-third of your guns out of the line and let them rest without lessening your barrage—a very important point.

That was done with the prismatic compass for direction, the map, and the clinometer; and in order to make the thing foolproof, in addition to the clinometer there was an aiming mark on which the gunner himself aimed when the gun had

been set by the clinometer, so that should the gun shift even in the slightest degree, the aim shifts, and he at once corrects it and gets it back on the aiming mark. I want to point that out, because it is a very important point. As long as that man keeps his gun on the aiming mark, so long is the gun firing with the correct quadrant elevation by the clinometer.

Now, to make certain, to make doubly certain—because, mind you, we were shooting over the heads of our own infantry, and a single mistake on the part of one of those gunners meant death to our people, firing into their backs 300 rounds a minute, something like a million rounds of ammunition, like hail; a single mistake meant wiping out a whole line of our own people—to make doubly certain, between every 250 rounds (that is, each belt) a non-commissioned officer placed the clinometer on each gun and shouted out the reading, so that if the gun had shifted, or the aiming mark had shifted, between every 250 rounds, that reading was checked. He shouted out the reading, "Four degrees ten minutes," or whatever it was "Three degrees twenty-five minutes," and the man who had it there written up in front of him said: "Right!" or if it was wrong he again adjusted the gun. That was the safety precaution taken.

The exact rate of fire was laid down for each gun, and it was not to be exceeded under any circumstances, keeping every area under effective fire. If a gun was knocked out, the battery commander was responsible for seeing that a fresh gun took up the fire.

The battery commander was also responsible for the supply of ammunition. That alone was an enormous problem. He was also responsible for the moving of his gun, for the time of moving it. He selected the moment to move, because no one else could judge when to move, and no one else could judge how to move. He had to watch the enemy's barrage, and when he thought the barrage had lifted he had to move, and he had to move in the direction that he thought was safest for his team. All that he had to do was to reach his second objective on the hill at the schedule time.

The quadrant elevation and safety angles were checked, put on paper on an army form and again checked by the Divisional Officer, and then sent in to be checked by me, as far as I could check such a large number, at headquarters; so there was a complete check; and each form was signed by the officers checking it, so that if anybody had been shot, we could go through those and see that no mistake had been made, as far as calculating the angles went.

The map error is a very serious one. You find that your map shrinks when wet, and you get completely different readings on a wet map, a map that has been exposed to the weather, than you do on a new, dry map.

Calibration is probably the most important safety precaution of all. Unless you calibrate your guns you cannot all be shooting at the same spot. There is an enormous difference in the idiosyncrasies of each gun, and they must be calibrated. The easiest way is to do it on the twenty-five yard range.

Extra oil-cans had to be purchased by me locally, as the Government did not supply cans sufficiently large to enable me to carry the oil required.

Now, while our infantry were digging in on the black line, we had to put down our S. O. S. barrage. We also had to arrange to assist our infantry in moving forward on to the green line, and we had to arrange for a barrage on the green line, while they were digging in on the green line. I will show you that S. O. S. barrage on this second drawing.

You will notice that whereas the guns on Hill 63 were able to stand in position where they were, the guns that were here have all moved forward to these new positions, and in some cases they made three moves. We tried to avoid three moves. Here a battery has made three moves. Where they moved they were called by their letter with the figure "2." For instance, "S-2" is S's second position. He was originally there. "S-3" is S's third position. But they had to make two moves to get forward, and those moves were made in this way:

A gun was to be in position by a certain time, and the officers were allowed to move after a certain time. Roughly from twenty-five minutes to half an hour was allowed, and it was at the discretion of the battery commander and no one else when to move his guns; and it was most successful, because they moved with practically small losses.

The first barrage that was to come down was this barrage here, which you see is a complete barrage right away down to our flanking barrage here. These guns were behind Plugstreet Wood, which you will see on that map in a minute, and were firing over the top of Plugstreet Wood. Now, that barrage never came down, because the Hun never attacked.

We then moved forward to this green line, and in doing so we were able to do a little creeping barrage here. That was a creeping barrage forward at the times set—10:10, 11, 12, 13, 14, 15, and so on—to here. Then that remained down for ten minutes and ceased fire. That barrage, as you see, joins the old barrage here, so that the old barrage joined up with the new barrage in that way and formed one complete belt of fire four hundred yards in front of our consolidation. To get co-operation, we had the Ninth Corps put their barrage down overlapping ours by fifty yards in that way.

At 7:25 on the seventh of June, 7:25 in the evening, the Hun launched his great counter-attack, and he came over in masses, and as soon as he was seen coming, the infantry put up their rockets. That is the S. O. S. signal. On that, the artillery officer runs to the telephone and telephones down to the batteries "S. O. S." The batteries fall in on their guns and load and fire; and as the guns are some three or four miles back, it takes some time, generally about four to five minutes, before the artillery barrage can actually come down thick. Well, I was told by officers at the front—an artillery observer in the front-line trench told me —that on the S. O. S. going up, the machine gun barrage came down instantly, while the rocket was still in the air, exactly like a heavy shower of hail, and he said it was the most curious sight he had ever seen. This barrage came down, the weather was dry, and the dust flew, and the masses of Germans, he said, seemed to eddy and then melt away, and there was nothing left —nothing left; and then the artillery barrage came down and blotted it all out.

What really happened was this: They walked straight into that barrage, and it simply staggered them. The front lines went down. and the back lines disappeared. Every man who was not hit disappeared into a shell-hole, with which the ground was covered. The whole country was full of shell-holes, and all the shell-holes were full of Huns, except the dead ones and at that moment down came the artil-

lery barrage, and there they were, pinned into their shell-holes, and they had to endure the artillery barrage.

I mention that because I want you to realize the enormous importance of this S. O. S. barrage.

Our guns were so far back that under normal circumstances they would have been perfectly safe. As it happened, the barrage was so successful that at the end of forty-eight hours two out of the three Divisional Commanders asked that the barrage might remain on longer, and the barrage actually remained on for another thirty-eight hours, by their request, because they were so pleased with it.

The result of this was that the guns for which we had selected these positions—we had to select these positions off the map; we could not walk up there before the Battle of Messines; it had to be done on the map—were exposed to shell-fire, and this particular flank of Messines was shelled very heavily, and I am sorry to say the machine-gunners in those trench slits were pretty badly knocked about. Practically the heaviest of all our casualties occurred there. It was unavoidable, but it teaches the lesson that if you are going to select positions on a map you will not necessarily select the safest positions. I have often felt rather sad to think that I was responsible for that loss of life through possibly an error of judgment on my part; but one had to do the thing, and there it is. But they did suffer very heavily, and they did not forget to let me know.

Now I propose to tell you the results of the Battle of Messines, and then to quickly run through some very interesting photographs of the battlefield itself.

The ammunition expended is rather an interesting thing.

The Twenty-fifth Division fired 345,000 rounds before the battle in harassing fire.

The Third Australian Division fired 264,000 rounds before the battle in harassing fire.

The Fourth Australians fired 30,000 rounds; and they were in reserve, you will remember.

The New Zealand Division fired 110,000 rounds.

Total, 749,000 rounds fired in harassing fire before the battle.

Incidentally, La Petit Douvre, or what we call La Douvre farm, was a very strong point, very strongly defended, and was a difficult nut to crack. It was surrounded by barbed

wire; and when our artillery had cut it, the artillery commander said: "Now, can you keep that wire open? We have cut the wire; can you keep it open? We cannot waste any more ammunition on it." I said: "Yes"; and we had special machine gun batteries told off to keep that wire open. That wire was kept open, and we took La Douvre farm with no loss. We kept the wire open with machine guns only. I shall show you a picture of it presently. I mention it only so that you will realize what the picture means.

In Barrage No. 1 we fired 944,000 rounds—practically a million rounds.

In the S. O. S. barrage, which of course came down very often, we fired 1,714,000 rounds. Now, there is a very interesting thing about that S. O. S. barrage. It used to go up about five or six times a day, or oftener, and of course led to an awful waste of ammunition. Finally I wanted to know what it meant, because of course we knew there was nothing very great going on. We wanted to know what it meant, and the reply was: "The Hun is sending up the S. O. S. signal." He sent up the S. O. S. signal, saw it the first time, got similar rockets, sent up the S. O. S., and our boys back behind here, where of course they could not see what was going on, naturally thought it was the attack. So you are up against all those little things with our friend the enemy.

Our losses—I am speaking only of the machine guns, gentlemen—were as follows:

The Twenty-fifth Division lost three officers killed and fifteen men; nine officers wounded and ninety men; two men missing; total, 129.

The Third Australian Division lost no officers killed, twenty men killed, eleven officers wounded, ninety-five men wounded, and ten missing; total, 136.

The Fourth Australian Division lost two officers killed, eleven men killed, four officers wounded, and fifty-four men wounded; four missing; total, 75.

The New Zealand Division lost three officers killed, thirty men killed, eleven officers wounded, and one hundred and fifty-one men wounded; five missing; total, 200.

The total losses of my Corps in the battle, as far as machine gunners were concerned, were eight officers killed and

seventy-six men, thirty-five officers wounded and three hundred and ninety men; twenty-one missing; total casualties, 530 out of my Corps of machine-gunners. I do not think that was a heavy price to pay for what we did.

The losses in those divisions in taking that ridge, gentlemen, I think I am right in saying—I will not give you this as gospel—were less than in any other great battle that we have fought in this war. They were the lightest losses we have ever had; and it was said that those light losses were largely due to that machine-gun barrage, which prevented the Hun doing what he usually does, and that is shooting down our men with rifles and machine guns after the heavy artillery barrage has passed over.

The losses in material were very large. We lost thirteen guns, fifteen tripods, two hundred and twenty-nine boxes of ammunition, three belt filling machines, eight spare-part boxes complete, three first-aid cases, and one range-finder; and most of those stores were lost by the brigade that took forward eight guns to consolidate. The officer said: "Those guns are going forward with my line. They are going into the trenches with my line, and I am going to have them really protect me from my line." I saw the machine-gun officer afterwards, and he told me what his losses were—they were nearly all his losses; he lost men and material frightfully from shell-fire—and when asked what firing he did, he said: "One gun fired a little, but we practically did not fire a shot. There was nothing to fire at."

That shows you the danger of allowing an infantry officer to take forward machine guns unless he understands their tactical handling; and for that reason, gentlemen, let me beg, whether you be a Divisional Commander or whether you be a humbler commander of a platoon, for God's sake learn all about machine-gun tactics, not only your own, but the enemy's.

It may be interesting for you to know that at the Battle of Messines—I got this from the general officer, the chief staff officer of the Second Army, so I know it is absolutely correct—for ammunition alone we used eleven trains a day, and we fired twenty-two thousand tons of ammunition in the Battle of Messines—twenty-two thousand tons of ammunition! That is, during the six days of the battle.

That concludes my lecture, gentlemen; and I shall be very pleased to answer any questions that I can on the subject.

(Great applause.)

AN OFFICER. Colonel, I should like to ask you how many men you had serving all of your guns—how many men you had in your machine-gun organization.

COLONEL APPLIN. How many men to each machine-gun?

THE OFFICER. No; your whole organization.

COLONEL APPLIN. In the whole organization, the whole corps?

THE OFFICER. Yes.

COLONEL APPLIN. I cannot answer that off the reel, but I shall be very glad to give you the figures. I had two hundred and forty guns, and each gun had an average of ten men. That is just a rough statement of the number.

ANOTHER OFFICER. Colonel, you spoke of the administrative general on the staff. What are his particular functions?

COLONEL APPLIN. He does all movements, all quarterings and material, ammunition-supply, roads so far as they affect the movement of troops—not the repair of roads, but movements and quarters; practically what we used to call, in the old days, the Quartermaster General. He also does adjutant general's work. He has a deputy assistant adjutant general under him who does promotions and orders. He does the whole of the administrative side of the army corps.

ANOTHER OFFICER. You spoke of the Hun imitating your S. O. S. signal.

COLONEL APPLIN. Yes.

THE OFFICER. Would it not be possible to arrange a schedule of alternating colors of rockets which he could not imitate?

COLONEL APPLIN. I have no doubt that it would be quite easy; but we are a very simple people, and we have kept the same S. O. S. signal for some time now. The S. O. S. signal, ever since I can remember, has been a red rocket, and it is a very easy thing to imitate. Of course the Hun did not do us any harm by doing it. We found it out very quickly, and it did not do us any harm. It just wasted a little ammunition.

ANOTHER OFFICER. Colonel, you spoke about a lesson you had learned in regard to the flanking barrage. I did not understand the difference between what you said was a failure and what you intimated would be done in the future. You spoke of having

seen this flanking barrage tested, and you thought you could improve on it.

COLONEL APPLIN. The flanking barrage theoretically is done by placing the cones one over the other. That is to say, the first gun fires at eight hundred yards, the next gun fires at nine hundred yards, the next gun fires at one thousand yards, and all on the same line, so that you get the cones one over the other, and the ends overlapping. Is that clear?

THE OFFICER. Yes.

COLONEL APPLIN. Right; but owing to the rigid mounting of the gun, and to the fact that it does not lose anything in direction—that is to say, the bullets follow each other out in a straight line—you get a very thin line of bullets. The depth of that may be six hundred yards of ground completely swept, but it is only swept about five or six feet across; so that if you can jump across six feet you have got the barrage behind you; so the troops who want to pass through it have only to leap through a few feet, and they are clear of it. In other words, you would only make about ten per cent. of casualties with that barrage instead of about eighty or ninety per cent., as with an ordinary barrage.

Have I made that clear?

THE OFFICER. Yes. Then the alternative means is a frontal fire barrage?

COLONEL APPLIN. No; not necessarily. Our tests in France proved to me very conclusively that a concentration of eight guns on one aiming mark gives you two hundred and sixty yards depth by sixty yards breadth of absolutely concentrated hell. That was put down to show General Sir Douglas Haig; and he, realizing its importance, at once said to Colonel C———: "Yes, but can you put that down somewhere else? Put it down over on that white flag. How long will that take?" Colonel C———said: "Well, sir, they are students up there, and we will have to telephone up. It will take probably four or five minutes." General Haig said: "Do it." It came down, I think I am right in saying, in one minute five seconds.

COLONEL C———. Yes.

COLONEL APPLIN. In one minute five seconds from the order being given, and the guns were more than two thousand yards behind where we were sitting, it came down perfectly accurately

on that white flag. The depth of it on the sand, the length of it, was roughly two hundred and sixty paces—I paced it myself—and the breadth of it was roughly sixty paces, and nothing living could get through. The fire of those eight guns was concentrated on one aiming mark, and the spread was the natural spread due to the various errors that must creep in, the difference between each gun, the tiny difference in aiming or laying each gun, etc., etc.

ANOTHER OFFICER. What was the opening range of your fire there, sir?

COLONEL APPLIN. The opening range differed according to the position of the guns. Some guns were close, and some guns were further off. We may take it that the average range was about from eight hundred to twelve hundred yards.

THE OFFICER. What would be the effective range for such ...age?

COLONEL APPLIN. For a good barrage?

THE OFFICER. For a creeping barrage.

COLONEL APPLIN. You can creep with a barrage more or less ...tively to two thousand eight hundred yards, but at that ...nce the angle of descent of the bullet is very great, and ...s not kill. It wounds, but it does not kill. It is not very ...ve; but the moral effect of a creeping barrage at that ... is very great. The moral effect is very great of having ... bullets raining down on your head. We consider that up ...o thousand eight hundred yards you get moral effect; up ...o thousand five hundred yards you get actual effect; and ... get perhaps the best effect between eighteen hundred and ... thousand two hundred. I am speaking very generally.

THE STRATEGICAL AND TACTICAL VALUE OF MACHINE GUNS.

By Maj. Lindsay, Senior Instructor, British Machine Gun Training Center.

1. To enable the value of machine guns in war to be thoroughly appreciated, it is essential that sound ideas are held on the subject of what constitutes the fighting value of any body of troops.

The strength of a force is frequently judged by the number of the individuals of which it is composed. This point is fundamentally wrong, and the strength of any force lies not in numbers, but the volume of fire which that force is capable of producing.

It has been said that *"In War Fire is Everything"* and to-day this fact has been proved more conclusively than at any period in the history of war.

Were the combatants armed with stones, or archers at Crecy, or an army of to-day with its heavy guns, quick-firing artillery, machine guns and rifles, the basis of success has been always the same, and victory secured to that side which has been able to pour on to its adversary the greatest number of accurately directed stones, arrows, shells, or bullets in the shortest time.

If this fact is fully appreciated, there can be only one conclusion reached, namely: that it is not numbers of individuals that make for victory, but the amount of fire which those individuals can produce.

2. Even before the outbreak of the present war it was admitted that one machine gun could produce a volume of fire equal to at least 50 rifles, but subsequent experience has proved that even when machine guns have been used, either singly or in pairs, without the advantage of "higher direction" or even very highly trained teams, the effect produced on the enemy has been far greater than that of 50 rifles.

By the collective employment of machine guns in large numbers, under supervision, on a definite tactical plan, their powers as compared to that of the rifle increase out of all proportion to any figure that may be arrived at by a mathematical calculation based on the bullet-producing power of the two weapons.

Every officer of experience in the use of machine guns will agree that their power is underestimated when it is affirmed that employed collectively under these conditions one machine gun is equal to 100 rifles.

3. The establishment* of a machine gun company is

*This establishment is not sufficient to keep 16 guns in action. See Suggested Establishment, which has been found, by experience to be the *smallest* number of all ranks with which it is possible to "carry on."—G. L.

laid down as 150 of all ranks and 16 machine guns. Thus 150 individuals when armed with 16 machine guns are capable of producing a volume of fire equal to that of 1,600 rifles.

According to the establishment of the company it is seen that approximately 10 men are required for each gun, consequently when the machine gun is the weapon in use it may be said that 10 machine gunners are equal to 100 men armed with rifles.

4. Once these facts are clearly appreciated the value of the machine gun from a strategical standpoint forms an interesting study.

Most military operations of a strategic nature on a large scale consist in a defensive along one portion of the front while the offensive is being taken along another. Unless the army desiring to take the offensive is immeasurably superior in numbers over the defender the danger arises that, having massed troops for his offensive, he may have so weakened some portion of his defensive line that the enemy may be enabled to break through. Therefore, he must ensure that he only withdraws for his offensive such forces that the remainder of his line is not liable to be broken and defeated before that offensive has sufficiently developed to ensure a decisive victory against the enemy's main army.

5. It is admitted that for a decisive attack on any portion of the enemy's line large numbers of infantry are necessary, and so far as the British Army is concerned it is impossible to mass the required number of infantry on any one portion without the withdrawal from the remaining portions of considerable numbers.

Therefore some means of maintaining or even of increasing the fire power of that portion of the force which is acting on the strategic defensive must be secured while the infantry is massing for the offensive.

It is here that the value of machine guns does not appear to have been fully realized.

A machine gun company of 150 men, at any rate when acting on the defensive, is equal to 1,600 infantry in its power of resistance to attack.

Thus two machine gun companies would be roughly equal to 3,000 infantry.

Now, machine guns require a certain proportion of riflemen and bombers for their own local protection.

Therefore a force of two machine gun companies supported by 1,000 infantry would be a most efficient substitute in a defensive line for 4,000 infantry; that is to say, the line which had previously required 4,000 men will be held equally well, if not better, by 1,300 men.

6. Let this calculation be applied on a much larger scale. A certain front A.....D is held with 12 divisions.

It is decided to attack the enemy on that portion of the front marked A.....B, consequently it is necessary to mass on, or immediately in the rear, of the line A.....B all the available infantry which can be secured without dangerously weakening B.....D.

Now, 1,000 riflemen and bombers, i. e., one battalion of infantry with two machine gun companies, can hold a line of equal length to 4,000 infantry, i. e., one infantry brigade, but these 4,000 infantry have with them, on their own present establishment, 32 Lewis guns, so that to ensure a sufficient margin of safety let us add two extra machine gun companies per division to replace these regimental machine guns which will of course accompany their battalions to other portions of the line.

On the front B.....D are eight divisions; that is to say, 24 brigades, or 96,000 infantry.

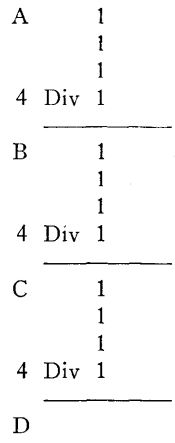
To replace each division withdrawn from these lines 8 machine gun companies and 3* battalions will be required.

Consequently to hold B.....D 64 machine gun companies and 24 battalions will be necessary.

Since 24 battalions equal 2 divisions, 6 of the 8 divisions can be withdrawn from B.....D and placed on or behind A.....B. Thus 72,000 infantry are released for the offensive, and have been replaced by 9,600 machine gunners; in this manner a saving of 62,400 infantry has been effected on the front on which it is intended to remain on the defensive.

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*These will have their 8 Lewis guns apiece, *i e.*, 24 Lewis guns.—G. L.



The majority of experienced machine gun officers will say that this calculation much overestimates the number of machine guns required to replace the divisions withdrawn from the line B.....D; but the argument must be the more convincing if, having erred on the side of safety, the power of the machine gun has been under rather than overestimated.

Needless to say, an efficient system of field fortifications in conjunction with these calculations is taken for granted.

7. They can also be applied on a still greater scale; this is to say, that they can be used to determine the number of troops that can with safety be removed from one theatre of war to another. As long as the strength of any military body is calculated on the number of individuals it contains, no true value of its strength can be obtained.

The only reliable way of deciding the relative strength of armies is by calculating the volume of fire that the armies in question are capable of producing.

8. The great tactical value of the machine gun both in defensive and offensive action is a subject of too great a scope to deal with in the present paper. A few points for consideration however are put forward:

(*a*) Assume that it was desired to send to the Balkans all the

troops that could be spared from other theatres of the war. Owing to the comparatively small numbers that were immediately available for this purpose, it was necessary for those troops that arrived to act principally on the defensive until further reinforcements could have been sent to them.

Let the above calculations be applied and it will be found that for defensive purposes two infantry divisions accompanied by 64 machine gun companies would have obtained a result equal to, if not greater, than 8 infantry divisions. In other words the machine gun force numbering 33,600 men could have obtained as great a result as that by 8 divisions of 96,000 infantry.

(*b*) Next take the case of a small cavalry force, say one brigade pushed forward rapidly to seize some tactical point which it is desired to deny to the enemy and hold until further bodies of troops can be pushed to their support.

Repeating that the Machine Gun Company is equal in fire power to about 1,600 rifles, therefore it follows that it is considerably greater than that of a cavalry brigade.

Thus if the cavalry brigade which was pushed forward had been accompanied by a machine gun company, the fighting power of the brigade would have been more than doubled by the 150 men composing that company.

Therefore the most economical way to employ cavalry for work of this nature is more or less as an escort for a number of machine gun companies.

Once the desired position has been occupied by the cavalry they can be replaced by machine guns and concentrated once more for further action if necessary.

(*c*) In attacks such as those which took place September 25th and 26th it is a noticeable fact that if the artillery have done their work thoroughly the infantry is instantly successful; in fact, as a rule, the assault is either completely successful in a very short space of time or it fails altogether.*

After breaking through the enemy's defensive line it is necessary for the infantry to press forward with the utmost vigor with the object, amongst other things, of capturing his artillery.

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*NOTE.—If 1,000 men can take a position, in 9 cases out of 10, 100 men could do so equally well. For you either succeed or fail according to the effect of your preliminary bombardment, and covering fire.—G. L.

By the time the infantry have got through they are much weakened by casualties, and probably somewhat scattered. The artillery is probably unable to support them, and they have to move forward to a new position itself.

It is then that the infantry, weakened by losses and unsupported by artillery, is brought to a halt by the enemy's reserve machine guns, and the weakened firing line has not sufficient fire power to overcome them.

Now is the time for pushing forward to their support formed machine gun units employed on a definite tactical plan.

These units will enable the infantry either to:—

(1) Consolidate and retain the line gained until supports and reserves arrive,

(2) Secure the superiority of fire necessary for a further advance,

or, if any portion of the attacking line has pushed forward beyond the troops on its right and left, these units will themselves be able to protect the exposed flanks.

(*d*) The value of the machine gun when used as a reserve of power to hold up and drive back infantry that have succeeded in breaking through the defensive line has been so amply demonstrated by the Germans that to draw further attention to it is superfluous.

(*e*) Lastly the mobility of a force composed of machine guns is definitely greater than that of a force composed of infantry equivalent in fire power.

It is obvious that it is far easier to move from one part of a battlefield to another, or from one theatre of war to another, 150 individuals and 16 machine guns than their equivalent of 1,600 infantry.

Furthermore, not only is it in itself more mobile but consider for a moment in the example above mentioned the difference between the numbers of reserves required for the force of 8 divisions of infantry, i. e., 96,000 infantry, and those of the machine gun force numbering only 33,600. Not only that, but an enormous saving in transport and supply is effected, as for example: Assuming the daily rations per man at 31 lbs. each, it only required 450 lbs. to be transported per machine gun company against 4,800 lbs. to its equivalent in infantry, or rather less than 1/10th.

A saving is also effected in forage in the proportion of 5 to 8.

Surely these advantages are worthy of very serious consideration, and the saving in personnel thus effected would tend towards a great reduction in the total casualties sustained by the armies in the field.

9. It is said that Great Britain has difficulty in obtaining under present conditions sufficient men to maintain armies of the required size in the field. If this is so there is greater need than ever for clear thinking on the machine gun question.

As it can be seen that 10 trained machine gunners are the equivalent in fighting value of 100 trained riflemen, it therefore appears to be a bad policy to continue piling up division after division of infantry until every machine gun that can possibly be acquired by next spring is assured of its full complement of trained machine gunners.

The reason ascribed by some for the delay in providing the large numbers of men required during the next few months in order that the machine guns which will become available during that time may be manned, is the lack of men for the infantry. Surely it is better that the infantry should go short than that a single machine gun should remain without its proper proportion of trained personnel. The training of men to use rifles, while there is lack of men to use machine guns, would appear to be like unto a commander, who, having a force, some armed with wooden clubs and some with rifles, continued to train men in the use of clubs, thereby neglecting to increase the numbers of his force who were armed with the more efficient weapon.

Or again, like unto a force, armed partly with magazine rifles and partly with "Brown Besses,' to which (both magazine rifles and "Brown Besses" being available) drafts armed with the "Brown Bess" were sent instead of drafts armed with magazine rifles.

Yet there is a greater difference between the "killing power" of the machine gun and the magazine rifle than between that of the magazine rifle and the "Brown Bess."

10. If it is by now decided, that the creation of a great machine gun force for strategic and tactical purposes is the

most urgent need of the moment, what means exist for its creation and growth?

Up to a few months ago there were no such means, for the machine gun strength both in the field, and as regards training at home, was split up into a number of isolated units, guided by no "higher direction" either in thought or action. But in the new Machine Gun Corps, if it is properly developed, there is the organization which will supply all needs in this direction.

It is, however, absolutely essential that the work and future policy of this Corps should be immediately considered and definitely decided upon.

A few suggestions are therefore put forward as to the lines on which the Corps should be developed.

It must first be remembered that the supply of machine guns no longer represents the difficulty. It is the supply of trained machine gunners to man these guns that is the difficulty.

Let it be decided at once that machine gunnery is the most important branch of infantry work, and that the men must be secured at all costs, even if it requires the decision to maintain a smaller number of infantry divisions in the field, and necessitates the breaking up of many formations now under training, and the conversion of them into machine gunners. Even then the machine gun corps will be faced with a stupendous task, and will need every help from those in authority to enable it to carry that task to a successful conclusion.

11. The following represents the broad lines on which the machine gun corps should work, and the order in which it should tackle its respective tasks:—

(*a*) (*i*) Train a sufficient number of machine gun companies to enable one of these to be attached to every brigade of the armies in the field.

(*ii*) Train a further number of machine gun companies so as to provide a fourth company for each division.

(*iii*) Create a reserve of trained personnel to replenish wastage in (*i*) and (*ii*).

(*b*) Train a further number of machine gun companies to be formed into larger units, say battalions of 4 companies each,

which may eventually be grouped together in still larger formations for strategical and higher tactical purposes.*

(*c*) Absorb into the corps all machine gunners of every kind, whether belonging to regimental sections, machine gun companies, machine gun squadrons or machine gun regiments. These men would be trained in every kind of machine gun in use with the army in the field.

A large reserve should be kept in England, and smaller reserves with each army in the field; it being the duty of the reserve in England to keep up the reserves abroad to some number to be decided upon, by this means all machine gunners, being members of the corps available for general service, and specialists trained in all the adapted types of machine guns, can be drafted in this indiscriminately to any unit that requires them at the moment.

Thus will efficiency be increased tenfold, and drafting be made a far less difficult matter.

12. In conclusion, the whole machine gun question must be fully and carefully considered, and a definite policy as to the creation and development of a machine gun force of great magnitude decided upon.

This question goes to the root of the difficulties of the supply of men for the army, for a number of men armed with a more effective weapon are of far greater value in war than a much larger number less efficiently armed.

In proportion of fire power there is also a saving in officers and N. C. O.'s when the machine gun company with its 9 officers and 11 N. C. O.'s is compared with the numbers required for its equivalent in infantry.

Therefore, if the total numbers of the British Armies are limited, it must be ensured that what there are can make up for lack of numbers by superiority of fire power.

The only way that this can be done is by developing the machine gun service to the utmost limit.

Therefore without one moment's delay the greatest machine gun service possible for this purpose should be created. For this purpose every machine gun is required, and it is necessary to train gunners to man them by every possible means, and in the shortest possible time compatible with efficiency.

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*A "Machine Gun Force," as advocated in Paragraph 6.—G. L.

MISCELLANEOUS NOTES FROM THE BRITISH MACHINE GUN TRAINING CENTER.

Sweeping Reverse Slopes.

Occasions may arise when the reverse slope of a hill can be swept by machine-gun fire. The following method is based on the fact that if machine guns are placed so that the angle of descent of the bullets conforms as nearly as possible to that of the slope of the ground, the maximum effect will be obtained.

The principle underlying this method is to note the angle which the reverse slope makes with the horizontal plane, and then add or deduct the angle of sight between the gun and crest of hill or visible horizon.

Method.

1. From a contoured map determine the angle of descent of the reverse slope.
2. Examine the angle of descent table, and find which range corresponds to this angle of descent.
3. Select a gun position on the map at the range determined, and calculate the angle of sight from the gun position to the crest.
4. Take the sum of these two angles, or, in the case of a negative angle of sight the difference and again determine the final range for this total angle of descent.
5. Place the gun at this distance from the crest corresponding to the range found above.
6. Adjust the sights for the range with an extra elevation of 100 yards for ranges up to 1,000, and 50 yards for ranges over 1,000, and aim at the crest. This extra elevation will ensure that the lower half of the cone is also assisting to sweep the slope.

As the angle of sight to the crest line may be considerably altered when moving the gun forward or backward to the desired position particularly on uneven ground, it may be desirable to calculate the angle of sight again.

The guiding principle of machine-gun fire, which is based on the characteristics of the weapon, is to produce and apply fire in groups, varying in volume according to the nature of the target.

The application of fire is to a great extent dependent on correct appreciation of climatic conditions, the permissible and probable errors in ranging and accurate observation of the strike of the bullets.

When the greatest volume of fire is required the groups fired will vary from 30 to 50 rounds, according to the proficiency of the firer. The firer pauses momentarily between each group to ensure that the sights are correctly aligned, and continues until ordered to cease fire or until he considers it necessary to do so.

When firing for the purpose of correcting ranging errors, groups of from 10 to 20 rounds are used. The word "Ranging" should precede the order or signal to fire. Ranging fire should never be used when surprise is of importance.

Permissible and Probable Errors in Ranging.

Fire will not as a rule produce results commensurate with the amount of ammunition expended, or fulfill the purpose for which it is used unless the target is included within the area beaten by 75 per cent. of the bullets directed upon it.

If an error in ranging is made which causes the nucleus of the cone to strike at a distance short of, or beyond the target, equal to more than half the depth measurement of the effective zone the target will not be included in this zone, and the fire will be ineffective.

The permissible error in ranging, if fire is to be effective, is therefore half the depth of the effective zone, e. g., at 1,000 yards the effective zone is 140 yards in depth; the permissible error is therefore 70 yards.

The probability of error in ranging increases with the distance. That is, the probable error in ranging increases at the same time as the permissible error decreases.

The probable error in ranging may be taken as 5 per cent. of the distance when a range finder is used; 15 per cent. when judging distance is the only means available; 10 per cent. when a combination of the two is possible. To this may have to be added errors due to climatic conditions.

The figures above are given only as a guide, and allowances must be made for indifferent rangetakers, etc.

To give a satisfactory degree of assurance of fire effect, it

becomes necessary, unless the situation permits of errors being corrected by observation of results, to increase the depth of the effective zone. The depth of the effective zone can be increased by the use of "Combined Sights" or "Searching."

Combined Sights.

When two or more guns are working together the depth of the effective zone can be increased by ordering different elevations to be used by each gun, while each uses the same aiming mark. By this means while the effective zone is increased, the density of fire is considerably reduced. The difference in elevation between guns depends on the number of guns available, the probable error in ranging to be allowed for, and the depth of the effective zone for one gun at the particular distance. The extreme difference in elevation must be limited so as to ensure that no gaps are left between the 75 per cent. cones of the different guns.

For general guidance, combined sights differing by 100 yards should be used at and beyond 800 yards and up to 1,200 yards, inclusive; beyond 1,200 yards the difference in elevation should not exceed 50 yards between guns. When two guns of a subsection are sighted to the same elevation "Combined Sights by Subsections" differing by 100 or 50 yards, according to the distance, may be used.

A Machine Gun Commander should use his judgment in modifying the application of the above in accordance with the facilities that may be available for accurate ranging, and thus gain the tactical end in view with less expenditure of ammunition, and less exposure of guns and personnel.

Combined sights should at once be discontinued if accurate obervation of the strike of the bullets can be obtained.

Machine Gun Commanders when ordering combined sights will give out the lowest range and the difference in sighting to be used. The lowest range will always be taken by the left hand gun of the section or sections as the case may be. The No. 1 of that gun will pass to the No. 1 of the gun on his right the range he himself is using and the difference ordered, and so on down the line.

When the target to be engaged is a narrow one, and all guns

are using the same aiming mark, it will generally be impossible for the firers to observe their own particular cones of fire. In these circumstances no alteration in sighting is permissible except under the orders of the Machine Gun Commander. If as a result of his observations or for other reasons, the Machine Gun Commander wishes to alter the sighting, the quickest method is to bring the elevation of the left hand gun above that of the right hand gun or to lower the elevation of the right hand gun below that of the left hand gun according as to whether he wishes to increase or decrease the elevation. To ascertain the amount up or down multiply the difference in sighting between guns by the number of guns used, *e. g.*, 4 guns 50 yards difference; amount necessary 200 yards.

When the guns are laid on different points of aim, each firer should endeavor to correct his elevation from observation of the bullet strike. In such cases the effect may be increased by traversing from the flanks inwards or from the center outwards.

Searching.

The principles of searching are taught in Part I of the Annual and General Course for Vickers, Maxim and Colt guns.

It is used when only one or two guns are available and combined sights will not overcome ranging errors. It requires much skill on the part of the firer to avoid gaps. The size of the groups will depend on the nature of the target engaged. When one gun is being employed for "Searching" the sights are adjusted so that the first group will include the lowest limit to be searched which is dependent on the probable error in ranging expected.

The gun is now laid on the aiming mark, and the sights adjusted without relaying so that the last group will include the highest limit to be searched. The line of sight will now strike the ground short of the aiming mark. A group is now fired, after which the elevating wheel is turned to cause the next group to strike sufficiently far beyond the first to ensure an overlap. This is continued until the line of sight is again brought on to the aiming mark.

When using two guns the left gun will act as described above; the sights of the right gun will be adjusted in the first instance to the highest limit to be searched, and will work down to the lowest limit.

Searching will be discontinued when observation of results is obtained.

The effect of ground rising with respect to the line of sight must be considered when combined sights or searching is employed.

Combined sights and searching can be used for engaging targets of great depth, such as roads, bridges, etc.

Traversing.

The principles of traversing are taught during elementary gun drill and during the Annual and General Machine Gun Courses.

This method of distributing fire laterally is employed against a linear target.

The normal method of traversing is by means of a series of small groups, with the object of covering as wide a front as possible with only sufficient volume to ensure effect. In this case a group should consist of from 5 to 10 rounds only, because against a linear target greater volume will not produce greater effect.

Traversing may be either horizontal or diagonal.

This method of engaging a linear target possesses certain disadvantages. It is a slow method and requires careful training, and the regularity of the groups may possibly detract from the effect produced on the target. The former can be remedied to a great extent by seeking opportunities for oblique fire thus reducing traversing to a minimum. Loss of effect due to the regularity of the groups, can be overcome by teaching the gunner when ordered to apply each group to a different portion of the target.

Up to ranges of about 1,000 yards experiments show that machine guns firing 250 rounds in a minute can distribute fire over about 25 yards of front.

An alternative method is the "Swinging Traverse," the traversing clamp being kept fairly loose, and the gun swung evenly and smoothly from side to side. This method may sometimes be found necessary against dense targets at close range, when the normal method would be too slow.

Using this method a gun can distribute fire over approximately 30 yards of front in 5 seconds at close ranges.

Night Firing.

If the gun position is not exposed to the enemy's fire, the gun, if not otherwise required, can be mounted and laid by day and left till night. At night some kind of auxiliary aiming mark is placed in front of the gun in line with the target. This auxiliary aiming mark can be a screen secured to the open side of a box in which is placed an ordinary siege lantern, or an electric torch. This screen is marked with lines to permit of searching and traversing within definite limits. The horizontal lines on the screen are 1 inch apart, which will give a difference of angle of 10 minutes from the center line if the screen is placed 10 yards from the gun. The amount that 10 minutes represents in range can be readily ascertained from the table showing the angles of elevation for the gun. The vertical lines are 2½ inches apart, which will give deflection of about 2 feet per 100 yards of range, when the screen is placed 10 yards from the gun.

Some searching is necessary at night to overcome any errors in laying, holding, or other factors.

When the gun position is exposed, or several lines of fire are required, it will often be possible for arrangements to be made by day, so that the gun and tripod can be brought up under cover of darkness and placed in position to open fire when required.

By day, an observer selects the gun position and also the target he wishes to engage. He places a stick (L) in the ground about 10 yards from his gun position and in rough alignment between the target and gun position. He then crawls back to the gun position and places a stick (G) in exact alignment with his first stick (L) and the target. If it is probable that more than one target is to be engaged other sticks (L^1, L^2) can be placed between the stick (G) and the different targets (T, T^1, T^2). To do this an assistant is required to place the sticks in position while the observer dresses them from (G). It is necessary to place the sticks vertically in the ground, and the stick (G) should not be more than 6 inches above the ground to avoid being knocked over by the crosshead of the tripod, when it is placed over it.

Ranges and angles of sight to the target must also be taken.

Should it be found impossible to place the stick (L) in position owing to the proximity of the enemy the stick (G) should first be placed in position and a second stick (M) placed in rear of it and in alignment with (G) and the target.

Under cover of darkness the position of (L) can be easily ascertained by an observer at (M) directing an assistant to place a stick in alignment with (M) and (G).

At night, the auxiliary aiming mark is placed in the exact position of the stick L, L^1, L^2, according to the target it is desired to engage.

The gun and tripod are brought up and the crosshead is taken from the socket. The tripod will then be placed over the stick (G) so that the intersection of the "Webs" in the socket is exactly over it. The crosshead and gun are then mounted and aligned on the lamp.

After the required angle of quadrant elevation has been placed on the gun, the tangent sight slide should be adjusted so that the line of sight is directed at the intersection of the central vertical and horizontal lines on the night firing screen. Allowance for any side wind blowing must now be made by using the vertical lines on the screen.

When the conditions are such as to render the placing of the night firing screen in front of the gun impossible, use may be made of mirrors to allow of it being placed in rear or to a flank.

Overhead Fire.

Direct overhead fire with machine guns may be employed under certain limited conditions. The following factors, all of which tend to increase the difficulty and risk in employing fire of this nature, necessitate the working out of a reasonable margin of safety.

1. The state of the barrel.
2. The condition of the tripod and the nature of the ground on which mounted.
3. The degree of visibility of the target.
4. Errors due to ranging and climatic conditions.
5. Accuracy of laying and holding by the firer.

The flat trajectory of modern ammunition necessarily restricts overhead fire at the closer ranges, if the gun position, friendly troops, and the enemy are approximately in the same place, while at long ranges the dispersion of the cone of fire and difficulty in ranging may make it dangerous.

Overhead fire therefore may normally only be employed under the following conditions:—

(*a*) When the gun is fired *from* or *at* a commanding position, or across a valley.

(*b*) When the distance to the target has been obtained accurately, that is by a highly-trained rangetaker, who is able to guarantee the distance within 5 per cent. of error.

(*c*) When the No. 1 at the gun is an expert firer.

(*d*) When an angle of 30 minutes is formed by the intersection of imaginary lines drawn from the target and friendly troops to the gun, the distance to the target being 1,000 yards or under.

If the distance to the target is over 1,000 yards and not more than 1,500 yards the angle thus formed must not be less than 60 minutes.

The above angles give a sufficient margin of safety at 1,000 and 1,500 yards respectively. At distances within 1,000 yards, and between 1,000 and 1,500 yards, the margin of safety continually increases. If the distance to the target is over 1,500 yards direct overhead fire should not be employed, as the position of the lowest shot of the 100 per cent. cone over 1,500 yards is uncertain.

The foregoing may be modified provided accurate and reliable observation is insured. This, however, is a matter for the exercise of judgment and commonsense on the part of the Machine Gun Commander. Too much reliance must not be placed on the ability of an observer to pick up the cone of fire during an attack. The fire of the attacking troops, as well as supporting troops, together with the artillery, may be such, that the machine gun cone of fire cannot be picked up correctly.

The safety angles of 30 and 60 minutes may be obtained as follows:—

1. From prismatic field glasses graticuled for Mark VII ammunition. In this case the distance between the zero line and the 600 yard graticule gives the required angle for 1,000 yards and under, while the distance between the zero line and the 1,000 yards graticule will give the angle for distances between 1,000 yards and 1,500 yards. This method of obtaining the safety angles is unreliable, since it is quite possible for the wrong lines to be used.

2. With the aid of the machine gunner's protractor, as follows: Hold the protractor vertically and at the full length of the

cord from the eye: the space between the safety lines marked will then give the required angles.

3. By means of the tangent sight:—

Lay the gun on the target with the correct elevation, then if the distance to the target is under 900 yards, move the slide up 400 yards; if 900 yards or over move up the slide 250 yards. In each case adopt the auxiliary aiming mark thus formed.

This method has its advantages and disadvantages. In one sense it is against the principles of machine gun training which emphasizes the importance of the No. 1 looking at the target, and not along his sights when firing. Again the gunner, having carefully marked the spot on which the sights are aligned, is trained to take the heads of the advancing infantry as his aiming mark, when they reach and pass this spot, a proceeding which may not always be desirable. The chief advantages obtained from this method are:—

Each gunner can obtain the safety angle required for the particular troops he is supporting; when the troops who are being supported pass the spot marked as an aiming mark, the gunner can still continue firing by elevating the gun so as to maintain his aim on their heads.

Thus the cone of fire passes over the heads of the friendly troops with a uniform margin of safety at each advance, and may search ground in rear of the enemy's position possibly occupied by supports and reserves.

The disadvantages of this method can be minimized by the Machine Gun Commander using a protractor as a check on the firer. This is particularly necessary when the nature of the ground on to which fire is being directed, gives a false impression as regards the limit of safety.

Indirect Fire.

On rare occasions indirect fire may be used. This form of fire is rendered possible by the "fixed mounting" of the machine gun. Lewis guns and others of a similar nature must *never* be used, owing to the fact of their being "air-cooled," and fired from light mountings.

Indirect fire may be of great value in annoying the enemy and affecting his morale, but except under unusually favorable conditions, cannot be expected to inflict serious loss,

The main disadvantages of indirect fire are:—

It requires in most cases a great deal of preparation, but accuracy in calculation. Unless officers possess experience, it may sometimes be employed under conditions, where direct fire is not only possible but necessary. Under certain conditions it may be positively dangerous to our own troops.

Spirit Level Method.

With the aid of a carpenter's ordinary spirit level, indirect fire can be quickly and accurately applied with machine guns, to a target which is invisible to the firer. The conditions necessary for success with this method are:—

(*a*) The target must be visible to the controlling officer from a position behind, and slightly above the gun.

(*b*) The gun must be far enough away from the obstruction to insure the bullets clearing it. This can only be ascertained definitely after the correct elevation has been placed on the gun to hit the target.

(*c*) The gun and the target must be approximately on the same level.

(*d*) The controlling officer, or the range-taker, must observe the fire through field glasses or the range-finding instrument respectively, preferably from a flank.

The method of employing this fire is as follows:

(1) The controlling officer raises his head only just sufficiently to enable him to give orders to the No. 1 as to aligning his gun on to the target for *Direction* only.

(2) Having finished aligning the gun, as described above, the controlling officer now gives the following orders:

(*a*) "Sights at zero."

(*b*) "Level gun with spirit level."

This is done with the Vickers or Maxim gun by laying the spirit level on the top of the breech casing and then by moving the elevating wheel until the bubble in the spirit level is central.

(*c*) "Place an aiming mark where sights are now pointing on near side of obstruction."

For example, a stone or handkerchief, or anything No. 1 can see plainly.

(*d*) "800" (or whatever the range to the target happens to be from the gun position).



(*e*) "Relay on aiming mark."

(*f*) Ascertain if shots will clear obstruction by adjusting the sights for the distance to the obstruction. If the line of sight now clears the obstruction, the cone will also clear.

(*g*) "Fire" (or signal to fire).

Since the gun is now laid, with the correct angle of elevation for the range to the target on the sights, the bullets will now strike the target or in its vicinity.

Any necessary alterations in elevation, or in deflection, are made according to the results of the fire which will be signalled in by the range-taker, observing the fire through his powerful instrument.

This method must not be employed when firing over the heads of our own troops.

Spirit Level, Contoured Map, and Elevating Dial.

From the map ascertain the distance to, and difference in height between, the gun position and target. From this work out the angle of sight in minutes in the following manner:—

Divide the difference in height reduced to inches by the number of hundreds of yards in distance, *e. g.*, difference in height 40 feet, distance 2,000 yards, angle of sight is therefore 24 minutes. The angle of sight can also be found by the following formula:

$$\frac{\text{VI X } 19.1}{\text{HE}} = \text{D.}$$

Where VI is the difference in height in feet, H.E. the distance in yards, and D is the angle of sight in degrees.

Add or deduct the angle of sight thus found to or from the tangent angle for the distance, according to whether the target is above or below the gun position. This will give the Quadrant Elevation to be placed on the gun.

To place the required Quadrant Elevation on the gun:—

Level gun by spirit level, No. 1 holding the while.

Slip dial round till zero is under pointer, without disturbing the bubble.

Clamp dial to, but without disturbing, elevating wheel,

One revolution of the elevating wheel equals 4° elevation or depression on the gun. To obtain an angle of elevation of 8°, the elevating wheel would have to be revolved twice.

The Elevating Dial is accordingly graduated to 4° showing sub-divisions of 5 minutes which are easily capable of sub-division by eye.

When the required elevation has been placed on the gun, put a suitable aiming mark in position between the gun and target; the night firing screen will do for this purpose. Raise the slide of tangent sight as when firing by night, without altering the elevation of the gun. The direction of the target can be obtained by means of the traversing dial, or prismatic compass. During pauses in the firing the gun *must* be relaid on the auxiliary aiming mark. The spirit level should also be placed on the gun at frequent intervals and the gun levelled. If the zero mark on the dial is then not opposite to the pointer, the dial should be unclamped and adjusted so that the zero mark is in the correct position as described above. The correct Quadrant Elevation should then be placed on the gun and the tangent sight slide altered as necessary.

Clinometer and Contoured Map.

From the map ascertain the necessary Quadrant Elevation to place on the gun. Now set the clinometer to the required reading, and place it on the cover with the arc to the rear and with the long edge parallel to the axis of the barrel. Turn the elevating wheel, No. 1 holding correctly, till the bubble is central. Place an auxiliary aiming mark in position.

The clinometer should be placed on the gun at frequent intervals and the elevation checked.

When firing over the heads of our own troops no clinometer should be used, unless it has been tested, and if necessary corrected, immediately prior to firing.

Graticule Method.

By means of graticules cut across the focal plane of a pair of prismatic field glasses, indirect fire can be as quickly applied, as ordinary direct fire.

These graticules represent the angles of elevation for the gun. The topmost graticule represents zero, and the lines below represent every 100 yards upwards, from 200 yards.

Proceed as follows:

(1) Obtain the range to the target.

(2) Move to a position whence you can observe the target through graticuled field glasses, look at the target in such a way that the graticule, representing the range to the target, falls across the target, then look for a suitable aiming mark above the target (which aiming mark must be visible from the position where the gun is mounted) and see which graticule falls across this aiming mark.

The range corresponding to this graticule, is the tangent elevation at which to open fire, using the suitable aiming mark to lay on. By this means great accuracy is obtained while the gun and firer are invisible to the enemy.

This method becomes inaccurate when the eye of the officer using the graticuled glasses is more than 6 feet above the gun.

It is important to get an aiming mark vertically above the target making any necessary allowance for wind. If it is found necessary to increase or decrease the elevation after fire has been opened, since the position of the slide does not indicate the range to the target, another method other than the normal must be employed; there are roughly as many clicks on the ratchet of the tangent sight as there are hundreds of yards in the range, at all ranges below 1,500 yards.

For example, if using 500 yards on the sights and the range to the target is 900, we observe our cone what we judge to be 100 yards short of the target, the officer would order the firer to increase his elevation by 9 clicks, when he will find the elevation recorded on his sight to be 700 yards.

This method must not be employed when firing over the heads of our own troops.

Long Range Searching Fire.

In trench warfare, where the positions of our own and the enemy's troops are clearly marked, long range searching fire, over the heads of our own troops, may sometimes be safely employed.

To obtain the best results, observation of the strike of the bullets is essential. The element of chance, due to errors in ranging, climatic conditions, errors as to the exact position of the gun, etc., will thus be removed.

When observation of results is possible fire may be directed on the hostile support or reserve lines, communication trenches, etc. When no observation is possible the most that can be

hoped for is to engage an area of ground with the object of sweeping reverse slopes of hills which are defiladed from fire at short ranges; interrupting traffic on roads, etc.

To insure the safety of our own troops the following must at all times be strictly adhered to:—

1. No target should be engaged at a range of less than 1,500 yards.

2. The guns must never be more than 1,500 yards distant from bodies of our own troops, over whom they are firing.

3. When the guns are 1,000 yards or under from our own troops, the range at which they are fired must be such as to ensure the center of the cone of fire passing at least 60 feet over their heads.

When the guns are between 1,000 yards and 1,500 yards from our own troops this height must be 125 feet.

4. The position of our own troops with reference to the gun must be accurately ascertained.

5. When there is a *negative* angle of sight between the gun and target, or a *positive* angle of sight between the gun and our own troops, the heights shown in the trajectory table will be reduced.

The guns must therefore be moved back to fire at a range which will give the required safety limits under these conditions.

6. Climatic conditions must be carefully studied.

7. As a slight sinking of the tripod during firing may seriously affect the safety of our own troops, owing to the altered angle of elevation, every precaution must be taken to prevent this happening. The legs of the tripod should be firmly imbedded in the ground, and provision made to prevent them moving from their original position.

8. When "traversing" or "searching" is used provision must be made in the shape of wooden battens, etc., to limit them to a safe amount.

9. A worn barrel should not be used.

10. All calculations must be carefully checked before firing.

11. Troops over whom fire is to be opened must be cautioned, and a certificate to this effect signed by the Company Commander.

12. Clinometers if used, must be tested, and if necessary corrected, before use.

To direct fire on to a target invisible to the guns, a map having

a scale of not less than 3 inches to 1 mile must be used. In order to find the correct elevation, the map must be contoured.

The following information is required from the map:—

The exact position of the gun, the direction and distance between the guns and target, and the angle of sight from the guns to the target. Small errors in the position of the gun will cause serious errors in direction.

The position of the gun on the map can be found by "resection" with the prismatic compass.

The direction of the target can be obtained by means of a compass bearing or by the use of the traversing dial.

To find direction with the traversing dial proceed as follows:

Select some convenient object visible from the gun position which can be identified on the map for use as a reference object. On the map draw lines from the gun position to the reference object and target. Measure with the protractor the angle formed by these two lines at the gun position.

Place the gun in position on the ground, and lay on the reference object. Note the reading shown by the pointer on dial. Add or deduct this reading from the angle already obtained from the map, according to whether the reference object is to the left or right of the target.

When the reference object it is desired to use cannot be identified on the map, its compass bearing must be taken from the gun position and "plotted" on the map. The required angle can then be measured and used with the traversing dial as before.

To place the required elevation on the gun use either of the methods of "Indirect Fire" described above.

To facilitate the making of notes on angles of elevation, bearings, safety of our own troops, etc., it is advisable to enlarge the area to be engaged.

TACTICAL SUMMARY OF MACHINE GUN OPERATIONS FOR OCTOBER, 1917.

(British General Staff.)

1. Nature of Information.

The material on which the present *résumé* is based consists of the brief list of tactical lessons noted in the Army Machine Gun Reports for October, Intelligence Summaries for the same

month, and the narratives of particular operations from September 20th onwards.

Owing to the large measure of agreement which has been reached among Armies as to the principles of the tactical employment of Machine Guns in warfare against highly organized defenses, no striking novelties are to be found in the technical lessons mentioned in the Army reports. On the other hand, the narrative of particular operations shows manifold variation in detail, and sheds fresh light on the application of these agreed principles to the special kind of warfare that was experienced in the fight for the Passchendaele Ridge.

2. Intelligence Publications.

In the daily summaries and special publications issued by the General Staff, Intelligence, the following facts stand out:—

(*a*) There is evidence that the enemy is beginning to copy our methods of indirect fire.

(*i.*) A captured graph was very nearly a facsimile of the clearance graph used in one of our Armies, but it appeared to contemplate the putting on of elevation by some form of tangent sight method.

(*ii.*) Prisoners captured in the beginning of November state that "Barrage and Indirect fire is now being taught to all men in the field as far as possible. One man from each Machine Gun Company is being sent to the *Deutsche Gewehr Fabrik,* at Spandau, for a course including instructions in Machine Gun construction and in Barrage and Indirect fire."

(*b*) In Flanders, during the month of October, the enemy changed his defensive dispositions in a way which very closely affected the tactical employment of Machine Guns on both sides. Instead of the thinly held front line defended in depth by nests of Machine Guns and mazes of wire which afforded gaps through which his counter-attacking Divisions could sally, he placed more reliance on a concentration of troops in the forward area liberally supported by Machine Guns. His counter-attacks were therefore delivered much sooner than previously, and by troops much closer forward. By the end of the month he seems to have found that this change had been carried too far, and reverted to a middle policy of keeping his main counter troops well in rear, and at the same time maintaining his extra

stock of fire power in the front line, especially Machine Guns. These changes affected our own Machine Gun tactics in two ways:—(*i*) It increased the importance of the task assigned to the Machine Guns sent forward to consolidate in the neighborhood of the final objective. (*ii*) It made an *immediate* response to S.O.S. calls of critical importance.

The effect of the machine gun barrage, as reported by prisoners, under the latest tactical conditions may be estimated from the following extracts:—

"Our machine gun barrage was so effective on October 30th, that reinforcements were entirely cut off. Several attempts were made to get through, but proved unsuccessful on account of the heavy fire of our machine guns.

"The 22nd Bav. Inf. Regt. were entirely cut off from their reserves by our machine gun fire. Both the front line and reserve companies sustained very heavy casualties, and the men in the front line, seeing that they could not expect any reinforcements, surrendered." (Second Army Summary of November 2.)

On the subject of Intelligence the Second Army report makes the following recommendation:—"The Machine Gun Company being a single unit distributed over a brigade front and in close touch with brigade headquarters, has opportunities for collecting information greater than those possessed by any infantry battalion. Section officers and N. C. O.'s should be trained in what to report and how to report it. Opportunities might be taken during winter months of attaching officers and N. C. O.'s of the Machine Gun Corps to the Intelligence Branch of the Staff for this purpose."

3. Forward Guns for Consolidation.

The lessons emphasized in the Army reports may be divided into two groups according as they deal with forward or rear guns:—

"The striking feature throughout these operations has been the execution done by machine guns pushed well forward—usually by guns close to the final objective. Excellent targets have been obtained, both as the enemy were retreating and when they counter-attacked. Enemy machine guns and strong points have been engaged and defensive flanks have been formed. Good

results have been obtained both at the intermediate and final objectives; and the rôle of these guns has not been merely a defensive one. On the 20th September on one Corps front 10 to 12 guns went forward in connection with each attacking brigade. About 4 guns were in most cases allotted to the final objective, the remainder consolidating in depth. In view of the results obtained, the casualties were not excessive. Those actually incurred on the day of attack were in many cases slight. Some 30 casualties and the loss of two or three guns may be taken as an average for a company on the day of attack and the two following days." (Second Army.)

"To hold a brigade front it was found that eight guns sent forward with the atacking waves were probably more than sufficient." (First Army.)

In the operations at Polygon Wood, September 26 to 30, the 88 machine guns available to support the attack of one division were distributed as follows:—

Mobile guns	16
Mobile reserve guns	16
Barrage guns, creeping	24
Barrage guns, S.O.S.	32

The mobile guns were under orders "closely to support the attack of their respective brigades."

The mobile reserve guns were under the control of the G.O.C.'s of assaulting brigades.

"The number of mobile guns, 8, allotted to each brigade proved quite sufficient, even in the case of the 15th Brigade where heavy calls were made on the machine guns to cover the exposed flank. . . . Not lsss than six men per gun should be sent forward with mobile guns. These men should all be machine gunners and not attached men." (Report by D.M.G.O.)

The object of forward or mobile guns is to effect consolidation in depth: the guns coming into position after each objective has been definitely captured by the Infantry, and being thinned out where possible in the intermediate objectives after the final objective has been sufficiently organized for defense.

On September 20 to 22 at Langemarck Ridge the work of defense was organized as follows:—

(*a*) "No guns were actually attached to the Infantry at all, but given certain objectives to go to in the ground captured by each battalion, and were given strict orders to work in close co-operation with the battalion.

(*b*) "The teams trained specially with the Infantry whose advance they were to support. A miniature board model was made, showing the whole ground to be taken, the objectives of each battalion, and of other gun-groups, the approximate direction in which they would fire when in position, and the artillery barrage . . . Every N.C.O. and man, both machine gunners and carriers, knew as much of the scheme as the officer did before going over, and this proved invaluable, especially in the cases when the officer was wounded early in the attack.

"N.C.O.'s carried on and went straight to their objectives, having a full knowledge of what their teams had to accomplish."

(*c*) The group of 6 guns which had been detailed to go forward for the defense of Wurst Farm area (which was in the neighborhood of the final objective and the tactical key to the whole situation), picked their way without loss through the artillery barrage with the exception of one gun team which went astray. On arrival the guns were established in their pre-arranged positions. "Infantry officers were informed of the positions of these guns, and the M.G.O. endeavored to assist in the organization of their Lewis guns for counter-attack defense, as the orders were that this position was to be held at all costs: Wurst Farm area being the key to everything. Eventually, by 12.30 p. m. the whole ground around this stronghold could be swept by machine gun, Lewis and rifle fire.

"No gun, Vickers or Lewis, had a field of fire of less than 600 yards. The co-operation between these guns, and their excellent field of fire, proved later, in the counter-attacks, to be invaluable. Every gun, Lewis and Vickers, had a clear and specific portion of ground to cover, which minimized the amount of ammunition that might be wasted (such as would be caused by the Vickers and two Lewis firing on the same point)."

In the operations by a division at Wallemolen at the foot of the Passchendaele Ridge, October 26th and 30th, all four ma-

chine gun companies, in accordance with an earlier Divisional instruction, received their orders from the D.M.G.O., who also had the supervision of all machine gun training. The forward guns came under the orders of the Group Commander of the rear guns at advanced brigade headquarters. This arrangement was made with a view to co-ordinating the work of forward and rear guns and keeping the D.M.G.O. in immediate touch with the general machine gun situation. Thus, when two guns of the right consolidating section were hit by shell fire, they were promptly replaced from the barrage batteries which, in turn, received guns from the rear. On October 26th the casualties were very heavy, and therefore on October 30th the gun teams were under orders to proceed more slowly with their guns wrapped in water-proof sheets. The casualties were then very light, and "as soon as the Infantry line was established, the whole front was covered by the cross-fire of these guns." Their orders were:—"These sections will advance after reconnaissance by bounds of about 50 yards. They will take every precaution to keep their guns and belt-boxes clean. Their duty is to deal with counter-attacks in force and not with snipers and small parties which will be dealt with by riflemen or Lewis guns of battalions."

4. Rear Guns for Covering the Advance, and S.O.S.

In contrast with the advance attempted on July 31st, the advances made by the Infantry in the latter stages of the Ypres operations were much shorter. This materially affected the tactics of the rear guns and enabled them to take steps for surmounting difficulties which had been experienced in the earlier stages.

"The shortness of range of a machine gun barrage makes it difficult to select positions clear of the hostile artillery barrage. In consequence, barrage machine guns are very liable to be silenced, and it has been found in operations on a large scale, machine gun barrages soon become thin and patchy." (First Army.)

"The failure of machine guns to be able to deliver effective barrage fire in certain operations has been invariably traced to the difficulties in reloading wet belts by hand (the employment of the existing type of belt-loading machines being alto-

gether out of the question) and the lack of ammunition in dry belts." (Second Army.)

To give the fullest value and the greatest reliability to the machine gun barrage under the exceptionally difficult fighting conditions in the Ypres theatre, various expedients have been adopted.

In the case of one division, dumps of S.A.A. and strong weather-proof belt-filling shelters were erected in the forward area during the comparatively quiet period before the divisional relief; and on the night following the firing of the barrage, by which time the objective had been fully organized for defense, the barrage guns were very considerably thinned out.

In other cases higher rates of fire than usual, *e. g.,* 100 rounds per minute for 1 hour 40 minutes, and wider traverses were adopted. "In a program shoot in shelled areas guns should not be called on to fire at a less rate than 75 rounds per minute. To fire at a slower rate involves the exposure of more guns and teams than is necessary. All available guns should be mounted at the conclusion of the shoot for the S.O.S." (First Army.)

Nearly all reports of operations emphasize the importance of avoiding, when possible, the necessity for a forward move of the barrage batteries, for two reasons:—

(*i.*) The exposure to shell fire while moving.

(*ii.*) The difficulty of carrying up sufficient S.A.A. to a forward position for S.O.S. work.

In contrast with Vimy and Messines, where a continuous covering barrage was considered necessary, it has now become more usual to put the machine gun barrage on selected parts of the front only. The chief reason for this has been the exceptional density of our own artillery barrage in the Ypres sector, and the small depth of advance attempted on any one day. For example, on September 26th, at 'Sgrafenstafel, the 64 guns of one division were divided into:—

Rear guns	40
Forward or mobile guns	24
Total	64

Instead of a continuous barrage the guns fired by batteries on (*i*) "Pill-box" areas, (*ii*) the 'Sgrafenstafel cross-roads, (*iii*)

along the Hannebeke valley. They had also as their second task a final S.O.S. line 400 yards ahead of the infantry objective.

The covering fire, beginning at zero or later, was maintained for two hours after the arrival of the infantry at the final objectives, which were consolidated without interference from the enemy.

The S.O.S. barrage line was on the basis of 30 yards per gun, and when called for at 3.15 p. m: it was down before the artillery barrage.

"On September 26th, at Polygon Wood, another division adopted a further modification. Each of the two groups of rear guns had a separate task. The creeping barrage group (right) covered the infantry advance to the intermediate red line, firing 50 rounds per minute. It was then under orders to "Stand by until ordered to withdraw;" but the attack of the division on its right partially failed, and therefore batteries of this group were switched to assist the arrested advance by area shooting. They were instrumental in breaking up counter-attacks on more than one occasion, and on the 27th opened fire on seven different occasions in the British area. At 4.30 p.m. on the 27th these guns were firing on localities where the enemy were reported to be massing for attack, one minute and ten seconds after the information reached me" (Report by D.M. G.O.). Constant telephonic communication was maintained between D.M.G.O. and the creeping barrage group. The guns were in position for 60 hours.

The S.O.S. rear group was allotted the task of replying to S.O.S. calls on an S.O.S. line 500 yards ahead of the final objective. In addition, during the consolidation of this line it searched its frontage to a depth of 800 yards. Between 7.30 a.m. of September 26th and 11.55 p.m. on September 28th, ten S.O.S. calls were answered, at a total expenditure of 738,000 rounds (including 314,000 for the first call on September 26th). The guns were in position for 85 hours. After 8.45 a.m. on September 26th, all communication with the S.O.S. group was by runners, as the buried cable was cut. This, however, did not interfere with their work. "These guns are usually firing for many minutes before word can be sent to the Group Commander even when communication holds."

The above arrangement suggests a very interesting point. It

is of course open to the objection, noted in the Second Army report, that two sets of positions have to be dug, and two sets of men have to be kept under fire during operations. But where there is a choice of ground and good cover in positions which would not be suitable for S.O.S. work, it is possible that batteries here can fulfill a double function. They can take part in covering the initial advance; and also, because, being on less exposed ground they can hope to maintain telephone communication, they can be used as switch batteries for concentrated fire on areas opposite their own front or that of an adjacent division.

The extent to which observation can be obtained varies with the weather and the position which the battery or group occupies with reference to the operations as a whole. On the flank in clear weather, as for example, at the capture of Hill 70, north of Lens, in August last, it was possible to direct the fire of a group of batteries in a division covering the Canadian left flank from an observation post on commanding ground. It is also on the flank of an attack where the Infantry advance is small or nil, that telephonic communication can be most easily maintained. It is, however, sometimes possible to get good observation even in the centre of an attack. Thus, on September 20th from Shrewsbury Forest it was possible to observe not only enemy movements, but also the strike of the bullets on the ground (the ground being dry and the concentration of fire intense.) The rear guns here, which were divided as usual into two groups right and left, were sufficiently under control to enable one group to co-operate with the other when there was a check on the latter's front.

The battery positions had been selected as far forward as possible with a view to avoiding a forward move. In addition to covering the infantry advance and firing on the S.O.S. line during the main counter-attack later in the day, the batteries, by reason of having good observation and communication, were able to fire on several different occasions on enemy troops as they were preparing for the counter-attack. In this way machine gun fire could be directed on to enemy targets from zero hour right down to and including the main counter-attack.

5. Forward and Rear Guns.

Hitherto the term mobile gun has been applied to guns detailed for consolidation because they have to go forward before they

can consolidate, and the arrangements for their move are almost the most important part of their work, but it would be a mistake to suppose that forward or mobile guns are in any sense peculiarly appropriate to mobile warfare. The contrary is the case. These guns are only intended to come into action when a position has been won and the fighting is momentarily stationary. While they are fulfilling their normal rôle they are not helping to cover the infantry advance. Moreover, inasmuch as when the infantry are moving, the guns also are moving at some distance behind, they are apt to be caught at a tactical disadvantage if they are hurried up into action suddenly. It is therefore to be anticipated that just as the stationary barrage guns cover the advance in warfare against highly organized defences when the total move is a small one, so some form of barrage guns of the nature of mobile batteries will be required to follow up and support by overhead fire the several successive stages of a more or less continuous advance. It is therefore possible that more instruction will be obtained from a study of the arrangements at the earlier fighting at Vimy and Messines than from the subsequent and perhaps exceptional type of warfare now under consideration.

6. S.O.S. Barrage in Defense.

The report of the Division referred to on the operation of September 26th submits as the final tactical lesson, "The advisability of considering machine gun S.O.S. barrage a permanent portion of all defensive schemes, owing to the *rapidity* with which such machine guns can open fire." This is in accordance with the suggestion put forward in previous *résumés*. Central control, flexibility and rapidity of action are the three great desiderata of machine gun barrage fire, and the operations of the third battle of Ypres have supplied a most valuable training ground for the realization of these lessons in the most trying conditions.

7. Lessons.

The principal lessons to be learnt from the operations under review may be summarized as follows:—

(*a*) The Germans are undoubtedly very much impressed by the effectiveness of our present methods of employing Machine

Guns, and we may expect a gradual development on similar lines in the German army.

The normal German establishment is now:—

Light Machine Guns: 2-3 per infantry company. (72-108 per division.)

Heavy Machine Guns: 8-12 per battalion machine gun company. (72-108 per division.)

The minimum figure is probably normal for divisions in quiet sectors of the front, the maximum being reached in active sectors.

The average number per division is:—

90 light Machine Guns
90 heavy " "

Total 180

There are also about 90 independent machine gun "marksman" detachments (each of 3 companies), which are G.H.Q. troops and are allotted as required to particular sectors of the front. These companies are similar in establishment to the battalion machine gun companies. Any development of scientific machine gunnery by the enemy, therefore, is deserving of the most serious consideration and can only be met by still further scientific development on our part.

The development of rapidly produced barrage fire by organized machine gun batteries will be an essential feature of any successful effort at pushing forward under conditions of open warfare to exploit an initial success, when adequate field artillery support is lacking.

For this reason, it must be realized that the development of scientific machine gunnery is as important from an open or semi-open warfare point of view, as it is from a trench warfare point of view, and this should be very carefully considered in the winter training of all machine gun companies.

(*b*) There is still a tendency to push forward too many forward guns into the forward portions of the positions to be consolidated.

(*c*) The fact that the forward guns should work on as carefully a thought out plan, and be given as definite orders, as the rear guns, still wants further emphasizing.

(*d*) Forward guns should seldom be definitely attached to

infantry battalions; they should have definite orders as to routes, positions, etc., and be directly under the brigade to which they have been allotted. The Machine Gun Commander at Brigade Headquarters should also be the channel of communication between the Brigade Commander and the forward guns.

(*e*) The great importance of an efficient Machine Gun S.O.S. Barrage has again been brought out, and the necessity of the Machine Gun Barrage being "flexible" and easy of control has been demonstrated on many occasions.

(*f*) There still appears a tendency in some divisions to use machine guns for work that is essentially the rôle of riflemen or Lewis guns, namely, to deal with snipers, infiltration, and early small local counter-attacks.

The tendency is dangerous insomuch as it weakens the machine gun defense in depth against the larger counter-attacks which develop later.

NOTE.—It is clear that the terms "Mobile Guns" and "Barrage Guns" hitherto used are misleading. It has therefore been decided to adopt the following:—

Forward Guns, that is, the guns allotted to infantry brigades to go forward in support of the attacking battalions and carry out consolidation in depth of the ground won.

Rear Guns, that is, the guns which supply barrage and other forms of covering fire from positions in rear.

THE BRITISH MACHINE GUN TRAINING CENTER.

(Report of an American Observer.)

When on April 20, 1915, I visited the Machine Gun School at the front, its Commanding Officer, Major B. stated that he had recommended the organization of all the machine guns of a brigade into a single company, to be attached to Brigade Headquarters. As a result of efforts along this line by officers expert in the matter of machine gun work and the necessities of its service, a machine gun corps has been organized in three branches—cavalry of the line, infantry of the line, and the motor machine gun service.

The training center of the machine gun corps, except as regards the motor machine gun service, has been estab-

lished at ———, in ———. It is commanded by Colonel (temporary Brigadier-General) H., C. B. He has a staff of eleven officers (one of these being at present a vacancy), ranging from the grade of Lieutenant to that of Lieutenant-Colonel, and consisting of two Assistant Commanders, two General Staff officers, one Deputy Adjutant and Quartermaster-General, a "Major," an Adjutant, an Assistant Adjutant, a Quartermaster, an Assistant Quartermaster, and an Instructor. This "Centre" at ——— consists of three branches or departments—the machine gun companies in process of organization and training, the machine gun depot companies, and the machine gun school. The staff of the school itself consists of 16 instructors, 22 assistant instructors, and a large and varying number of attached officers of all grades. The diagram shown in Appendix No. 1, which was drawn up for me by the senior Instructor of the school, Major C., will show the general outline of the administration of the Centre as a whole. The entire force on duty at the Centre at the present time consists of 1,830 officers and 12,500 enlisted men.

Colonel J. told me that at first they had some difficulty in impressing on unit commanders and commanding officers of training camps the importance of sending to them only the fittest men. They are gradually educating the service at large to correct ideas in this respect by promptly returning as unfit a great deal of the personnel sent to them. He said that in one case they sent back to a single unit 87 men of a draft of 130 from that unit. This raised a considerable stir and he was called upon for an explanation.

HEADQUARTERS,

9th March, 1916.

The depot companies and the machine gun companies are all under the charge of a Chief Supervising Officer with the rank of Major, who has several assistant supervising officers to direct the work. The new Field Service Manual, including the War Establishment for a machine gun company, has just been gotten out provisionally for the use of the training center at ——— and a copy of it was given to me. It has

already been changed to some extent as it shows a machine gun company with a strength of 150 while it is now in fact 153, as it includes an extra officer with the rank of Captain as second in command, one saddler, and one officer's servant. It is said by all here that the machine gun company is not nearly large enough, that it should contain at least 200 men, and that in the Guards Division which is able to regulate its own affairs to a much greater extent than can be done in other parts of the army they have already realized this and have taken ordinary infantrymen from the ranks and increased their machine gun companies to 250, a company in one case having reached 270. They are urgently impressing on the War Office the necessity for a larger number. As the organization stands now there is one machine gun company for each brigade attached to Brigade Headquarters and in no sense dependent on the individual battalions. This company has four sections with a total of 16 Vickers guns. There are in addition 32 Lewis guns with the battalions, eight to each battalion. (After I had returned from ——— Colonel L——— told me that he has understood there are but 16 Lewis guns to the brigade, while a wounded officer just back from the front told me that they aim to have one for each platoon which would give 64 to the brigade. The figures given me at ——— must of course be correct but it is probable that we are in a transition period in this respect.) There are thus three machine gun companies to a division, but Major L——— impressed upon me the serious error of having but three of these and having them attached to brigades. He says there should be five, giving a Division 80 Vickers guns, and that the organization should be completely divisional so that no Brigade Commander could interfere with the proper disposition of the guns of a divisional front by the claim that certain guns belong to him. As things are now he can and does.

Speaking to me most impressively Major L———, who is completely wrapped up in his work. seemed to be intensely desirous of hammering into me and through me into our service certain facts that he regards as basic. I noticed that he dwelt on much the same line in his lecture that I attended afterwards, and also in the notes which he sent me at my request and which form a sort of pamphlet that he

has prepared for the use of the school. There will therefore be some repetition in this respect. In our first conversation he said: "Organization is everything. Fire power is the one thing to be attained and the only thing that counts. In battle as a rule a man can command only himself or at the best he is very lucky if he can manage to control one man in addition. For that reason plans must be so thoroughly laid and so perfectly communicated in advance that all will follow out the plan and the result of the combined efforts of self-commanded individuals will thus in the long run be practically the same as if a real command had actually been exercised. The essential elements of a defensive line consist of a depth of wire and a front of machine guns. The machine gun with its personnel is no longer an auxiliary appanage of infantry and cavalry but is an arm of the service superior in fire power to any arm except artillery. A brigade is too small a unit to occupy a defensive front. A unit sector for defensive purposes must be occupied by at least a division. The infantry of a Division must be free for maneuvering and must not be held down to defensive fronts. To this end the machine gun corps of the division must be capable together with a small infantry support and a detachment of bombers detailed to it, of holding the defensive line while the main body of the infantry is left free to carry out the larger plan. In such a front there will obviously be certain places which will require a large number of guns and other places where guns would simply be wasted. For this reason the control must be central and divisional so that it can be exercised with a single view to the interests of the front taken as a whole The Machine Gun Commander should have the grade of Lieutenant-Colonel because the infantry units composing the division are battalions commanded by Lieutenant-Colonels. Controlling the entire sector he will place all of his guns according to the real demands of the situation as he sees it, and in such a way that they will afford mutual support. Otherwise, and as things now are, there is almost bound to be a diversity of plans on the part of the different brigades, each occupied with the apparent needs of its immediate front. The plan should provide for a number of curtains of fire, say, three, echelonned in such a way that every blade of grass in the whole sector will be covered, and all should

be in such complete readiness that at a simple signal from the commander these curtains of fire may be turned loose instantly over the entire sector. Communicating trenches will of course be arranged through the barbed wire so that infantry can move about at will according to the provisions of the higher plan."

Captain M———, one of the assistants to the Chief Supervising Officer, took me through the work of his office. He explained that each depot company takes care of six machine gun companies as to drafts, and here again it was pointed out by all of the officers with whom I talked that this is far too much. What they hope to do is to increase the strength of the depot companies and make one, thus greatly augmented, take care of the division unit when that comes to be organized. There are 20 of these depot companies at ———, each consisting of 20 officers and 250 N. C. O.'s, and men. In addition to furnishing drafts to their six companies at the front they are also used to form the machine gun companies here. As has been seen the Receiving Board may and frequently does send to the individual companies special men asked for daily, but as a rule recruits as received are assigned to the various depot companies and from these from time to time machine gun companies are made up as required. These machine gun companies are organized in groups of 12 each under an Assistant Supervising Officer. There must always be three of these groups of 12, the first consisting of companies almost ready to go to the front, the second of companies that are mobilizing, that is, under instruction and obtaining the necessary equipment but having already been completely formed as to personnel, and the third of companies that are in the process of forming from the depot companies as a matrix. There are just at present five of these groups. The number varies naturally according to the inflow of recruits. Major C——— told me that they are organized, equipped, and munitioned at ——— to turn out one of these 12 company groups to the front every week but that this is not actually done because they cannot get the men fast enough. He expressed great regret that having worked the system up to such a point they are so hampered by the slow recruiting.

The men are instructed first in the depots and afterwards

in the machine gun companies under the direction of officer graduates of the school. These officers spend a month as a rule instructing in the depots before they are posted to their companies which they then instruct for six weeks before leaving with them for the front. While the regulations do not at present provide for specializing the depot companies they have found it advisable to do so, and thus one depot is composed entirely of drivers, another of signallers, and others of gunners.

Each machine gun company when formed has 22 drivers. These have been given six weeks instruction in driving in the depot company before being posted. Their instruction is then continued in their company. Wherever possible drivers are specially selected from men who have had previous experience with horses. They must also be men of very good physique. They seem to make quite a specialty in this respect and to regard the selection and training of these drivers as a matter of very great importance.

Speaking generally as regards training Major L——— said that they do not have anywhere near enough time to give the proper training, but they go on the theory that it is better to send out a large number of partially trained units than to hold them back here for more detailed instruction while feeding the lines slowly with highly trained units. The idea is that once at the front they will learn very rapidly from actual experience in the trenches if they are given a good working basis to start with.

Captain M——— told me that during the first three weeks after the organization of a company the training is elementary, and that during this time the mobilization continues, the men being furnished their equipment, including guns and targets. During the third or the fourth week they get their mules and horses. The latter half of the course is devoted principally to target practice at the longer ranges and to such tactical instruction as can be given them in the short time at their disposal. He regrets that they have not eight weeks instead of six, in which case they could devote more time to tactical instruction. But as it is, they feel that they ought not to take too much time for this sort of work, in view of the present conditions of trench warfare. In other

words, as something has to be sacrificed, they think it best to let the loss fall on the tactical side. With the exception of the drivers, the minimum of instruction for men in depot companies is two weeks. The theory is that if drafts are sent out with but two weeks' instruction, the companies at the front can absorb these small numbers without danger and can continue their instruction there, while on the other hand an entire company formed here from the depots and sent out as a whole would be fatally handicapped if dependent on so short a course.

The matter of administration is carefully differentiated from training. A large number of "dug-outs"—old retired officers—have been attached, and it has been found that the proper use to make of these is in the administration work, and that while, on the one hand, these officers must keep their hands off of training, which is along lines that they were never familiar with in their service of a former day, on the other hand the officers engaged in the actual training must be relieved absolutely of the burden of administration. They find that this works very well. All the paper work, mess management, care of barracks, inspections, except such as are involved in the instruction, etc., etc., are taken care of exclusively by these dug-outs, while the younger officers trained for this purpose are given complete control of the instruction, regardless of rank. This goes even as far as the General commanding the Centre. At first there was considerable embarrassment in the matter, but they finally hit on the scheme of regarding the Director of the training of the whole camp, Major L———, and the Chief Instructor of the school, Major C———, as staff officers of the Commanding General, and as such charged with the exclusive control, nominally under him, of their respective departments, in which he allows them respectively an absolutely free hand.

The Machine Gun School.

The object of the school is to train officers in machine gun work with a view to their teaching their N. C. O.'s and men when posted to companies. The course of instruction lasts for five weeks, at the conclusion of which, and after a week's leave, the student officers are posted to companies

as Company, Section, or Sub-section Commanders, according to their efficiency and experience.

The standard of efficiency is gauged by:

(*a*) Result of a written examination held on completion of the course.

(*b*) Oral examination held during the course.

(*c*) Personal reports by the officers conducting courses.

(*d*) Note-books.

Officers who, at the completion of the course are not considered suitable to command a sub-section, but who have worked faithfully and shown the proper spirit, are retained in the school for a further course. If, on completion of this second course they are still considered inefficient, they are returned to their units as "Not likely to make M. G. Officers." Student officers who fail to take the proper interest are generally sent back to their units during the fourth week of the course. On an average about two per cent. fail to qualify. The standard of each officer completing a course is entered on his card, which is forwarded to the Chief Supervising Officer of the companies.

The instructional staff is composed of:

(*a*) Officers with war experience and considerable army experience generally, who are temporarily or permanently unfit for further active service.

(*b*) Officers selected from courses on recommendation of their instructors. Also a certain proportion of those who have been promoted from old regular army N. C. O.'s. Some of these have served as Staff Sergeants at Schools of Musketry.

(*c*) Staff Sergeants selected from regimental N. C. O.'s or reported on favorably by the "Examining Board." Some of these N. C. O.'s have previously been employed at Schools of Musketry.

In order to ensure a constant supply of officers to companies, student officers join the school in batches every two weeks. They are then allotted to courses and commence their five weeks' course of instruction. By this means the entire training staff of a course gets a clear week's break after finishing, and before commencing the next course allotted to it, while at the same time the continuity of supply is not interfered with. It is the general opinion at the school

that a course of seven weeks should be substituted for the present one. Each course is under one officer as Senior Instructor, with two assistant officer instructors, each of whom has charge of half the total number of student officers composing the course. He is therefore responsible for the instruction of his section, under the general supervision of the Senior Instructor of the course. The sections are divided into squads, the normal number in a squad being eight student officers, and each squad is under the direct instruction of an enlisted instructor. The number in a course must not exceed 100. If there are more than this to begin at any one time, they are formed into two or more courses. There are at present 900 officers under instruction. All instructors wear armlets to distinguish them, those of enlisted men being of a different combination of colors from those worn by officers. All officers and N. C. O.'s selected for the instructional staff undergo an additional five weeks' course under special instructors, after which they are attached as supernumerary instructors to courses until they are required to instruct. Major C——— said that the very best are the old army Non-Coms, but most of these are dead, so there are few left to draw from. Even those they have are men who have been wounded and rendered unfit for active service. Among officer instructors who have come from civil life the best are the actors. They seem to have the faculty of holding the attention and sounding the minds of their auditors which is naturally incidental to that profession. The next best are schoolmasters. Decentralization is the aim sought. Everyone is allowed to do his work in his own way as far as possible, but results are expected of him. An instructor who seems to be falling off in his work is warned once and then sent back to his unit (in this case, of course, machine gun unit is meant). The Major finds a difficulty here, because some are prone to let down on their work purposely in order to get to the front.

Asked as to text-books Major C——— said that of course the official manuals form the basis of all instruction, but that otherwise they get up their own courses and their own texts. I asked him if he could not make use of some of the publications on the market, and he said that one should be on

his guard in that respect; that these publications are made to sell, hastily written as a rule by some student officer of the school and almost certain to be inaccurate and misleading in many important particulars. The practice is frowned upon by the school and no recognition is given to any of these half-baked efforts.

There are twenty sets of equipment available, and two squads work each day of the first week in "Fitting equipment." The riding lectures are arranged for by the officer supervising the riding instruction. The hours for them are agreed upon between him and the officer conducting the course. In addition to these, riding instruction is given daily throughout the course from 7.00 to 8.00 a. m. As regards hours generally, the intention is to provide for an average of six hours per day for five days of the week and three hours on Saturday. In addition to this a great deal of studying has to be done. As will be observed from the above schedule the first three weeks are devoted principally to technical instruction and the last two to tactical. Courses are so arranged that in case of rainy weather indoor instruction replaces outdoor work automatically. Student officers have generally had from 5 to 7 months of ordinary infantry training. About 6 per cent. of them on an average have seen service in France or on other fronts. 187 Vickers guns are used in the school for instructional purposes. I saw several squads at work with Lewis, Hotchkiss, and Colt guns.

I was given the outlines of five of the lectures, these being among the most important of the course and dealing with the following subjects:—

The training of machine gunners.

The employment of machine guns in open fighting.

The occupation of various positions by machine guns.

Machine gun field works.

The employment of machine guns in trench warfare.

These are attached as Appendices Nos. 2 to 6, inclusive. They also gave me a number of sheets of "Lecture Notes" covering most of the lectures delivered in a course as shown in the above schedule. These are attached as Appendices Nos. 7 to 19, inclusive. They are issued out to the student officers to assist them in taking notes. As has been remarked they are graded on these notes. In connection with the practical work

they have a large room that they call the "Studio" where a number of artists, officers and men, who have been obtained from the Artists' Rifles are at work all the time getting up drawings and paintings which are lithographed and used in the course. They say that by using these drawings, especially colored ones, a much clearer idea can be quickly gathered by a student officer hitherto unfamiliar with mechanics than would be the case were he suddenly confronted at the outset with the parts of the gun themselves. And the artists are able to give a more life-like appearance to the sketches than they would have if prepared by an ordinary mechanical draughtsman. After this they are given a thorough course of instruction with the actual gun taken apart and I saw a lot of this going on, the sergeants being seated with their squads sitting grouped about them. This sort of work is done indoors and the lectures are also given indoors, the huts provided for that purpose being large and well-lighted.

In connection with the tactical lectures, diagrams of actual emplacements at various portions of the front are employed, and large reproductions of aeroplane photographs of various machine gun positions in France and Belgium are used for illustration. These reproductions have been made by the artists in the studio. On the lecture platform is a frame containing something like a score of these plates. It contains a system of pulleys so that any desired plate can be dropped down into view by the lecturer at any time as he goes along with his talk. Nothing is used to illustrate the instruction except actual positions, emplacements, etc., on the lines at the front. In other words no pure theory is made use of whatsoever. In some cases the instructor will call attention to an apparently faulty position of the guns as shown in one of these plates and will say "It would seem that this position should have been so and so, but as a matter of fact this is the way it was."

I was given a number of these plates, and notes on various operations, and I attach them as Appendices Nos. 20 and 34 inclusive.

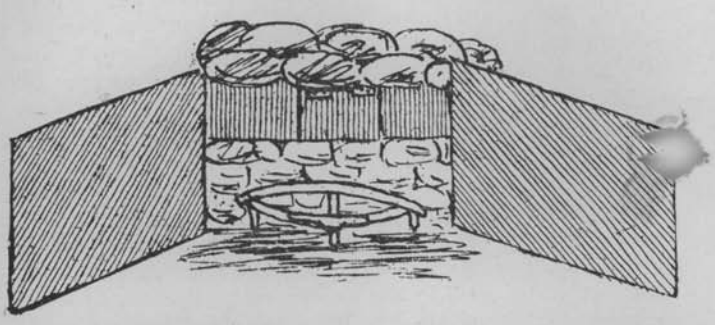
Captain M———, the officer in charge of practical trench work, took me over his training grounds. Here he has nearly a mile of works constructed and to these he adds from time to time as new types are developed at the front regarding which he is all the time receiving information from his graduates who make

it a point to keep in touch with the school. They report in full and promptly all details which come under their observation and which may be of value in keeping the training up to date. The importance of this is impressed upon them during the course.

Captain M———'s training ground serves a double purpose. Besides the instructional use to which it is put for the benefit of the school, the actual work on it is done by the machine gun companies which in this way are trained for the work they will have to do at the front. To begin with all men are given one hour in building sand-bag parapets. At the end of this time they have become sufficiently proficient. They are taught how to lay the rows in alternate headers and stretchers breaking joints and also how to slope them back to the required degree of slope. These parapets where they are built on the plan generally employed at ———, that is, having the solid ground as a step, are nine feet thick at the base and six feet at the top, and they are raised to four feet six inches above the ground. About one and one-half feet back from the parapet a shallow trench is dug. In some places the step is made of sand-bags and is one foot six inches high. The bottom layer of sand-bags is then laid ten feet thick. The working parties are divided up into sections and each section does all the work in connection with a certain sector of the line. If any sector has different features from others all the men are shown this part of the work so they will get some idea of it.

Particular attention is paid to the construction of loopholes [illegible] to their location. All are made with the idea of giving flank fire and cross-fire as this is regarded as the A B C of the instruction. All the loop-holes that I saw were very carefully blinded. This is sometimes done by means of a board covered with poultry wire tacked on its outside face, the meshes of the wire being filled with moist earth of the same color as that of the work. This earth is held in place by the meshes but from the inside the men are able to see through very well as there are always little open spaces. At a very short distance there is no sign of a loop-hole. I noticed one very elaborate loop-hole consisting of a steel box flanked on the inside of the work by steel plates set up in the form of a wall. This had been constructed in a machine gun emplacement The box had a hinged lid on its inside face, the hinges being at the top so that it naturally hung

down when not in use, thus closing the loop-hole. When firing was to commence the lid was raised. The outside face of the box was removed altogether and during the day the space was filled in by two full sand-bags, thus completely blinding it. As this face was flush with the outside of the parapet the sand-bags seemed no different from all the others. Between the hinges and the top of the dug-out in which this emplacement was constructed were simple rows of sand-bags. Captain M——— said that steel plates should have been put there as well. The plates were ¼ in. thick. They will not stop bullets of themselves but when the bullet has passed through one or two sand-bags it is said to be sufficient protection as it will not then penetrate the steel. Captain M——— remarked that they have received many complaints from the front about American steel. He says that a great deal of it is bad and that now they always use two plates of American steel laid side by side in lieu of one plate of their own. He thinks that one cause of the trouble probably is that this steel has not been tested against German bullets which he says have a very high penetration, but they have been satisfied with it when tested against some other projectile.

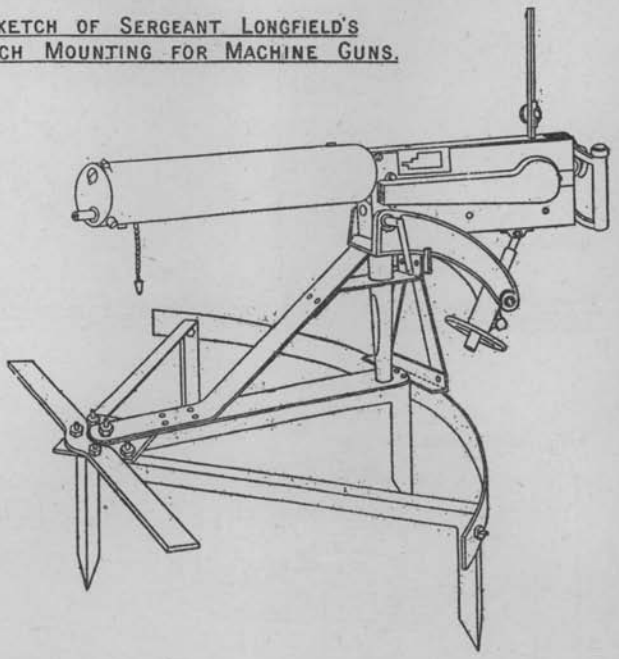


It was in this loop-hole that I first saw the muzzle pivot device. I had been told at ———, on the occasion of our visit there, of a new scheme for traversing a machine gun at the breech by pivoting it at the muzzle, thus enabling the gunner to have better protection by firing through a loop-hole splaying inward instead of outward. Major C——— gave me a set of drawings showing this method of trench mounting invented by Sergeant Longfield.

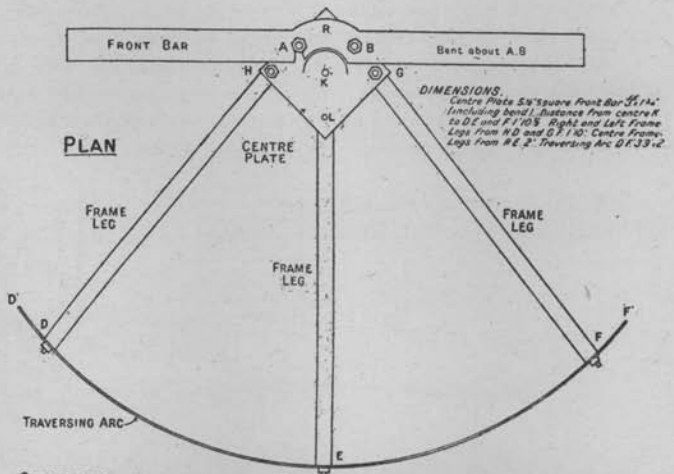
Plates showing the Longfield mounting are reproduced herewith. The gun that I saw thus mounted was made of wood but was an exact model of the Vickers gun to all outward appearance. They use these dummy guns in the emplacements wherever it is desirable to leave them in position all the time. They are just as good for instructional purposes and it saves the real ones.

Opposite the main works in this training ground they have

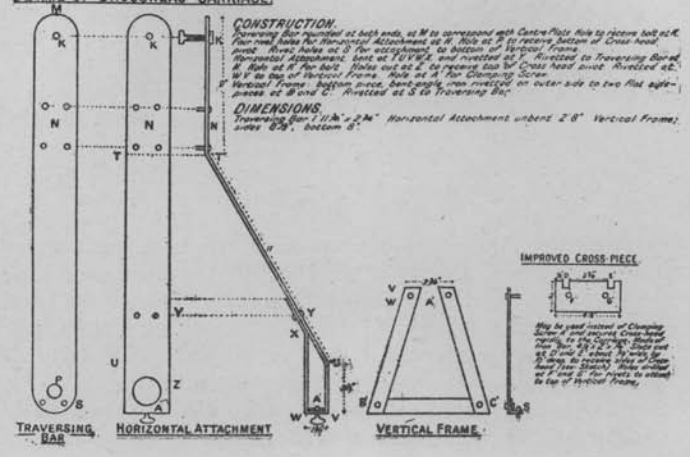
SKETCH OF SERGEANT LONGFIELD'S TRENCH MOUNTING FOR MACHINE GUNS.

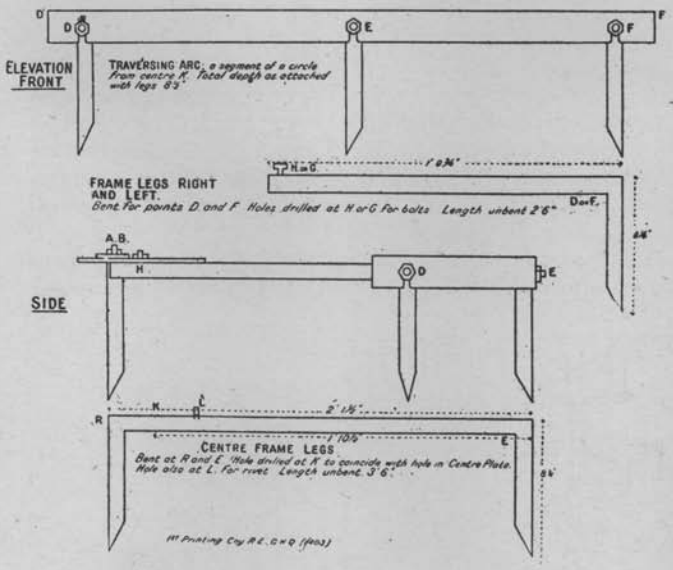


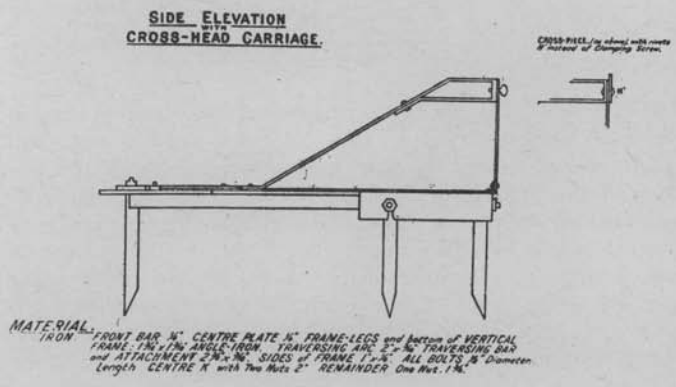
constructed a line of simple works to represent the German defences. These are about as close to the main works or British line as are the German works at many points of the front as we saw them last year. In this way the men get a more realistic idea than they would if they were limited to a study of their own works only. One part of the British line is in the form of a pronounced salient and back of it is a moderately straight line of trench acting as a sort of chord to the arc



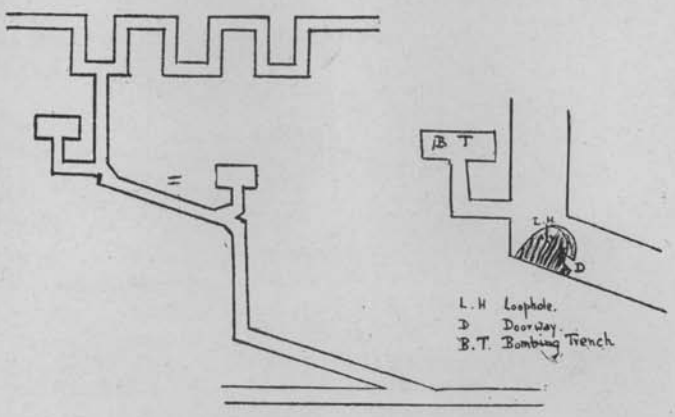
DETAIL OF CROSSHEAD CARRIAGE.




D
D
E
F
F
ELEVATION
FRONT
TRAVERSING ARC. a segment of a circle
From centre K. Total length as attached
with legs 8'3"
H or G
1'0¾"
FRAME LEGS RIGHT
AND LEFT.
Bent for points D and F Holes drilled at H or G for bolts Length unbent 2'6"
Dor F.
6¾"
A B.
H
SIDE
D
E
K
C
2' 1¾"
R
1' 10⅛
E
CENTRE FRAME LEGS
Bent at R and E Hole drilled at K to coincide with hole in Centre Plate.
Hole also at L. For rivet Length unbent. 3'6".
8¼"
H.M. Printing Cty R.E. C=O (1903)


SIDE ELEVATION
WITH
CROSS-HEAD CARRIAGE.
CROSS-PIECE, (as shown) with rivets
H instead of Clamping Screws.
H
MATERIAL
IRON
FRONT BAR ¾" CENTRE PLATE ½" FRAME-LEGS and bottom of VERTICAL
FRAME 2½"x 2½" ANGLE-IRON TRAVERSING ARC 2" x ½" TRAVERSING BAR
and ATTACHMENT 2¾" x ½" SIDES of FRAME 1"x ¼" ALL BOLTS ⅜" Diameter
Length CENTRE K with Two Nuts 2" REMAINDER One Nut. 1¼.

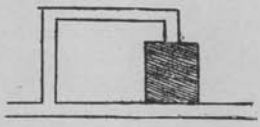
formed by the salient. This they called a "switch." It is about 60 yards behind the main work at the widest point of the sector and is connected to the salient trench by a number of communicating trenches. The idea is that if the salient is taken the switch may be held and will form a rallying point for the defenders of the line. To this end it is necessary to equip the communicating trenches in such a way as to prevent the advance of the enemy's bombing parties. Captain M——— said that there must be reaches in these communicating trenches offering at least 30 yards of a clear straight course. He has employed in some cases the "island traverse," but he does not like this method so well as what he calls "caponiers." The following diagram will show how they construct them at ———:



The trouble with the island traverse is that it can be bombed from all sides while the caponier has much more natural earth protection. These caponiers are located at every change of direction of the communicating trench and at the same point a T-shaped bombing trench is run out, as machine guns must always have bombers for their protection. They are then placed in the T while the machine gun covers the straight reach of the communicating trench from its emplacement in the caponier. The enemy is unable to ascertain from exactly what point the bombs are coming and of course the range is accurately known to the

bomber protectors of the machine guns who have a great advantage in this respect over the enemy. I saw just off one of the communicating trenches a novel form of dug-out. A loop had been made consisting of a narrow trench leading from the back end of the dug-out around into the communicating trench some yards away, as shown in the diagram. The dug-out opened into the communicating trench in front and into the loop in rear. In this way two lines of escape were open and in case of a bombardment causing a cave-in and blocking one entrance the other might still be available. If the communicating trench were congested by a movement of troops the loop would offer a secondary passage for the personnel of the dug-out to escape for some little distance and await the passage of the troops.

Captain M——— called my attention to a dug-out, the roof of which instead of resting on upright posts, had been built on



cross-beams laid on the solid ground on each side. These beams had been originally placed some distance back from the open trench and it had been supposed that the solid ground would furnish a sufficient support but the weight of the roof had caused the ground to crumble little by little away from the opening until now the beams were almost flush with the open space and in a very short time would cave in. Captain M——— said that he kept this dug-out as an illustration of the way it should not be done. Upright posts are insisted on for all dug-outs. I was also told that emplacements should never be constructed without having a gun at hand as a model. When the gun is not so used some important feature is invariably overlooked and the emplacement is found to be useless for practical purposes. They showed me one that they had also left as a shocking example, in which, although the emplacement was beautifully constructed and finished, the traversing of the gun was rendered impossible by the earth projections. This was not apparent at all until the gun was actually placed.

At one point I noticed the blinding of a loop-hole in which the color of the bags used was slightly different from that of the others in its neighborhood and the presence of the loop-hole was thus betrayed. Captain M——— said that he had suggested using white and black bags in about equal numbers, indiscriminately placed, so that any little difference that might exist between colors would be overlooked in the general break-up of the color scheme.

The traverses in the infantry trenches were 12 feet wide and 10 feet deep from the rear of the traverse to the inside line of the parapet. The bays were made from 18 to 20 feet long and were intended to accommodate six men. Dug-outs are built at least six feet back from the fire trench, and should if practicable be nine feet back. Great difference of opinion exists as to the size of these dug-outs but they have arrived at a compromise verdict of 6 by 6 feet and 10 feet deep. This gives 7 feet cover because although the posts that support the bottom of the roof are 4 feet 6 inches high, 1 foot 6 inches of earth is added on top after the roof has been built flush with the ground. (It must be kept in mind that the dug-outs in question were in all cases behind parapets and not simply behind a trench whose top would be the original ground level.) The floors of the dug-outs were of concrete and in their construction the base timbers on which the uprights rest had been placed first, then the posts were set on top of these, and finally the concrete was set in. They insist on this as they say that if the posts alone, or if both the posts and the base timbers are laid on top of the concrete, the weight of the roof will cause the latter to crack.

Captain M——— remarked that the use of dug-outs in front line trenches is now confined practically to machine guns. The danger of their demolition and consequent annihilation of their occupants is now so great that infantry must be kept back at a safe distance. For this reason it is all the more necessary that the personnel of machine gun companies, especially the gunners, should be made up of men of the highest degree of courage. He said there has been considerable discussion as to the proper station of the lookout man. Some would place him during the bombardment in the emplacement itself, the rest of the crew occupying the dug-out. In such a position he would be able to see better what the enemy is doing and to give prompt notifica-

tion to the crew so that they may re-take their posts in the emplacement in time to operate with some chance of success against the enemy's advance. On the other hand he would be out of reach of his comrades and if killed they will know nothing of it and being unwarned of the enemy's rush both they and their guns are apt to be taken before a shot can be fired. Captain M——— inclines to the opinion, which he says is now coming to be the generally accepted one, that the look-out should be placed with a periscope at the mouth of the dug-out. He can then be seen by the others and if he falls he will be replaced. He will of course not see quite so well. But no one knows when the bombardment will end except the enemy, and as the charge will take place at once and will have to pass as a rule over a very short distance, it is a matter that must be arranged for and met without the loss of a moment. I asked why it would not be a good idea to furnish the lookout man with a wire or cord or something of that sort which he could pull every half minute or so to show that he was still on the job, but they replied that this would be impracticable as it would be almost sure to be injured in some way by the enemy's fire, it would be a menace lying along the trench line where it might trip up a man advancing rapidly and thus disorganize a column at a critical moment, and that anything at all complicated is never favored in the trenches. Captain M——— said that there would generally be five men to a gun and this would leave four in the dug-out which it would just comfortably accommodate.

I noticed a considerable amount of expanding wire used for revettments. They say they find this very good for parapets but it is no good for steps because it wears out very fast owing to the weight of men passing back and forth and climbing onto the steps. When using it on parapets the posts on which it is strung should lean in against the parapet at a slope of 4 on 1, and should not be more than two feet apart. If at a greater distance the wire will bulge outwards due to the weight of the parapet, and will cause the latter to crumble. This revettment is always anchored by a tight wire fastened to stakes driven into the parapet. No tourniquet is to be used as it damages the wire and causes it to rust rapidly. The stake is simply leaned forward, the wire tightly drawn, and the stake is then pulled back and driven in sloping backwards thus tightening the wire.

I saw one emplacement made of an ammunition box fastened on top of the parapet. A little round hole is bored in the top of the box for the pivot of the gun and heavy cleats are nailed round this hole to strengthen the point of support. In all emplacements are little boards on stakes driven into the ground and tacked on these are cards giving the standing orders for sentinels and gun team commander, together with the number of the gun position. At the bottom of these printed orders a space is left for special orders. (Appendix No. 35.)

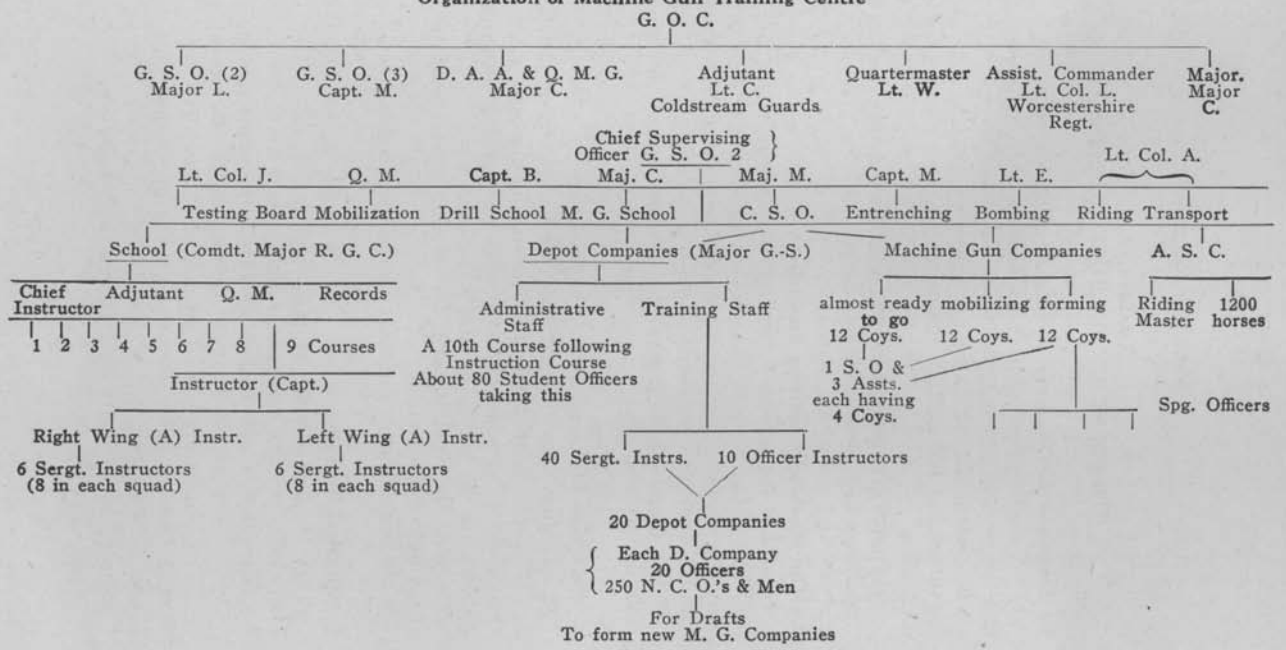
The trenches are drained by little gutters made of half sewer-pipe of pottery. They run down the middle of the trench and a slat-work walk is laid over them which they call a "duck-walk." They say the proper width for this walk in a communication trench is two feet and in fire trenches 1 foot 6 inches.

Captain M——— told me that all loop-holes for Vickers guns must be 9 inches high. The width of the loop-hole should be from 1 foot to 1 foot 6 inches on the inside and from 2 feet to 2 feet 6 inches on the outside, except of course where the trench mounting is used in which case the loop-hole may be very small and splay inward. Sometimes a larger traverse is necessary in cases where there are but few guns and each has a bigger belt to cover. 'Here the outside measurement might even reach almost three feet. Where the emplacement is roofed over there must be two feet clear from the bottom of the loop-hole to the bottom of the roof for the Vickers gun in order that the rear cover may be lifted. Major C——— told me that he saw one such emplacement near ——— where the rear sights could not be raised. They had constructed this emplacement with a view solely to close range fighting and never thought of the sights. Captain M——— remarked that elbow rests have now disappeared altogether their fault being that men are thrown too far back from the protesting wall of the parapet.

Major C——— pointed to a crest against the sky-line about half a mile back of the works and said that there had been quite a discussion as to the proper position of a redoubt or rallying point that they were going to construct. One of the officers had insisted on placing it on this crest. The Major wanted to put it somewhere where it could be sure of concealment from aeroplanes, and said that of four such redoubts that he had seen in France one was in an orchard, two were in woods, and only one was at all open and exposed to aeroplane reconnaissance.

APPENDIX No. 1

Organization of Machine Gun Training Centre



Appendix No. 2.

Lecture.
TRAINING OF MACHINE GUNNERS.

1. Standard of Training Required.

To obtain the best results from machine guns, it is necessary that the personnel should be highly trained.

The officers and N.C.O.'s must have a thorough knowledge of the theoretical and tactical side of their work, as well as of the mechanical.

They must study the theory of machine gun fire, and of the trajectories of bullets at various ranges.

2. The Machine Gunner a Specialist.

To obtain the standard required, the Machine Gun Officer, N.C.O., or Man must be a specialist; he should seldom be required to perform any duty that is not immediately connected with his work as a Machine Gunner.

If this is not borne in mind good results cannot be obtained from the machine guns.

3. Selection of Personnel.

In selecting men for machine gun work, great attention should be paid to intelligence, education, and physique.

Running or crawling from position to position, carrying a machine gun or tripod, is most exhausting work.

Therefore physical strength and staying power generally are of the utmost importance.

A mechanical turn of mind is also of great value.

4. Physical Training.

Every Machine Gunner should—

(*a*) Do physical exercises, running, etc.

(*b*) Practice Drill with gun. This is to include running and crawling with gun over all kinds of ground and mounting it in all manner of positions.

(*c*) Have training in carrying guns and tripods for long distances.

Some of the above should be practiced every day.

5. Fire Control.

Too much attention cannot be paid to a thorough training of all ranks in:—

(*a*) Visual Training.
(*b*) Judging Distance.
(*c*) Indication and Recognition of Targets.
(*d*) Fire Orders.
(*e*) Passing of Orders.

The methods of indication and recognition, and fire orders, that were taught in peace, have been found of great value during the war.

It has been found that training in these subjects is of value for the purpose of indicating targets and giving fire orders.

In addition, they quicken the soldier's intelligence, powers of observation, and eye for ground.

They impress upon him the fact that *it is his duty to make certain* that all orders passed down are received and understood by those for whom they are intended.

A thorough training in fire orders forms a basis on which to build up any other method of control that may be found necessary in any particular circumstances.

6. Training.

Every number must be trained in such a manner that he can take the place of any member of the team.

In addition to mechanical training and range work great attention must be paid to.

(*a*) *Elementary Drill*—Including tests of Elementary Training.
(*b*) *Advanced Drill*—Including carrying and dragging gun and tripod, and creeping and crawling with them over all manner of ground.
(*c*) *Occupation of Positions*—Including moving to and from them without being seen.
(*d*) *Tactical Training.*
(*e*) *Training with other Troops.*

7. Tactical Training.

(*i*) *Reconnaissance and Study of Ground*—Reconnaissance is of two kinds:—

(*a*) Actually going over the ground.

(*b*) Studying the ground with glasses, etc., without actually going over it.

The second of these methods is the most common. Therefore, training in the study of ground, selection of fire positions, lines of advance and retreat, etc., must be constant and thorough.

All ranks, but officers and N.C.O.'s especially, should practice crawling forward to some point, and then selecting fire positions, lines of advance, etc., in advance of that point.

They should then go forward and see if their selection has been correct.

The teams should then be ordered to bring up the guns, and occupy the positions chosen, the officers placing themselves so that they can observe and criticise the actions of the various numbers.

(*ii*) Instruction and constant practice should be given in:—

(*a*) *Selection of Gun Positions*—In selecting gun positions, the officer should note the following:—

(*i*) The actual position of a gun should be chosen in the lying position.

The person selecting the position should then raise himself on his elbows until his eyes are on the same level as those of the No. 1 will be when firing the gun.

(*ii*) Select a position from which he can command his guns.

(*iii*) The Range Taker should accompany the officer, but he must not press too closely upon him, as two men are more likely to be seen by the enemy than one.

(*b*) *The Selection of Alternative positions*—This should always be done:—

(*i*) An alternative position must be capable of being reached under cover from the first position.

(*ii*) It must be far enough from the first position to avoid the effect of shells fired at that position.

(*c*) *Duties of the Range Taker*—The Range Taker should immediately make a range card.

If no time is available for this, he should quickly note the ranges of suitable objects and give them to the officer.

(*d*) *Methods of bringing up the Guns*—

(*i*) When the officer has selected the gun positions, the Sergeant should join him.

(*ii*) The officer then informs the Sergeant of the exact position for each gun, targets, ranges, methods of bringing up the guns, etc.

(*iii*) The Sergeant signals up the guns—

On being joined by No. 1 (with tripod) he:—

(*a*) Indicates the position for each gun.

(*b*) Gives all instructions possible (*under cover*).

(*c*) Orders them to their respective positions.

(*e*) *Position and Movements of Limbered Wagons*—

(*i*) Limbers should approach as close to the gun positions as is possible, having due regard to cover, etc.

(*ii*) On receipt of the signal "action" from the Sergeant, the Corporal superintends the unpacking of the limbered wagons, ensuring that the Mk. iv. tripod goes first, if required. the gun second, followed by ammunition, spare parts, and condenser.

(*iii*) The guns having gone forward, the Corporal moves the limbered wagon to a suitable covered position, if possible out of the direct line of fire.

(*f*) *Duties of N.C.O. in Charge of Limbers*—It should not usually be necessary to give any special orders to this N.C.O., as he should be very carefully trained in carrying out his duties, and using his own initiative as to the selection of positions for the limbers, etc.

The great importance of keeping in touch with the sections in action, of noting any change in their posi-

tions, and notifying them of any change in his, should be impressed upon him.

(*g*) *Arrangements for Ammunition Supply*—

(*i*) It is inadvisable to have a great deal of ammunition with the guns, because in case of a retirement or sudden change of position it may be lost.

(*ii*) No. 3 should bring up two or three belts to the gun, taking care not to expose himself in doing so.

Any exposure on the part of men approaching the gun may give away its position.

He then returns to the limbers (or if it is far off he is met by No. 4) and makes a second journey to the gun with—

(*a*) Condenser.

(*b*) Water.

(*c*) Two more boxes of ammunition.

He then fetches more ammunition from limbers, or No. 4, and places himself in some covered position in rear, and to a flank of, the gun, where he can follow the course of the action.

He can establish a depot of ammunition if the situation renders this desirable, thus releasing No. 4 for duty with the wagon.

He is responsible that at least two boxes of ammunition are always at the gun, and that empty belts are returned to the limbered wagon.

He will work in conjunction with No. 4, with whom he is responsible that the supply of ammunition is maintained.

(*iii*) If the limbers are far from the guns, men should be obtained from the nearest unit to assist with the ammunition supply.

(*h*) *Arrangements for Water Supply*—Water supply must be arranged for.

(*i*) *Methods of Communication between Guns*—All methods of communication, *i. e.*, Orderlies, Visual Signalling, and Telephones, should be tried and practiced.

Fire Orders and indication and recognition of targets should be constantly practiced on the ground.

No movement of men between the guns must take place except under cover.

It must be remembered that any movement is very liable to give away the position.

All orders should be given in the lying position.

(*j*) *The Selection of Description Points*—These should at once be pointed out to gunners, so as to make indication and recognition of targets easier.

(*k*) *Targets*—Likely targets, that is to say, places that are likely to be occupied by the enemy, should be pointed out to the gunners, and all men should be asked to point out positions, that they consider the enemy would be likely to occupy.

This will teach them to recognize positions likely to be occupied by the enemy, and will therefore tend to greatly simplify the giving of fire orders, and the indication of targets.

(*l*) *Changes of Position*—Alternative positions having been selected, practice should be given in quickly withdrawing guns from one position, and mounting them in another, without the enemy being able to observe their actions.

(*m*) *Enemy's Machine Guns*—Practice in locating hidden machine guns should be given.

If a number of guns are working together, it is often advisable that a certain number of guns should be told off in pairs for the purpose of engaging those of the enemy.

(*n*) *Choice of Gun Positions*—The choice of a gun position must be governed by the following considerations:—

(*i*) Enfilade fire, against the enemy and against ourselves.

(*ii*) Overhead fire, to support our own troops.

(*iii*) Long range fire, against enemy's supports.

(*iv*) Fire against houses, etc.

(*v*) Fire against likely places for enemy's machine guns.

(*vi*) Concealment from enemy's artillery.

(*vii*) Alternative positions.
(*viii*) Lines of advance and retreat.
(*ix*) Covered approach for ammunition carriers, etc.
(*x*) Facilities for control of guns.
(*xi*) Avoid:—
(*a*) Obvious positions.
(*b*) Positions easy to describe, either from surroundings or maps.
(*c*) Positions easy to range upon, either from surroundings or maps.
(*d*) Positions near prominent objects or aiming points.
(*e*) Ground which will facilitate observation of fire by the enemy.

8. The Training of Machine Gun Teams in Combination with Other Troops.

(*a*) It is impossible to consider the training of machine gun teams to be complete unless they have been trained in combination with other troops.

(*b*) This should be done as soon as a thorough training has been given in:—
(*i*) The mechanical side of machine gun work.
(*ii*) Indication, recognition, and fire orders.
(*iii*) Firing on the range.
(*iv*) Occupation of positions of all kinds.
(*v*) The principles of the use of machine guns in action.

(*c*) During this final training, care should be taken that the teaching given in the previous training is brought out.

(*d*) The importance of physical training must not be lost sight of.

(*e*) The need for the close co-operation between guns at all times, even though they may be of different units, cannot be too greatly impressed. Unless this co-operation is insisted upon, the full value of the machine guns will never be obtained.

(*f*) The aspect of the various formations of other troops should be taught.

LECTURE NOTES.

1. Standard of Training.

Officers and N.C.O.'s—thorough knowledge of theory, tactics, and mechanism.

2. Keep Men to Their Own Special Work.

3. Selection of Personnel.

Select men for—

(*i*) Physical Strength.
(*ii*) Intelligence.
(*iii*) Mechanical Aptitude.

4. Physical Training.

(*i*) Physical Exercises.
(*ii*) Advanced Drill (running and crawling with the gun).
(*iii*) Carrying of gun for long distances.

5. To Facilitate Fire Control.

Teach—

(*i*) Visual Training.
(*ii*) Judging Distance.
(*iii*) Indication and Recognition of Targets.
(*iv*) Fire Orders.
(*v*) Passing of Orders.
(*vi*) Use of Telescope.

And so quicken intelligence and powers of observation.

6. Training of Gun Numbers.

(*i*) In all Duties.
(*ii*) Allowed to be No. 1 in turn.
(*iii*) Particular attention paid to—
- (*a*) Elementary Drill.
- (*b*) Advanced Drill.
- (*c*) Occupation of Positions.
- (*d*) Tactical Training.
- (*e*) Training with other Troops.

7. Tactical Training.

(*i*) *Reconnaissance of Ground*—

By—

(*a*) Going over it.

(*b*) By studying it with glasses.

Practice should be given in selecting gun positions, and officers should then watch and criticise the advance of the guns.

(*ii*) (*a*) *Selecting Gun Positions*—

(*i*) Choose position while lying down.

(*ii*) Note position to command guns.

(*iii*) Range Taker with officer but not pressing on him.

(*b*) *Selecting Alternative Positions*—

(*i*) Covered communication from first position.

(*ii*) Far enough from first position to avoid fire at that position.

(*c*) *Range Taker's Duties*—

(*i*) At once make a range card or give suitable ranging objects to the officer.

(*ii*) Use his instrument for observation.

(*d*) *Method of Bringing Up Guns*—

(*i*) Instructions given by officer to Sergeant.

(*ii*) Instructions given by Sergeant to gun numbers.

(*e*) *Position and Movements of Limbered Wagons*—

(*i*) As close as cover permits to gun positions.

(*ii*) Corporal ensures systematic unpacking.

(*iii*) Corporal generally moves wagon to a flank.

(*f*) *Duties of N.C.O. in Command of Limber*—

(*i*) Exact orders should be unnecessary as he must move on his own initiative.

(*ii*) He must keep touch at all times with the section.

(*g*) *Ammunition Supply*—

(*i*) Only a small quantity at the gun position.

(*ii*) No. 3, careful not to expose himself.

(*iii*) No. 4, must keep touch with No. 3 and also the wagon.

(*iv*) Men may be requisitioned from neighboring units for ammunition supply if necessary.

(*h*) *Water Supply*—
Arranged for

(*i*) *Communication*—
(*i*) Every method should be practiced.
(*ii*) No sign of movement entailed.
(*iii*) All orders given lying down.

(*j*) *Description Points*—
At once pointed out when gun is in action.

(*k*) *Targets*—
Practice in determining likely enemy positions given.

(*l*) *Changes of Position*—
Practice given, while officer criticises.

(*m*) *Enemy Machine Guns*—
Practice given in locating.

(*n*) *Choice of Positions.*
Governed by—
(*i*) Fire effect to be obtained.
(*ii*) Concealment.
(*iii*) Covered lines of supply.
(*iv*) Distance from obvious points.

8. Training with Other Troops.
(*a*) Must be done before training is complete
(*b*) Criticism of points in elementary work to continue.
(*c*) Formation of other troops taught.
(*d*) Co-operation closely studied.

Appendix No. 3.

Lecture.

THE EMPLOYMENT OF MACHINE GUNS IN OPEN FIGHTING.

1. General Principles.

It is essential that the general principles of the employment of machine guns should be carefully considered.

Unless this is done, it will be impossible to make the best use of these weapons.

These principles are exactly the same in either open fighting or trench warfare; but to obtain the best effects from machine guns on all occasions, both kinds of warfare must be studied.

2. Co-operation.

Co-operation between all machine guns taking part in any action is essential if the best results are to be obtained.

Not only must there be co-operation between the machine guns of any one brigade, but the Machine Gun Company Commanders of adjacent brigades must arrange for co-operation between the machine guns on the flanks of their brigades.

3.

The Machine Gun Officer must keep in touch with the situation; look for and make opportunities for the effective use of his machine guns.

The good Machine Gun Officer, by keeping himself in close touch with the situation and handling his machine guns with boldness and cunning, will make opportunities for their successful employment.

4. Justification for Opening Fire.

(*a*) *Effect likely to be produced on the enemy*—Although the general rule, that machine guns should not open fire unless a good target presents itself, still holds good, this must not be carried to extremes, otherwise opportunities of inflicting both moral and material damage may be lost.

It must be remembered that it is often impossible to see anything of the enemy.

Therefore likely positions for him to occupy must be looked for, and, if necessary, searched with fire.

The fire of well concealed machine guns may often be directed against:—

(*i*) Windows, doors, roofs, etc., of houses thought to be occupied.

(*ii*) Areas of bush, crops, etc.

(*iii*) Open spaces across which the enemy are dribbling in small parties in order to concentrate at another point.

(*iv*) The enemy's firing line.

(*b*) *Necessity*—It may happen that machine guns are forced to open fire to assist the advance of infantry in spite of the target offered not being a suitable one for the guns, or in self-defence.

NOTE.—Any tendency to open fire with machine guns without good reason must be suppressed.

5. Extended Lines of Infantry.

Great material effect will seldom be obtained on a target of this nature, and should be engaged with oblique or enfilade fire when possible.

This can usually be done by arranging for mutual support by cross fire between separated machine guns.

The advance of extended lines of infantry can, however, frequently be stopped by the frontal fire of machine guns.

6. As Few Men as Possible Should be Round the Gun.

Those not actually required to work the machine gun, should either be attending to the ammunition supply, or be kept under cover.

7. Escort.

Machine guns, in spite of their great fire power, are very vulnerable to the attack of riflemen who may stalk them on suitable ground, and pick off the gun members.

They should not be sent on a detached mission without being provided with a suitable escort.

If a Machine Gun Officer feels the necessity for protection of this kind he should apply to the nearest unit.

8. Movement.

When on the move with infantry, machine guns should mix with the infantry, and try and disguise their identity as much as possible.

This should be frequently practised, and every device for disguising the presence of machine guns should be tried.

Masks and gloves should always be worn in action to assist in concealment.

9.

Guns should be *"dug in"* whenever possible, in certain cases it may not be advisable, if the act of digging is likely to

give away an otherwise well concealed position. Machine guns well concealed in crops, scrub, folds in the ground, etc., will be far safer from the mere fact of their concealment, than a hastily "dug-in" machine gun that has been located.

To prevent surprise, or with a view to taking advantage of a fleeting opportunity, guns should be mounted on their tripods before digging is commenced.

10. Boldness.

Boldness of handling is a great factor of success with machine guns.

By boldness of handling, it is in no way intended to advocate the running of useless risks with machine guns, or of exposing them to almost certain destruction through lack of care in concealing them from the enemy.

The secret of success is surprise, which in the attack must be obtained by a carefully concealed advance.

This necessitates careful training in the use of ground, concealment, selection of positions, seizing of opportunities, and constant co-operation between machine guns.

If thorough training in these matters have been given, and the need for a well thought-out plan of operation between the guns allotted to any task has been kept in view, it should be possible to employ machine guns with great boldness, and without undue risk.

11. Machine Guns and Artillery.

Every effort must be made to prevent machine guns being located by artillery.

If machine guns are shelled they must either:—

(*a*) *Change their positions at once.*

This would be the usual proceeding. A movement of quite a short distance, say 50 yards, is quite sufficient in many cases; or

(*b*) *Cease Fire while Detachments take cover until the Shelling ceases.*

If this is done, the hostile artillery may think that the machine guns have been put out of action.

Good targets may then present themselves, and the guns may be able to reopen fire with good effect from the same position.

There have been several cases of machine guns firing against artillery with great success.

The following instances are quoted:—

(*i*) A section of machine gunners worked forward to a concealed position 900 yards from an enemy field battery in action. The section brought oblique fire to bear on the battery and completely silenced it.

(*ii*) A section took an enemy field battery in enfilade at 2,400 yards. The battery was firing at the time; the gunners fled from their guns, and the battery was silenced.

Attack.

1. It is generally of *little use* to *push forward* machine guns with the leading lines of infantry unless the ground is exceptionally favorable.

The progress of the infantry must therefore be carefully watched, with a view to pushing on a certain number of machine guns to closely support them whenever possible.

2. The usual methods of supporting an infantry attack are:—

(*i*) Fire from the flanks.

(*ii*) Overhead fire.

(*iii*) Long range searching fire.

(*iv*) Fire from a forward position.

3. Every opportunity for the use of overhead fire should be seized. All suitable ground, buildings, etc., that may enable this kind of fire to be used should be looked for.

4. Machine guns may often be usefully employed to *systematically search* all places, in the area of the attack, likely to be held by the enemy.

This searching fire has a bad moral effect on the troops subjected to it, and this assists the subsequent infantry advance.

5. It may often be possible to push forward machine guns where the ground is favorable, so that they can assist the advance of troops on their right and left.

Opportunities for this should be looked for. It is quite possible for machine guns thus employed to remain undetected although pushed well forward, if the preliminary reconnaissance is properly carried out.

6. The *enemy machine guns* are the weapons most likely to hold up an attack. Every effort should be made to *locate them* with telescopes, to concentrate the fire of machine guns on them, and *to indicate their position to the artillery.*

7. The Machine Gun Company Commander should be fully informed of the plan of operation at the earliest possible moment.

He will make his plans in consultation with the Brigadier.

8. The Machine Gun Company Commander will ascertain, as far as possible, the intended action of the Lewis guns.

9. The Machine Gun Company Commander, in conjunction with the Section Officers, must make detailed plans for the employment of the machine guns.

The Machine Gun Company Commander will:—

(*i*) By studying the ground and his map, make a careful reconnaissance of the position.

(*ii*) Issue definite orders to the Section Officers.

10. In this manner each machine gun, or group of machine guns, will have a definite task allotted to it.

Before the action commences all will thoroughly understand their duties.

11. It must be clearly understood by all officers that the machine guns have definite tasks allotted to them.

Also, that they are under the orders of the Machine Gun Company Commander, and are therefore not to be interfered with, or given orders by other officers.

12. The machine guns may be allotted as follows:—

(*a*) *Some to go Forward with the Attacking Infantry*—

(*i*) The number of machine guns to go forward will depend on the length of the front to be attacked, and the nature of the ground.

(*ii*) The time of their advance will be determined by the ground and the progress being made by the infantry.

(*iii*) They should conceal their identity as machine gun teams as much as possible by mixing with the infantry, and carrying their machine guns in the least conspicuous manner.

(*iv*) Lewis guns or machine guns fitted with light mountings should be employed for this work.

(*v*) The role of the guns will be to:—

(*a*) Help the infantry to gain fire superiority.

(*b*) Make good positions won.

(*c*) Pursue the enemy with fire.

(*d*) Repel counter-attacks.

(*e*) Cover a reorganization of the infantry.

(*f*) Cover a retirement.

NOTE.—When machine guns are advancing under shell fire, the areas being swept should be watched and avoided, and detours made if necessary.

(*b*) *Some to cover the Infantry Advance*—These machine guns will:—

(*i*) Provide covering fire for the infantry up to the last moment.

(*ii*) Search all ground likely to be held by the enemy, and over which he might counter-attack.

(*iii*) Sweep ground behind his trenches over which his reserves might advance.

(*iv*) When their role of covering fire is completed, they should automatically come again under the control of the Machine Gun Company Commander, who will issue further orders.

(*c*) *Some as Reserve in the hands of the Brigade Commander*—

(*i*) These should be retained as a real reserve and not be pushed too early into the fight.

(*ii*) From positions in rear they may be used to sweep the ground behind the enemy's front line, fire against counter attacks, etc., indirect fire with observation being employed if necessary.

NOTE.—If reserve machine guns have to be brought forward under fire, the gun teams must be well extended.

Advanced Guard.

1. The duties of an advanced guard make it necessary that great fire power should be available when required.

A large proportion of machine guns should therefore be allotted to advanced guards.

2. These machine guns should move well forward in the column, so that they may be able to get quickly into action.

3. The principal duties of machine guns with the advance guard are:—

(*a*) Assist in driving back enemy forces by rapid production of great fire power at any required point.

(*b*) Assist in holding any position gained until the arrival of the infantry.

(*c*) Cover the deployment of the main body by holding the enemy on a wide front.

4. Lewis guns should be employed with the van-guard, the machine guns being with the main guard.

Rear Guard.

1. As a rear guard will usually be required to hold positions with the minimum of men, a large proportion of machine guns should be allotted to them.

2. Experience of war has shown that well placed machine guns, only supported by a few infantry, will frequently hold up an advance for long periods.

3. In occupying a rear guard position with machine guns, the ordinary principles of the defence apply, but the following points should be specially noted:—

(*a*) Wide field of fire.

(*b*) Machine guns concealed in the least obvious places.

(*c*) Covered lines of retirement must be reconnoitered.

(*d*) Limbered wagons should be close up to facilitate a hasty retirement.

(*e*) Positions in rear chosen before the machine guns retire from their forward positions.

(*f*) A proportion of the machine guns should occupy the position in rear, before all the machine guns retire from forward position.

(*g*) Thus the retirement of the last gun can be covered. Pack transport is very useful.

Village Fighting.

1. As soon as the infantry have made good one edge of a village, machine guns will be brought up in close support.

They will then search windows, doorways, roofs, etc., likely to be held by the enemy.

2. Machine guns will be used to command cross-streets, etc., so as to guard against attack on the flanks or rear of the infantry.

3. Machine guns should be also posted on the edges of the villages to prevent flank attacks.

4. When possible machine guns should be pushed forward on the flanks, so as to command the exits of the village.

5. During village fighting every use should be made of windows, doors, etc., as machine gun positions.

NOTE.—For the more advanced work with the leading infantry, Lewis guns should be used in preference to machine guns.

Defence.

1. *Creation of a "Belt" of Machine Gun Fire—*

In placing machine guns to defend a position, the ideal would be to create a complete "belt" of machine gun fire across the front of the position to be defended.

2. The defence of entrenched positions is dealt with fully under trench warfare.

The principles being the same, both in open fighting and trench warfare, it is only necessary to deal shortly with this subject.

3. When occupying a position for defence, the following arrangements must be made:—

(*a*) All machine guns arranged under the direction of one officer, who must be thoroughly acquainted with the plan of operations.

(*b*) Machine guns placed so that the whole front to be defended is swept by cross-fire, and a "belt of fire" thus created.

(*c*) Machine guns placed to command covered approaches, and the ground where the enemy might concentrate prior to an attack.

(*d*) Some machine guns should be held in reserve. They may be used for long range fire from positions in rear, if required, and the ground is suitable.

(*e*) Lines of retreat and secondary positions must be arranged for.

(*f*) Positions of limbered wagons and supply of ammunition arranged.

(*g*) Intercommunication between Machine Gun Company Commander and his Section Officers, and between Section Officers and their machine guns arranged.

(*h*) Definite orders given to all machine gun officers.

(*i*) A general plan of action arranged, so that all can co-operate in the event of unforeseen circumstances.

4. Not only the position itself, but the ground in front, in rear, and on the flanks must be thoroughly reconnoitered.

5. In case of retirement some machine guns should be withdrawn first to the secondary position under cover of the remaining guns.

The retirement of the remaining guns being covered from the positions in rear.

6. Each machine gun team should know the line of retirement, and the positions of the guns on its right and left.

7. A range card should be made for each gun.

8. Guns should be concealed in the least obvious positions and as much cover as time permits provided for the teams.

9. The best positions for machine guns are not always the same by night and day.

It may often be necessary to move machine guns from the night to the day positions before daylight.

10. Arrangements for night firing should be made.

Lecture Notes.

EMPLOYMENT OF MACHINE GUNS IN OPEN FIGHTING.

1. General principle same in open fighting and in trench warfare.

2. Co-operation essential if best effect is to be obtained from machine gun fire—

(*a*) Between all guns taking part in any action.

(*b*) Between guns of neighboring forces.

3. The officer must keep in touch with situation, look for and make opportunities for the effective use of his guns.

4. *Justification for opening fire.*

(*a*) *Effect likely to be produced on enemy.*

General rule is only to fire when good target presents itself.

But moral and material effect may often be obtained by firing at—

1. Windows, doors, roofs, etc., of houses thought to be occupied.
2. Areas of bush, crops, etc.
3. Open spaces across which enemy are dribbling in small parties.
4. Enemy's firing line.
5. Enemy artillery.

(*b*) *Necessity.*

1. Assist advance of infantry, although target unsuitable for machine guns.
2. Self-defence.

NOTE.—Whenever fire is opened there must be some good reason for doing so.

5. *Extended Lines of Infantry.*
   (*a*) A bad machine gun target.
   (*b*) Oblique or enfilade fire if possible.
   (*c*) Arrange for cross-fire between guns.
6. *As few Men as possible round Gun.*
   (*a*) Only those required to work gun.
   (*b*) Others kept under cover.
7. *Escort.*
   (*a*) Machine guns entitled to escort.
   (*b*) Apply to nearest unit if required.
8. *Movement.*
   (*a*) Mix with infantry.
   (*b*) Disguise identity as much as possible.
   (*c*) Wear masks and gloves.
9. 1. Dig in when possible without giving away position.
   2. Mount gun first, so as to seize fleeting opportunity.
10. Boldness is necessary, but does not mean useless exposure of guns.
   (*a*) Good use of ground.
   (*b*) Good choice of fire positions.
   (*c*) Concealment.
   (*d*) Good tactical training.
   (*e*) Co-operation between guns.
11. *Machine Guns and Artillery.*

If shelled—

   (*a*) Move to an alternative position.
   (*b*) Cease fire till shelling ceases, so as to deceive the enemy.

Attack.

1. Avoidable losses will usually be incurred if M.G.'s are pushed forward with the leading lines of infantry; but close support must be aimed at.

2. *Attack may be supported by—*

(*i*) Fire from flanks.
(*ii*) Overhead fire.
(*iii*) Long range searching.
(*iv*) Fire from forward position.

3. Overhead fire often the only method of support, and opportunities specially to be sought after.

4. The moral effect of systematic searching will greatly assist subsequent infantry advance.

5. Careful reconnaissance may permit of guns being pushed forward to favorable positions undetected, if progress of infantry is carefully watched.

6. *Enemy Machine Guns—*

(*i*) Most likely weapons to hold up attack.
(*ii*) Efforts should be made to locate them, and point them out to artillery.

7-10. Best effect by machine guns produced by—

(*i*) M.G.C.C. being fully informed of plan of operations.
(*ii*) Complete arrangements made for their employment.
(*iii*) Careful reconnaissance.
(*iv*) Definite orders to every M.G.O.
(*v*) Definite task to each group of guns.

11. Interference by other officers with considered plan must be prevented.

12. Distribution of Guns.

(*a*) Some to go forward with the attacking infantry.
(*i*) Number of guns decided by length of front.
(*ii*) Time of advance decided by progress made.
(*iii*) *Duties to:—*
(*a*) Assist in gaining fire superiority.
(*b*) Pursue with fire.
(*c*) Make good positions won.
(*d*) Repel counter attacks.
(*e*) Cover retirement or reorganization.
Lewis guns or M.G.'s with light mounting used for this work.

(*b*) *Some to cover the Infantry Attack—*
Duties—
(*i*) Covering fire as long as safe.
(*ii*) Searching of ground held by enemy.
(*iii*) Sweep ground over which reserves might advance. Will come into reserve as soon as task is completed.
(*c*) *Some as Reserve—*
(*i*) Must not be pushed too early into an action.
(*ii*) Used for long range fire if necessary.

Advanced Guard.

1.
(*a*) Rapid production of large volume of fire will prevent A.G. being held up.
(*b*) A large proportion of machine guns allotted to A.G. for this purpose.
2. Position well to the front.
3. *Duties—*
(*i*) Application of fire at the required point.
(*ii*) Consolidation of any position.
(*iii*) Cover deployment of main body.

Rear Guard.

1. Wide field of fire.
2. Guns concealed in least obvious places.
3. Covered lines of retreat.
4. Limbers as close up as possible.
5. Selection of secondary positions.
6. Rear positions occupied by some guns before all leave forward positions.
7. Pack transport useful.
8. Co-operation between guns carefully arranged.

Village Fighting.

1. When one edge of the village has been made good, guns brought up in close support of infantry.
2. Machine guns used to command cross-streets, etc.
3. On edges of villages, to prevent flank attacks.
4. Guns will fire on windows, doors, roofs, and any other places likely to be occupied by the enemy.

5. If possible, pushed forward on flanks to command exits of village.

Defense.

1. Create, if possible, a "belt" of machine gun fire.
2. Subject fully dealt with in trench warfare.
3. *Arrangements*—
   (*a*) All guns under one command.
   (*b*) Cross fire on whole front.
   (*c*) Covering guns placed.
   (*d*) Reserve guns used for long range fire if suitable.
   (*e*) Lines of retreat and second position.
   (*f*) Intercommunication.
   (*g*) A general plan of action.
4. Careful reconnaissance of all ground.
5. Systematic retirement.
6. Lines of retirement and position of flank guns known.
7. Range card made for each gun.
8. As much cover as is possible constructed.
9. Night and day positions very often different.

Appendix No. 4.

Lecture.

THE OCCUPATION OF VARIOUS POSITIONS BY MACHINE GUNS.

The occupation of all positions is governed by:—.

(*a*) Effect likely to be obtained.
(*b*) Safety of the Detachment in Action.
(*c*) Line of Communication, and Ammunition Supply.
(*d*) Nature of the action.

1. Barricades.

(*a*) When barricading roads, bridges, streets, etc., the barricades should be made as strong as possible. Dummy barricades, apparently bullet proof, but really not so, can often be placed in front of the real one with advantage. This device may deceive the enemy as to the exact position of the barricade, and if he attempts to rush the dummy, he can be subjected to very heavy fire.

(*b*) The placing of machine guns on the barricade should be avoided, if equal effect can be obtained by placing them elsewhere in positions commanding the approaches to the barricade.

2. Banks.

The banks of rivers, canals, streams, etc., can be made good use of for gun positions, and for covered lines of advance or retreat.

They provide an entrenchment already made which can be rapidly improved.

The best use of banks is obtained when the front legs of the gun are dug well into the bank.

Even small banks on the edges of roads should not be neglected, as they afford cover which can be rapidly improved.

3. Crops.

Standing crops afford useful cover for machine guns, and provide concealed lines of advance, etc.

Care should be taken to avoid being seen entering the crops, and the edge from which it is intended to fire must not be too closely approached.

If the machine gun is obliged to remain far back in the crop, the field of view will naturally be restricted; but even should the No. 1 be unable to see his target, accurate fire can often be obtained by observation from a flank.

It may be necessary to raise the gun platform to obtain field of fire.

4. Ditches.

These can often be used to enable machine guns to be pushed forward so as to bring oblique or enfilade fire to bear on the enemy.

Care must be taken not to show above the banks of the ditch. A few men should be pushed along the ditch, on the exposed flank, as a protection against snipers, counter attacks, etc.

5. Folds in the Ground.

Use can be made of small folds in the ground for the concealment of machine guns. The machine gun should be placed

so as to enable the bullets to clear the crest, while being as little as possible exposed itself.

A great deal of practice is required in crawling into position and in judging exactly how far from the top of the fold to place the machine gun.

6. Haystacks.

These can be made use of as follows:—

(*a*) Hollow out *front* of haystack. No. 1 sits in this hollow with his back against the hay.

The loose hay is piled up in front of the machine gun.

(*b*) Cut out a place for the machine gun on the top of the haystack. If possible make a rough platform of boards. The gun then fires over the top of the ridge of the haystack.

(*c*) Place the machine gun behind the stack in such a manner that oblique or enfilade fire may be brought to bear on the enemy.

The gun is then entirely concealed from the front.

This is, as a rule, the best method of using a haystack.

NOTE.—Avoid single haystacks.

7. Hedges.

Can often be used as a covered approach, and as fire positions giving cover from view.

A few men should be placed along the hedge, on the exposed flank, for protection.

8. Houses (see Plate II).

Care must always be taken to arrange for a hasty retirement from any building, as if the presence of a machine gun is detected, artillery will be directed against it.

Houses may be used as follows:—

(*a*) Place the machine gun back from the window or door of a room, firing through an open window from which a few panes of glass have been removed.

(*b*) Remove a *few* tiles from the roof, and fire through the opening thus made.

(*c*) Should a house have two doors, or two windows directly behind one another, the machine gun may be

placed *in rear* of the house, and fire through these windows or doors.

(*d*) Place the machine gun *in rear* of the house so that enfilade fire can be brought to bear on the enemy.

(*e*) If the house possesses a cellar, the machine gun may be placed in the cellar, and a few bricks removed so as to enable the gun to fire from the ground level.

(*f*) In whatever position the machine gun is placed, some protection should, if possible, be provided for the numbers, such as an emplacement of sandbags, stones, bricks, etc.

(*g*) Isolated houses should usually be avoided.

NOTES.—When machine guns are mounted in buildings the cellars should be prepared as bomb proof shelters for the teams. A strong "dug-out" at the back of the house is often better than the cellar itself.

In occupying buildings of any kind care should be taken to see that they are bullet proof.

A large number of small houses, barns, etc., have mud or single brick walls which are not bullet proof.

9. Mounds of Earth, Roots, etc.

These may be used as follows:—

(*a*) Hollow out the mound from the rear, so that the machine gun can be fired from the hollowed out place, while being concealed from the front. Planks, sandbags, etc., can be used to support the earth.

(*b*) Fire over top of mound, using mound as a parapet.

(*c*) Place the machine gun behind the mound, using mound as cover from the front, while oblique or enfilade fire is brought to bear against the enemy.

10. Stacks of Wood.

The stack may be hollowed out from the rear, so that the machine gun can be placed inside the stack and fire to the front, while being perfectly concealed from view.

The position can be strengthened by using sandbags inside the stack; stacks of planks leaning against buildings may also be used.

11. Stooks of Corn.

Place the machine gun behind the stooks. It can then fire through to the front while being concealed from view.

12. Trees.

Trees when in leaf may be considered as possible machine gun positions. Trees with strong branches are necessary, and a platform for the machine gun must be built in the branches.

Positions in trees are usually dangerous, as the upper parts suffer severely from shrapnel fire, if they are subjected to it.

13. Woods.

Woods, especially when in leaf, are often most valuable for concealing the positions of machine guns.

Care must be taken that the machine guns are not placed too near the edge of the wood and that individual men do not expose themselves.

All communications between machine guns should be made in the wood well in rear of the guns.

Alternative positions should be selected, so that machine guns may be rapidly moved from one to another, if desired.

Lines of communication through the wood must be arranged, and lines of communication between the machine guns and limbers also thought out.

Rides and paths in the wood are the best places to arrange for communication, rallying, etc., during an advance or retirement. But care should be taken to avoid showing for too long in the ride itself.

Lecture Notes.

THE OCCUPATION OF VARIOUS POSITIONS BY MACHINE GUNS.

1. Barricades.

(*a*) Make strong.

(*b*) Avoid placing guns on barricade if equal fire effect is obtained from elsewhere.

2. Banks of Rivers, Canals, etc.

(*a*) Good gun positions.

(*b*) Covered lines of advance or retreat.

3. Crops.

(*a*) Good cover.
(*b*) Conceal advance or retirement.

4. Ditches.

(*a*) Guns pushed forward for oblique or enfilade fire.
(*b*) Do not show above banks.
(*c*) Picket on exposed flank.

5. Houses.

(*a*) Arrange for hasty retirement.
(*b*) Gun in back of room firing through window.
(*c*) Tiles removed from roof, fire through hole.
(*d*) In rear of house, fire right through.
(*e*) In rear of house, oblique fire to flanks.
(*f*) Fire from cellar, along ground level.
(*g*) Provide protection for gun numbers.

6. Folds in Ground.

(*a*) Gun placed behind fold.
(*b*) Bullets just clear crest.
(*c*) Much practice required.

7. Ground.

(*a*) Constant study required.
(*b*) Use every feature for concealment.

8. Hay Stacks.

(*a*) In front of stack.
(*b*) On top of stack.
(*c*) Behind stack.

9. Hedges.

(*a*) Covered approach.
(*b*) Position giving cover from view.
(*c*) Picket on exposed flank.

10. Mounds of Earth, Roots, etc.

(*a*) Hollow out from rear.
(*b*) Fire over top.
(*c*) Gun behind oblique fire to flanks.

11. Stacks of Wood.

(*a*) Hollow out from rear.
(*b*) Sandbags used to strengthen.
(*c*) Planks leaning against buildings also of use.

12. Stooks of Corn.

Gun behind, firing through.

13. Trees.

(*a*) Strong branches.
(*b*) Platform for gun.
(*c*) Oblique fire from behind trunk.

14. Towers, Windmills, and other High Buildings, useful for:

(*a*) Overhead fire.
(*b*) Directing fire of guns.

15. Woods.

(*a*) Not too near edge.
(*b*) Communication between guns, and with other troops, etc.
(*c*) Lines of retreat selected.

Appendix No. 5.

Lecture.

MACHINE GUN FIELD WORKS.

1.

The following notes are intended to assist machine gunners in siting and constructing machine gun works.

In a line of semi-permanent trenches, time, labor, and material available, as well as the concealment of machine guns will be the factors that will govern the construction of machine gun works.

When very elaborate work is required which necessitates expert engineering knowledge, advice and aid should be obtained from the Royal Engineers.

It must be remembered that the obstinate defence of the front trenches will often depend on the machine guns, and

that although the rifle garrison may sometimes be withdrawn during a bombardment to "shell slits," etc., machine gunners must remain at their posts. Therefore, machine gun sections, which have few men to spare to carry out all the work required, must be assisted by working parties, which are, if possible, detailed by the brigade.

As far as possible the construction of machine gun works *in all lines* should be supervised by a trained machine gun officer.

In open warfare there will usually be no time for elaborate works, therefore, concealment of machine guns will often be their best protection, but the following notes, which deal with semi-permanent trenches, may be applied on broad lines to include hasty field works.

2. Sequence of Work.

(*i*) Judging by the number of enemy emplacements that are known to us, it may be assumed that a certain number of our own are known to the enemy, and that these will receive particular attention from the enemy's artillery prior to his attack.

The general experience of the effect of intensive bombardments on front trenches, when well carried out, has been that large portions of the parapet have ceased to exist; and that unless machine gun emplacements in the parapet are made of concrete, or dug in at ground level, and covered by 15-inch beams which are strongly supported, they will be destroyed at the same time.

The destruction of some of these emplacements during a bombardment will, if the machine guns are mounted in them, mean the breakdown of the machine gun defense on some portions of the line, before the enemy infantry attack is launched.

(*ii*) A system of strong "dug-outs," in which the machine guns should be kept, except during the actual hours of darkness, should ensure that the majority of machine guns are available after an enemy bombardment.

These dug-outs must be well protected against artillery fire, and can be made behind the parados, where they will have the maximum protection against flat trajectory projectiles.

Further, the construction of "dug-outs" in the front line can proceed without interruption both by day and night; this is not always the case with emplacements.

Open emplacements, or S.A. Ammunition box mountings must be placed at frequent intervals along the parapet.

After the bombardment the machine gun will normally be mounted on the Mark IV. tripod in one of the former. If the Mark IV. tripod has been destroyed, or it is impossible to reach it, the Light Mounting should be used.

(*iii*) *Splinter-proof Look-out Posts.*

It is necessary to give ample protection to look-out men, who are detailed to give the signal for the mounting of the machine gun the moment the artillery cones lift. This is always a difficult matter to determine, unless the sentry is at his post.

(*iv*) *Splinter-proof Emplacements will be required under the following conditions:—*

(*a*) To support an attack.

(*b*) To meet an attack; giving protection from the enemy's covering fire.

(*c*) For protection against a bomb attack and small shells.

(*v*) *Emplacements at the end of a covered sap in front of our obstacles.*

In localities where the line of the ground permits, these are useful:—

(*a*) To meet an attack by enfilading our own obstacles.

(*b*) To cover an assault from our trenches.

(*c*) To escape the large calibre shells directed at the main trench.

(*d*) To direct fire on to ground, which is dead from the main works.

All these emplacements will probably be subjected to field gun fire directed at the obstacles; a dug-out must be close by.

They must be manned the moment a bombardment begins.

(*vi*) *Emplacements just in front of the parapet,* may be used where they cannot be placed further out—

(*a*) To get enfilade fire.

(*b*) To give concealment.

In this position they will probably not escape the larger shells directed at the main trench.

(*vii*) *Concrete Emplacements.*

On account of the material, labor, and time required to construct these, it is impracticable to place them all along the front line, but it may be imperative to build them in at special points in the line.

When consolidating a line, the above considerations point to the fact that work should be undertaken in the following sequence:—

(*a*) Open machine gun platforms, and strong "dug-outs."

(*b*) Splinter-proof emplacements, emplacements in forward saps, or emplacements just in front of the main trench, splinter-proof look-out posts.

NOTE:—The sequence in which these latter are made depends entirely on the tactical requirements.

(*c*) Concrete emplacements.

3. Dug-outs—Dug-outs can be made:—

(*i*) By tunnelling deep down under the parapet or parados.

(*ii*) By building a shelter in a traverse, under the parapet, behind the parados, or in the side of sap.

The overhead cover on the latter must be really strong, with as much earth and timber on top as possible, without making the work conspicuous.

The roofing must be strongly supported, it is advisable to place feet under the supports to prevent them sinking too far into the ground.

Mere weather shelters are not only useless but dangerous.

When digging below the level of the fire trench, and it is only by this means that the maximum of protection can

be obtained, difficulty will always be experienced owing to water, which will be found in most places.

This may be overcome by digging a deep sump-pit in one corner of the work, and by pumping off the water, while the sides and floor are revetted in order to resist the earth pressure, and a thin (2-in.) layer of concrete or corrugated iron is put over the revettment.

Machine gun dug-outs should be made 5 ft. x 4 ft. and 4 ft. in height.

As a rule they should not be more than fifteen paces from the machine gun positions.

Machine gun sections should aim at building two dug-outs for each gun.

Recesses should be made in the sides of a dug-out for a machine gun, spare parts box, and ammunition boxes.

Recesses for ammunition boxes should also be dug in the sides of machine gun emplacements.

4. Emplacements.

The position of emplacements will always be governed by the primary consideration of the siting of the gun.

Siting.

In both semi-permanent trenches, and in hasty open field work, the siting of the gun will probably be decided by the following tactical considerations:—

(*i*) The lie of the ground.

(*ii*) The zone to be covered.

(*iii*) The position of the enemy trenches.

In all cases the machine gun should be sited as near the ground level as possible, and must effectively sweep the required zone, which must be seen by the machine gunner when firing.

Concealment.

Emplacements must be constructed to look like the remainder of the trench, and there should be no appreciable difference in height to the surrounding parapet.

The exception to this is when an emplacement is specially constructed to appear like a mound of earth, in which case the conformation of the ground will be the guide.

The loopholes must be masked from the view of the enemy.

Hints Regarding the Concealment of Loopholes.

These apply to the various forms of trenches, and serve as a guide to the best method of making the loopholes fit into the surrounding aspect of any line of entrenchments.

(*i*) Sandbags filled with straw or grass, which are easily and quickly pulled out. In this case, when emplacements are not being fired from, a steel loophole plate should be placed behind the sandbags to prevent bullets coming through.

(*ii*) Light hinged trapdoor in front of loophole; it must harmonize with the remainder of the parapet and to assist in this, torn pieces of old sandbags, roughly nailed on, are useful, as they break up any straight edge. This should be tested in the support trenches before being placed in the front line.

(*iii*) Close mesh rabbit wire over the loophole at the angle of the parapet with mud, sticks, or grass thrown over. This can be seen through from the inside but is invisible at thirty yards.

(*iv*) By defilading from the front.

(*v*) Board with earth thrown over, and placed over loophole so that it can be pushed over from the inside.

Concealment from Enemy Patrols.

Care must be taken that machine guns in forward positions are not discovered by enemy patrols.

Concealment from Aircraft.

Every endeavor must be made to prevent emplacements, saps leading to emplacements, etc., from being located by means of aerial photography.

Canvas, grass, brushwood, etc., can be used as overhead cover to conceal the work, or make it appear similar to the remainder of the parapet.

It is important that any covering of this nature can be quickly removed if desired.

Protection.

Machine guns and teams should be protected, as far as possible, from rifle fire, shrapnel, splinters from shells, bombs, and small H.E. shell from field guns.

Protection will be obtained by having the parapet at least 6½ ft. thick. From this it will be seen that open machine

gun platforms should have the above thickness of earth in front.

Where it is desired to build emplacements with head cover, and where the height of the parapet does not permit of overhead cover being made, the height of earth above the loophole should be 12 inches.

Emplacements with overhead cover are only splinter-proof, when they have two layers of sleepers (or similar material) laid crossways with 20 inches of earth on top. The sleepers in each layer must be closely bound together with wire, iron bands, dogs, etc., in order to form a compact mass. The supports of his roofing must be very strong in order to prevent it collapsing by the concussion of large calibre shells bursting near.

If overhead cover is to be made stronger, a layer of rubble is used. On top there is a layer of earth, then a layer of rubble, followed by another layer of earth. The rubble in the middle will help to detonate the shells before they penetrate into the interior of the work. An air space left below the detonating layer will help to take the concussion of the explosion.

Corrugated iron placed over the layers of timber will further strengthen the work, and prevent water from dripping through.

NOTE.—Where the soil is likely to crumble or fall away, the sides of the emplacement should be revetted with sandbags, brushwood, boards or other suitable materials.

Dimensions.

Open machine gun emplacement should be roughly 4 ft. square. If the legs are dug into the parapet the dimensions may be reduced.

The platform must be from 1 ft. 6 ins. to 2 ft. below the height over which the gun is to fire, according to the splay of the legs.

The following are absolute minimum dimensions for an emplacement with overhead cover:—

5 ft. long to enable No. 1 to sit or stand comfortably behind the machine gun.

4 ft. wide allows only just sufficient space for No. 2 to feed the machine gun.

As emplacements built by a section armed with a Vickers gun, may later have to be occupied by sections armed with a Maxim, the clearance between the bottom of the loophole and the overhead cover must not be less than 2 ft., so that the cover may be raised to remedy stoppages during firing.

The loophole must not be less than 9 ins. in height to allow the firer to take a sight on to the target. Other dimensions of the loophole depend on the degree of traverse required and the thickness of the parapet.

Material.

The following material is required to construct an efficient splinter-proof machine gun emplacement of the type shown in the sketch:—

Loophole box (complete with battens), 2 in. planks used.....	1
Sleepers for Roofing, say 9 in. x 4 in. x 6 ft.	15
Posts, say 7 in. x 4 in. x 4 ft. 8 in. (or Sleepers)	6
Corrugated Iron Sheets (for roof).....	2
Nails (6 in.)	say 20
Sandbags	say 100
Close-mesh Wire Netting for revettment	24 feet

If the parapet is thin in front of the emplacement, the side facing the enemy should be protected by 18 inches of sandbags packed with broken brick or road metal. The brick should be in small fragments.

Steel loophole plates arranged behind the weak parts of the parapet will further protect the detachment in the emplacement.

Sliding steel plates can be fixed between the battens of the loophole, and these can be shut to prevent bullets from penetrating into the work when it is not being fired from.

If delays in obtaining material are to be avoided the Machine Gun Company Commander should inform the Staff Captain of the requirements as early as possible.

He should not be influenced by the assurance that any particular work he thinks necessary cannot be done.

NOTE.—If the supports are strutted by diagonal pieces of timber, the work is considerably strengthened.

5. Lime and Mortar Mixtures for Machine Gun Emplacements.

Ordinary slaked Lime can be used by mixing well with the hand.

Lime. *Ashes.*

Best stone slaked....1....to....4 good mortar for foundations —sets like cement.

Ordinary slaked.....1....to....2 very good with ashes.

Sand.

" .....1....to....2 takes a long time to set.

Pounded Brick.

" .....1....to....2 takes a long time to set, but makes a very good job.

Plaster of Paris or cement will increase the rapidity with which the composition sets.

In all cases most depends on the lime.

To prepare slabs, ration boxes can be used as a mold.

If a continuous wall is required the ends should be knocked out and the boxes placed together closely so that no gap is left.

For height, knock out the bottom, and place one on top of another, and pour mixture in from the top.

6. Tunnelling.

Tunnels may be used—

(*i*) As a covered emplacement.

(*ii*) As a passage to an open or covered emplacement.

(*iii*) As a dug-out.

They may be divided into two distinct kinds, namely—

(*i*) Just below ground level with a view to concealment; the covering must only be a few inches thick, or it may block the trench if hit by shells.

(*ii*) At great depth, with a view to protection from shell fire.

The former may be used in two ways—

(*i*) Sapped or dug, and then covered.

(*ii*) Mined or propped from the inside.

This latter work may be carried out in daylight, if the earth is filled into sandbags, which are not exposed.

The following tools are required for mining:—

Pick.

The best implement is a "Pick-miners," but an "axe-pick" can be converted. The helve should be spoke-shaved down so that it

can be gripped in the full of the hand almost up to the head; it should be 24 in. to 30 in. long. The head should be shortened so as to be about 12 in. long; one end will be sharp, the other end flat—about 2 in.-2½ in. wide.

Spade.

For neat work a spade with a flat rectangular head is required; a French "beche" will, if shortened, answer the purpose.

A *saw, hammer,* and *nails* are also required for the first method.

The Dam.

When commencing a mine, a dam must be left to prevent water draining from the trench into the tunnel.

The sides of the dam must be strongly revetted, and reinforced by a plank placed vertically in the line with the inner wall of the parapet.

Width of Tunnel.

The tunnel can be made as narrow as 3 ft., but the work is quicker and less tiring to the men, if the width is increased to 4 ft. 6 in.; the height should be at least 3 ft. 6 in.

There are two distinct methods of propping, viz.:—The one used in architecture, and the one used in coal mines. Either, or a combination of both, may be employed according to the following circumstances:—

(*i*) The nature of the soil.

(*ii*) The time available.

(*iii*) The former occupation and skill of the workmen.

Method 1, Figure 1.

In architecture a "sole piece" about 6 in. x 1½ in. in section, is placed on the floor; two "posts" are erected at each end of it; above them are placed a "lintel;" "wedges" are driven in along the direction of the tunnel between the lintel and the posts. The posts are secured at the bottom by dogs made from old iron, or by stops of wood nailed to the sole pieces.

Method 2, Figure 2.

In coal mines, two small holes are dug to receive the bottoms of the posts, or "legs" as they are called in this case.

Into these holes are placed small pieces of wood called "feet" to prevent the legs sinking.

The "bars" which support the roof should be slightly longer than the width of the tunnel and their ends should be let into the walls.

The legs, which may be cut from small trees or be made from sawn timber are of such a length that they just touch the bar at an angle of 30° to the vertical; to correct an error in length pieces of ration boxes should be placed between the bottom of the leg and the feet.

The legs are then knocked vertical.

Grooves should have been made in the walls to receive the legs, which should be never more than 3 ft. apart.

When the soil is crumbling, it is advisable to drive thin boards about 6 ins. wide (the sides of bacon boxes) sharpened at the ends between the bars and the roof of earth, these are called lids, and can be driven forward as the excavation continues.

The sides of the tunnel can be supported in a similar manner.

Combination.

Probably the most efficient way of propping the roof will be:—

(*i*) To use sole pieces (Method 1).
(*ii*) To use legs and bars (Method 2).
(*iii*) To use lids and sides (Method 2).

Lecture Notes.

MACHINE GUN FIELD WORK.

1. General.

(*a*) Time, labor, material, and concealment are chief factors.
(*b*) Working parties must be provided by brigade.
(*c*) All work supervised by M.G.O.
(*d*) Time in open warfare is all important, and concealment often best protection.

2. Sequence of Work.

(*a*) *Strong "dug-outs"* only way of ensuring protection—
(*i*) Can be made day and night.
(*ii*) Should be placed behind parados.
(*iii*) Must be made strong.
(*iv*) Numerous open emplacements and S.A.A. boxes placed in parapet.

(*b*) *Splinter-proof Look-out Posts*—
Ample protection for look-out men required.

(*c*) *Splinter-proof Emplacements*—
Useful—
(*i*) To support an attack.
(*ii*) To protect from enemy covering fire.
(*iii*) To protect from bombs.

(*d*) *Emplacements in front of our Obstacles*—
(*i*) Where lie of ground permits.
(*ii*) To enfilade the obstacles.
(*iii*) To cover an assault.
(*iv*) To escape large calibre shells.
(*v*) To fire on dead ground.
(*vi*) Dug-out must be close by.

(*e*) *Emplacements just in front of Parapet*—
(*i*) Only if not possible to put further out, as they will be subjected to heavy calibre gun fire.

(*f*) *Concrete Emplacements*—
(*i*) Impracticable to build them everywhere, owing to time, labor, or material required.
(*ii*) May be necessary at special points.

(*g*) *Sequence of Work is*—
(*i*) Open machine gun platforms and "strong" dug-outs.
(*ii*) Splinter-proof emplacements in forward saps, or just in front of parapet, and splinter-proof look-out posts, to be made as situation requires.
(*iii*) Concrete emplacements.

3. Dug-outs can be made.

(*a*) By tunnelling.

(*b*) By building shelters.
(*i*) Overhead cover must be really strong, and must be strongly supported. Weak shelters are useless and dangerous.
(*ii*) Maximum protection only obtained by digging below level of the fire trench, but difficulty owing to water to be expected.
(*iii*) Water overcome by digging a sumph pit, and revetting with 2 in. concrete.
(*iv*) Dimensions 5 ft. x 4 ft., by 4 ft. high.

(*v*) Position not more than 15 paces from gun position.
(*vi*) Two dug-outs per gun, if possible.
(*vii*) Recesses for gun, ammunition boxes, etc., in sides of dug-outs and emplacements.

4. Emplacements.

Governed by the siting of the gun:

(*a*) *Siting depends on:—*
(*i*) Zone to be covered.
(*ii*) Lie of the ground.
(*iii*) Position of enemy trenches.
Line of fire must always be definitely visible to firer.

(*b*) *Concealment—*
(*i*) Construct to resemble parapet.
(*ii*) Loopholes must be masked, and can be concealed by:—
(*a*) Sandbags filled with straw, etc., and protected.
(*b*) Hinged trap door with old sandbags nailed on.
(*c*) Close mesh rabbit wire at angle of parapet.
(*d*) Defilading.
(*e*) Pushover board.
(*iii*) Location by enemy patrols and aircraft must be guarded against.

(*c*) *Protection* must be provided against bombs, small H.E., shells, etc.
(*i*) Both open and "bomb-proof" emplacements require 6½ ft. of earth in front of them.
(*ii*) Open emplacements with a loophole, require 12 in. of earth above the loophole.
(*iii*) Splinter-proof head cover is two layers of wooden baulks, etc., bound together with 20 in. of earth on top, and strongly supported.
(*iv*) A bursting layer of rubble will increase strength. Corrugated iron will prevent water dripping through.
(*v*) Emplacements should be revetted.

(*d*) *Dimensions*—

(*i*) Open emplacement about 4 ft. square.

(*ii*) Platform 1 ft. 6 in. to 2 ft. below level of barrel.

(*iii*) Loophole 9 in. high.

(*iv*) Minimum dimensions for "bomb-proof"—
5 ft. long by 4 ft. wide.
2 ft. high from bottom of loophole, to allow maximum cover to be raised.

(*e*) *Material* to construct bomb-proof emplacement—

Loop-hole box (with battens), 2 in. planks...	1
Sleepers, 9 in. x 4 in. x 6 ft.	15
Posts, 7 in. x 4 in. x 4 ft. 8 in.....	6
Corrugated Iron Sheets	2
Nails (6 in.)	20
Sandbags 100	
Wire Netting (revettment)	24 feet

Sandbags filled with brick increase strength of parapet.
Steel loop-hole and sliding plates give extra protection.
Diagonal struts strengthen roof.

5. Lime and Mortar Mixtures.

Depend on quality of lime.

(*i*) One of quicklime to 4 of ashes. Set like cement.

(*ii*) One of slaked lime to 2 of pounded brick. Takes a long time to set.

(*iii*) Cement easy to get. Helps to set quickly.

(*iv*) Use ration boxes for molds.

6. Tunnels may be used:

(*a*) As covered emplacements.

(*b*) As passages to an emplacement.

(*c*) As a dug-out.

They may be placed—

(*i*) Just below ground level and lightly covered, made by sapping and mining.

(*ii*) At great depth; by mining.

(*iii*) Tools required, "Pick-miners" or converted pick, spade, saw, hammer, and nails.

(*iv*) Method of mining—

(*a*) Make a dam and revet it.

(*b*) Make a tunnel 3 ft. wide or 4 ft. 6 in. for rapid work, and 3 ft. 6 in. high.

(*c*) Prop by one of the following methods—

1. Method 1 (Architectural).
   Sole piece 6 in. x 1½ in.
   Uprights.
   Lintel.
   Wedges.
   Dogs or stops.
2. Method 2 (Coal Mining).
   Feet.
   Legs.
   Bars.
   Wedges.
   Lids.
3. Combination (probably best).
   Sole pieces, legs, lids, and sides.

Appendix No. 6.

Lecture.

THE EMPLOYMENT OF MACHINE GUNS IN TRENCH WARFARE.

PART I.

GENERAL.

1. Co-operation.

As in open warfare, so in trench warfare, co-operation is essential to enable the best results to be obtained from machine guns.

Not only must there be co-operation between the machine guns of any particular sector of a defensive line, but the Machine Gun Company Commanders of adjacent brigades must arrange that no ground is left unswept near the point of junction of their brigades. In this way only can it be ensured that all ground in front of the entrenched line is swept by cross fire, and the required "Belt" of Machine Gun Fire obtained.

Machine Gun Company Commanders and Section Officers should always be thoroughly conversant with the situation.

The co-operation of machine guns from a flank against points where the enemy are very close should always be arranged for.

2. Taking Over Trenches.

When a line of trenches are being taken over by a *brigade,* the *Machine Gun Company Commander should,* if possible, reconnoiter the *whole line* before it is taken over by his brigade, and note:—

(*a*) *Position of each machine gun and the area covered by it.*

(*b*) *Number, position, and nature of any extra emplacements,* dug-outs, splinter proof look-out posts, etc., that have to be made, or any other work that requires to be done.

(*c*) Positions of and *methods of communication* between himself and his Section Officers, and between the Section Officers and their machine guns.

He will then issue any necessary machine gun orders.

3. Bombardments.

With a view to reducing losses, both from daily shell fire or from an intensive bombardment, the following rules should be followed:—

(*a*) (*i*) During an enemy bombardment the machine guns should be dismounted and placed in strong dug-outs, or if for any reason such dug-outs are not available, in the bottom of the trench.

(*ii*) The tripods can be left in position, so that the machine guns can be quickly mounted to repel an enemy attack.

(*iii*) When dismounted the machine guns should be placed in strong waterproof covers so as to prevent their being clogged with dirt, if they should happen to be buried by shell-fire.

(*iv*) The Gunners should not be in one dug-out, or all together in one part of the trench. This will obviate all being disabled by one shell.

(*v*) When machine guns are being mounted after a bombardment only two men should mount each gun, and these should not expose themselves. This should be practiced. The remainder of the machine gun personnel should be kept under cover.

When an enemy attack is launched, without covering machine gun and rifle fire from the flanks, and speed in mounting the machine gun to repel the attack is all important, and undue attention need not be paid to exposure.

(*vi*) Strong dug-outs should be provided near each emplacement for the Machine Gun personnel.

(*vii*) Strong splinter-proof look-out posts should be provided for use during a bombardment when the machine guns are in dug-outs.

(*viii*) Three or four men are sufficient for each machine gun in the front trenches, the remainder being kept in reserve trenches.

(*b*) During a bombardment of the enemy trenches by our own guns, the machine guns should not, as a rule, be fired unless a very favorable target presents itself. A good target may be presented by the enemy trying to pass a gap that has been made in his parapets, retiring from his trenches, etc.

4. Ammunition.

(*i*) Ammunition supply must be carefully thought out, and its distribution arranged for on the following lines:—

(*a*) With each machine gun, eight full belts, and 4,000 rounds in unopened boxes ready to refill belts as they are fired.

(*b*) Remaining full belts, belt filling machine, and 4,000 rounds in unopened boxes, with spare gunners at a central depot in the reserve trenches, battalion headquarters or other suitable place.

NOTE.—The above is to be considered merely as a guide.

(*ii*) Arrangements must be made for belt filling in dug-outs or reserve trenches.

(*iii*) In wet trenches great care must be taken that belt boxes do not become sunk in the mud.

(*iv*) Belts and belt boxes should be kept in ammunition recesses and be covered up to keep them clean and dry.

(*v*) Ammunition should not be all together in one place.

(*vi*) Ammunition should be kept as dry as possible, and there should be a daily inspection of belts. Each round should be slightly turned to prevent stickiness and should be pushed well home.

If spare boxes of S.A.A. are opened they should be replaced by closed ones.

5. Emplacements.

(*a*) One emplacement should usually be reserved for each machine gun as a "Battle" emplacement. This should never be used except to meet an enemy attack.

(*b*) Several alternative emplacements should be made. At least one of these should be an open platform from which the machine gun can fire over the top of the parapet.

(*c*) Every emplacement should be numbered, marked "M.G. Emplacement," and a range card should be placed in each.

(*d*) In a brigade the whole of the emplacements of a brigade should be numbered from right to left.

Dummy emplacements—a few rounds being fired from them at intervals may sometimes be found of value.

(*e*) After firing from one emplacement it is often advisable to move the machine gun at once to another emplacement as the previous one may have been located.

If machine guns are often fired, their positions should be frequently changed, and practice given in moving quickly from one emplacement to another. Thus, the enemy may be deceived as to the number and position of the machine guns.

(*f*) Machine gun emplacements and dug-outs should always be kept in good repair.

(*g*) In each emplacement the limits that the machine gun can, with safety, be traversed without endangering friendly troops should be clearly marked by posts or sandbags, arranged so as to make traversing beyond these limits impossible.

(*h*) Unless a position is liable to be suddenly rushed, due to the wire being weak, or so close to the parapet as

to permit of the trench being cleared by a bomb attack, machine guns should always be dismounted and kept in dug-outs during the day time. This will prevent the machine guns being knocked out by *chance* shells and mortars.

(*i*) Smoke helmets will have to be worn if firing for long from a "bomb-proof," owing to the cordite fumes.

6. Overhead and Indirect Fire.

Whenever machine guns are going to fire over our own trenches, the occupants of those trenches should be informed.

7. Siting of Trenches—(such as subsidiary lines).

Entrenchments deliberately dug should be sited principally with a view to defence by machine guns.

The sites for machine gun emplacements should first be chosen and the trenches sited accordingly.

This will enable the trenches to be held by machine guns, supported by the minimum number of riflemen.

8. Reliefs.

(*a*) A proper system of relieving machine gunners should be followed, so as to give both officers and men sufficient rest.

Three or four men are all that are necessary with each machine gun in the front line trenches at the one time.

The remainder should be kept in reserve at the central reserve ammunition depot.

This will enable the men in the front line trenches to be relieved every twenty-four hours.

(*b*) As far as possible machine gun sections should be relieved as often as battalions.

(*c*) Every assistance should be given to machine gun sections in the transport of their machine guns, etc., to and from the trenches, when required.

9. Control of Guns.

The Machine Gun Officer must:—

(*i*) Establish himself at some place where a message can always reach him.

(*ii*) Keep in touch with the machine guns under his command, and with the officers of the line of trenches he is assisting to defend.

(*iii*) Arrange for fire control—In the trenches this can, as a rule, only be done by placing a man in charge of each machine gun. This man must be given definite instructions as to what he is to do in various eventualities.

10. Enemy Machine Guns.

If enemy machine guns are located, and they are not doing any material damage, it may be advisable to leave them in position, instead of firing at them and forcing them to alter their position.

Then, if an attack is launched from our side, the enemy machine guns may still be in the same position, and our machine guns may be able to prevent them firing on our attacking troops.

Telescopes have been found of the greatest value in spotting enemy machine guns, observation of fire, etc.

It requires much training to get the best value from a telescope, and both Officers, N.C.O.'s, and men who use them should practice constantly.

11. Cleaning.

Machine guns and all stores should be cleaned carefully at least once daily.

12. Bright Parts of Machine Guns.

In order to prevent any bright portion of the machine gun reflecting light it is advisable to paint it khaki or rainbow smudge.

If paint is not available, old puttees, string, etc., can be used.

13. Periscopes.

As a rule a periscope should not be placed above the machine gun position, but at the side. All ranks should be carefully trained in their use.

14. Positions, etc., Known to All.

Every machine gunner must know the position of all machine guns in his section, whether they be in the firing line, in support, in reserve, or in positions in rear, and the best way to them.

The position of the section officer must be known to all.

15. Traversing.

When using the "Tap" traverse, fire will be more effective if the groups are dotted about and not placed regularly along a position, as otherwise the enemy will know where to expect the next group, and will take cover accordingly.

For sweeping parapets, or repelling assaults at close range, the "Swing" traverse will be found effective.

16. Firing Without Tripods.

A method of fire which, on occasions, is most useful. It enables the machine gun to be fired from very cramped positions and adds very greatly to its mobility. In the attack, for instance, there may be delay in bringing up the tripod, or difficulty in finding a suitable emplacement in the enemy's lines.

In such cases the machine gun can be rested on the parapet or other support and fired.

Also in ordinary trench garrison duties, the machine gun may be placed in any part of the line to fire on enemy working parties, etc., and speedily removed to another part, or back to its proper position.

Machine gunners should have opportunities afforded them to practice this, or faults in ejection and feed will occur.

17. Shovels.

In the attack, a small shovel is of great use if brought up by one of the machine gun numbers strapped to his back.

18. Opening Fire.

It should be a point of honor for a machine gunner always to have his machine gun tuned up, so that it will fire correctly immediately the double button is pressed.

19. Very Pistols.

Each machine gun in the front should be provided with a Very Pistol to show up enemy night attacks and enable fire to be directed on them.

20. Bombers.

In attack it is advisable to tell off two or three bombers with each machine gun, then when a machine gun is in position close

to which enemy bombers can approach along old communication trenches, etc., the bombers can be posted so as to keep the enemy out of range. This will enable the machine gun to be made the best use of.

Where enemy trenches are close, or where the existence of ditches and old trenches would enable the enemy to approach within bombing distance, bomb posts should be placed to overcome or keep enemy bombers out of range.

It is advisable that machine gunners should understand how to use the various types of bombs.

21. Order Board.

To ensure strict discipline, the following Order Board should be placed in a convenient position near each gun:—

Order for Sentry and Gun Team Commander at Number ——— Gun Position.

(*i*) Fire is only to be opened by order of the Gun Commander, unless a sudden emergency arises, in which case the sentry will use his own initiative.

(*ii*) When relieving another gun team or sentry, the following facts will always be ascertained:—

(*a*) Whether the gun has been fired during the relief.

(*b*) If fired what the target was.

(*c*) If fired, the emplacement from which it was fired.

(*iii*) The sentry will always inspect the gun when taking over the position.

(*iv*) The sentry on duty must have an accurate knowledge of the points shown on the range card.

(*v*) In cases of alarm, or a gas attack, the sentry will wake the gun team.

(*vi*) The gun will not be mounted in an emplacement, except during the hours of darkness or unless the situation makes it imperative.

(*vii*) The gun will be cleaned daily, and the weight of the fuse spring noted, both morning and at night.

(*viii*) Ammunition, spare parts, and hyposulphite solution will be inspected daily.

(*ix*) The lock spring (return, or hammer spring), will never be left compressed.

It is sufficient to half-load, and press the double button with the Vickers or Maxim, to press the trigger and then enter the belt in the case of the Colt, or to place a magazine in position on the magazine post of the Lewis, when mounting the gun at night.

In order to meet an attack, it is only necessary to complete the loading motion.

(*x*) All dug-outs, emplacements, ammunition recesses, belonging to the gun position must be kept clean and in good repair.

Special Orders for this Gun Position

(*xi*)
(*xii*)
(*xiii*)
(*xiv*)

Date Machine Gun Officer.

22. Machine Guns in Enemy Gas Attack.

(*i*) Gas affects the working parts of a machine gun, and also the cartridges in the belt.

If exposed to it for many minutes it may be found impossible to fire the machine gun.

(*ii*) As gas is heavier than air, and sinks to the bottom of a trench, machine guns that have been placed in dug-outs or low-sited emplacements should at once be removed and placed in position to fire over the parapet or in readiness to do so.

(*iii*) A sprayer should be kept with each machine gun.

(*iv*) In some instances, while a gas cloud was being sent over, rapid firing has been opened by one side with a view to keeping down the heads of the opposing troops.

After a cloud, advances have been made in a somewhat careless manner.

(*v*) There are two courses open to the machine gun officer:—

(*a*) To order fire to be opened with a view to:—

(*i*) Preventing the enemy leaving his trenches, and keeping down their fire so as to enable his own troops to keep their heads high.

(*ii*) Encouraging his own troops.

(*iii*) Keeping his machine gun working, as, while in movement, the various parts are less affected by the gas, and the firing of the machine gun has the effect of dispersing the surrounding gas to a certain extent.

(*b*) To reserve his fire, with a view to taking advantage of a careless advance on the part of the enemy following up their gas. In this event he should use his "Sprayer" constantly.

(*vi*) The course of action adopted by the machine gun officer will depend on the effect produced by the gas on the troops in his trench.

23. Communication.

1. Owing to the cutting of telephone wires, the difficulties of communication in defence are often great.

In attack, when an enemy barrage of fire is placed behind troops who have occupied enemy trenches, and when it is difficult to determine how far the various portions of the attack have progressed, difficulties are increased.

2. For this reason, every form of communication between machine guns in rear on the flanks, with the troops they are assisting, should be considered.

The various points:—

(*a*) *Telephones*—The usual system of telephones in trenches is as follows:—

(*i*) Each Company is connected direct to Battalion Headquarters.

(*ii*) Companies in the front line are connected laterally.

(*iii*) Support and reserve trenches are connected with the companies occupying the front trenches, and with Battalion Headquarters.

(*iv*) Companies in the front lines, and Battalion Headquarters, are connected direct with the battery in support.

(*v*) Battalion Headquarters is connected with the Brigade Headquarters.

From the above it can be seen that:—

(*i*) Lateral communication can usually be facilitated by the use of company telephones.

(*ii*) By placing the Central Belt-filling Depot and the spare gunners in the support, or reserve trenches, or Battalion Headquarters, communication can be obtained between the Central Depot and the machine guns.

NOTE.—Separate telephones for machine guns would be an undoubted advantage, but at present they are not an article of issue.

(*b*) *Orderlies*—Machine Gun Company Commanders and Section Officers should provide themselves with a sufficiency of orderlies.

These men should be intelligent and trained in their duties. Where an attack is contemplated, orderlies should be attached to the Machine Gun Sections for some time beforehand.

(*c*) *Visual signalling*—All machine gunners should be thoroughly trained in semaphore signalling. If necessary, signallars should be applied for.

3. The best method of ensuring success is:—

(*a*) A carefully arranged plan of action.

(*b*) That the plan is understood by all concerned.

(*c*) Definite orders to Officers and Machine Gun Commanders.

Then if communication breaks down the individual on the spot can do his best to ensure the success of the general plan.

The foregoing should afford a guide to Machine Gun Officers in choosing their own position, which will, of course, vary according to the ground and the tactical requirements of the situation.

PART II.

Defence.

1. When placing machine guns for the defence of an entrenched line, the machine guns of each section must be arranged under the direction of one officer.

In the case of a brigade, this will be the duty of the Machine Gun Company Commander.

This officer must allot areas to be covered by each machine gun. These areas should slightly overlap.

In allotting these areas, care must be taken that the whole of the area can actually be seen by the man firing the gun. The mere marking out of theoretical lines of fire on a map is not sufficient. In addition, a trench map should be prepared showing the positions of the machine guns, and the areas swept by each.

Machine Gun Company Commanders of adjacent brigades must confer together as to the placing of their flank machine guns, in order to ensure that all ground in front of the entrenched line can be swept by machine gun fire. It is most important that the Machine Gun Company Commander should find out the positions of the enemy's advanced trenches, which our artillery cannot reach or only reach with difficulty, and then place machine guns to bring enfilade fire, or oblique fire, to bear on these trenches.

Further, he should acquaint himself with the positions of the Lewis guns.

2. The "ideal" of creating a "Belt" of machine gun fire across the front of the position must always be kept in view, provided that the proportion of machine guns placed as in par. 3 (iii) is not too greatly reduced.

3. The machine guns should be placed so as to bring oblique or enfilade fire against:—

(*i*) The enemy trenches.

(*ii*) The ground over which the enemy must pass should he attack.

(*iii*) Our own front line trenches in case the enemy penetrate into them.

4. To achieve these objects machine guns may be placed:—

(*a*) In a salient.

(*b*) In a re-entrant.

(*c*) At a bend in the trench.

(*d*) In front of the trench.

(*e*) In or near the support or communication trenches.

(*f*) In a straight length of trench, firing through an oblique loop-hole.

NOTE.—Emplacements some distance in front of the trench, concealed in crops, grass, etc., and approached by a covered sap, are useful both for attack and defence.

5. In all cases the machine guns should, if possible, be covered from fire from the front, while themselves being able to sweep the front of the entrenched line with cross-fire.

Thus, although each machine gun may be firing to its flank, its front is swept by the fire of a neighboring machine gun.

Arrangements can be made so that the machine guns so placed may be able to fire to their front, should an emergency make this desirable.

This can be done by:—

(*a*) Arranging that some sandbags can be removed and the machine gun fired to the front through the loop-hole thus made.

In this case it must be remembered that:—

(*i*) If the sandbags are left in place for a considerable time without being removed, they may become embedded and found immovable.

(*ii*) That loop-holes filled with single sacks will not be bullet-proof.

(*b*) By training the gunner to:—

(*i*) Quickly remove the machine gun from the tripod and fire the machine gun from top of the parapet without it.

(*ii*) Lift the machine gun and tripod out of trench and fire it from some previously selected spot.

NOTE.—Both these methods require much practice.

6. Every endeavor should be made to conceal the position of the machine guns from the front.

Distribution.

7. When arranging the distribution of machine guns in an entrenched line, the following positions should be considered:—

(*a*) *In the Front Line of Trenches*—This may be taken as a general rule, as if it is intended to obstinately defend the front line, the machine guns may just make the difference between success and failure.

(*b*) *In Support Trenches*—A proportion of the available machine guns must be placed in or near support trenches.

Here they may be arranged so as to:—

(*i*) Prevent further advance of the enemy should they capture the front line.

(*ii*) Enfilade front line should it be captured.

(*iii*) Sweep communication trenches.

(*c*) *In Positions in Rear*—If the ground is favorable it will be possible to place machine guns in concealed positions, in rear of the entrenched line.

They can be arranged so as to:—

(*i*) Fire over the trenches and sweep the ground in front.

(*ii*) Fire through gaps in the defensive line.

(*iii*) Command positions where the enemy might concentrate prior to the assault.

(*iv*) Command covered approaches to the defensive line.

(*v*) Command positions likely to be occupied by the enemy's machine guns.

(*vi*) Enable machine guns to fire on the enemy's trenches with greater effect.

(*vii*) Give overhead covering fire in case of an advance by our own troops.

(*viii*) Use indirect fire against ground in rear of enemy's lines.

(*d*) *In Strong Places Just in Rear*—These positions should be inconspicuous and very strongly built. They should be arranged so that the ground in front is swept by cross-fire.

(*e*) *Some in Reserve*—These can be used for instructional purposes when not otherwise required, but tests should be periodically carried out to ensure that they will reach the threatened points in good time.

8. In conclusion it may be said a system of distribution for the machine guns should be worked out on the following lines:—

(*a*) Some in the first line.
(*b*) Some in places close behind the front line.
(*c*) Some in positions in rear.
(*d*) Some in reserve.

The number of guns available will govern a decision as to whether machine guns can be placed in all these positions at one time. In any case, emplacement should be prepared and arrangements made so that the machine guns can be quickly placed in any of the above positions as required.

Attack.

1. The Machine Gun Company Commander must be fully informed of the plan of operations at the earliest possible moment.

2. The whole of the machine guns of the brigade will be organized under the command of the Brigade Machine Gun Company Commander.

3. The Machine Gun Company Commander, in conjunction with the Section Officers, must make detailed plans for the employment of the machine guns.

The Machine Gun Company Commander will:—

(*a*) Make a careful study of the enemy front line and its relation to his own trenches.

(*b*) From a study of maps make himself acquainted with the ground in rear of the enemy front line, and also with his trench system.

For this aeroplane maps are required.

(*c*) Issue definite orders to his Section Officers as to the employment of the machine guns.

(*d*) Make certain that the machine gun positions, which he will require, are in good order.

4. In this manner each machine gun, or group of machine guns, will have a specific task allotted to it. Before the action commences all concerned will thoroughly understand their duties.

5. The plans of the Machine Gun Company Commander will have been made in consultation with the Brigade Commander, and the latter will explain to him the course the action is expected to take.

6. All machine guns must be in their allotted places and ready for action by the time the preliminary bombardment commences.

7. Machine guns are the weapons most likely to hold up the attack, and every effort should be made to locate enemy machine guns, in order that some of our machine guns may be detailed in pairs, if possible, to engage them immediately the bombardment ceases.

8. It must be clearly understood by all officers that the machine guns have definite tasks allotted to them, and that they are under the command of the Machine Gun Company Commander, and are therefore not to be interfered with or given orders by other officers.

9. The machine guns will be allotted as follows:—

(*a*) *Some to go Forward with the Attacking Infantry.*

(*i*) The number of guns to go forward will be determined by the length of the front to be attacked, and the nature of the enemy trenches.

(*ii*) The machine guns should, as a rule, not open fire before the infantry advance takes place. All should be in readiness for them to be rushed forward at a moment's notice.

(*iii*) Their role will be to make good the ground gained by the infantry against a counter attack.

(*iv*) They should not go forward until it is fairly certain that the infantry are established in the captured trench.

(*v*) They should advance in such a position as to allow them a reasonable chance of reaching the position gained by the infantry in safety. They should conceal their identity as machine gun teams by mixing with the infantry, and carrying their machine guns in the least conspicuous manner.

(*vi*) The approximate locality in which the machine guns will be mounted in the captured lines should be settled before the advance.

(*vii*) Lewis guns, or machine guns fitted with light mountings, should be used for this work. In this case the heavy tripod should only be brought forward after the captured position has been consolidated.

(*b*) *Some to Cover the Infantry Advance*—The positions of these guns will depend on:—

(*i*) The lie of the ground.

(*ii*) The position of our own and the enemy's trenches.

(*iii*) The nature of the attack.

These machine guns will be allotted as follows:—

(*i*) Some to prevent the cross-fire by rifles and machine guns from the enemy trenches situated on the flanks of the attack.

(*ii*) Some to bring oblique or enfilade fire on to the portion of the enemy trenches being attacked.

(*iii*) Some to sweep the ground over which enemy reserves might advance to the counter-attack.

(*iv*) Some may be pushed out in front of the line, to keep down enemy fire while the infantry are getting out of their trenches and through the wire.

These may be in saps, crops, folds in the ground, etc.

(*v*) When the attacking infantry mask the fire of the machine guns they should, if possible, direct their fire past the flanks of the attacking troops so as to keep down flanking fire and prevent flank attacks.

NOTES:—

(*i*) If our troops are forced to lie down between the trenches, the machine guns must try to keep down the fire of the enemy's rifles and machine guns.

(*ii*) When the role of covering fire is completed they should automatically come again under the control of the Machine Gun Company Commander, who will issue further orders.

(*c*) *Some in Reserve Under the Brigade Commander*—

(*i*) These should be retained as a real reserve and not pushed too early into the fight.

(*ii*) From positions in rear they may be used to sweep the ground behind the enemy front line, fire against counter-attacks, etc.

Indirect fire, if with observation, being employed if necessary.

10. If the attack is to consist of more than one phase, that is to say, of two or more distinct advances, separate plans must be made for each.

11. Arrangements for ammunition supply, belt filling, ammunition depots, etc., must be made before the action commences. An officer should be placed in charge of these arrangements.

12. The Machine Gun Company Commander should, as a rule, remain with the Brigadier.

He should provide himself with a sufficiency of orderlies.

Lecture Notes.

THE EMPLOYMENT OF MACHINE GUNS IN TRENCH WARFARE.

GENERAL.

1. Co-operation.

(*a*) Between guns on brigade front.
(*b*) Between guns of adjacent brigades.
(*c*) Most likely to break down after a relief.
(*d*) Against points of particular danger (not always thought out).

2. Taking Over Trenches.

1. Whole line reconnoitered by M. G. C. C. beforehand.
2. Points to be noted:—
   (*a*) Position of each gun and the area swept.
   (*b*) Number of extra emplacements, dug-outs, s.p. look-out posts, etc., required.
   (*c*) Particular points of danger.
   (*d*) Means of communication.

3. Bombardment.

(*a*) 1. Guns in dug-outs, or bottom of trench.
2. Tripods mounted.
3. Guns covered up.
4. Gun teams distributed.
5. Two men only required to mount gun.
6. Strong dug-outs.

7. Strong s.p. look-out posts.
8. Four men sufficient in front trenches.

(*b*) The guns should not be fired during our own bombardment, except when very favorable target seen.

4. Ammunition.

Arranged for on the following lines:—

(*i*) Eight belts and 4,000 rounds in S.A.A. boxes with the gun.
(*ii*) Remaining belts, b.f. machine, and 4,000 rounds at some Central Depot.
(*iii*) Belt-filling machine set up in reserve trenches.
(*iv*) Belt boxes in ammunition recesses and covered up.
(*v*) Ammunition distributed.
(*vi*) Ammunition inspected daily, and opened boxes changed.

5. Emplacements.

1. Keep "battle" emplacement.
2. Alternative emplacements made.
3. Emplacement numbered, with range card, and orders placed at each gun position.
4. All emplacements numbered from right to left.
5. If guns often fired, vary positions.
6. Limits of traverse marked.
7. All emplacements kept in repair.
8. In dug-outs, except during darkness, or extraordinary circumstances.
9. Smoke helmets may be necessary in "bomb-proofs."

6. Overhead Fire.

Warn troops holding trenches.

7. Siting of Trenches.

Defence by machine guns considered first in a deliberately dug line, so as to enable trenches to be held by minimum number of riflemen.

8. Reliefs.

1. Systematically carried out.
2. Relieve the four men in front trenches every twenty-four hours.
3. Obtain assistance in carrying stores, etc.

9. Control of Guns.

The Machine Gun Officer must:—

(*i*) Be where he can be found.

(*ii*) Keep touch with his guns.

(*iii*) Arrange for fire control.

10. Enemy Machine Guns.

(*i*) If located and not causing damage may be left for future occasion.

(*ii*) Telescopes valuable for locating them.

11. Cleaning.

Guns and stores cleaned daily.

12. Bright Parts of Guns.

(*i*) Painted, or

(*ii*) Covered with putties or sacking.

13. Periscopes.

(*i*) Used to one side of gun.

(*ii*) All ranks trained in use.

14. Positions of Guns.

(*i*) Known to whole company.

15. Traversing.

(*i*) "Tap" traverse irregular.

(*ii*) "Swing" traverse at close ranges necessary.

16. Firing Without Tripods.

(*i*) Of value in emergency.

(*ii*) Practice to prevent faults in ejection, and feed.

17. Shovels.

Should be carried in attack.

18. Opening Fire.

Point of honor to have gun ready.

19. Very Pistols.

To direct fire at night.

20. Bombers.

(*i*) Every machine gunner should know how to bomb.
(*ii*) Bombers detailed to cover machine guns in attack.
(*iii*) Bomb posts placed to cover machine guns in defense when necessary.

21. *Order Board.

As per draft, should be placed near each sentry. *To be taken down in full.

22. Machine Guns in a Gas Attack.

1. Gas affects gun and cartridges.
2. As gas sinks to bottom of trench, machine gun should be raised, ready to fire over parapet.
3. "Sprayer" kept with each gun.
4. During gas cloud, rapid fire, after gas cloud, careless advance.
5. Machine gun officer may—
   (*i*) Open fire—
      (*a*) To prevent enemy leaving trenches.
      (*b*) Encouraging own troops.
      (*c*) Keep his gun working.
   (*ii*) Reserve his fire to take advantage of advance.
6. Condition of troops will determine course of action.

23. Communication.

1. Difficulties both in attack and defense are:—
   (*i*) Cutting of telephones.
   (*ii*) Barrage of fire.
2. Every form he practiced.
   Various points:—
   Telephones—Company telephones permit connection laterally and to the rear.
   Orderlies—Who must be trained, and attached beforehand if an attack is contemplated.
   Visual Signalling—In which (Semaphore) all the gunners should be trained.
3. Communication available will decide Machine Gun Officer as to his position.

Defense.

1. (*a*) All guns arranged by M.G.C.C. and Brigadier.
   (*b*) Cones of fire must overlap.
   (*c*) Actual reconnaissance necessary to ensure this.
   (*d*) Trench map prepared showing these cones.
   (*e*) Guns specially placed to cover points in enemy front line which artillery cannot reach.
   (*f*) Positions of Lewis guns known.

2. Belt of fire to be aimed at, but guns covering front line must not be too greatly reduced.

3. The guns placed to bring oblique or enfilade fire against—
   (*i*) Enemy trenches.
   (*ii*) Ground in front of the trenches.
   (*iii*) Own front line.

4. To achieve these objects the guns may be placed—
   (*i*) In a salient.
   (*ii*) In a re-entrant.
   (*iii*) At a bend in trench.
   (*iv*) In a straight line of trench firing through oblique loop-hole.
   (*v*) In front of trench.
   (*vi*) In any commanding parts of support or counter trenches.

5. Defilade whenever possible, but arrange to fire to front by—
   (*i*) Removable sandbags—which should be constantly shifted and backed with steel plates.
   (*ii*) Training men to fire quickly over parapet with or without tripod.

6. Conceal emplacements.

7. Distribution—
   (*i*) *In Front Line for Cross-Fire.*
   (*ii*) *In or about Support Line to—*
   Cover front line.
   (*iii*) *In Positions in Rear to—*
      (*a*) Sweep ground in front of trenches.
      (*b*) Fire through gaps in defensive line.
      (*c*) Command covered approaches and positions of assembly.
      (*d*) Command position for enemy machine guns.
      (*e*) Indirect fire.

(*iv*) *In Strong Places Just in Rear*—
To prevent deep break in line.
(*v*) *In Reserve*—
(*i*) For emergency
(*ii*) For instruction.
Tests often carried out with these guns.

8. Number of guns may not allow of all these positions being manned, but emplacements should be made for them, and they should be known to all.

Attack.

1. Machine Gun Company Commander fully informed of plan of operations.
2. All guns organized under one officer.
3. Machine Gun Company Commander will:—
(*a*) Study enemy front line and its relation to own trenches.
(*b*) Study enemy trench system from aeroplane maps.
(*c*) Issue definite orders to Section Officers.
4. All guns ready before preliminary bombardment begins.
5. Every effort made to locate enemy machine guns.
6. Machine guns may be allotted as follows:—
(*a*) *Some to go Forward with Attacking Infantry.*
(*i*) Not open fire before advance.
(*ii*) Make good ground gained by infantry.
(*iii*) Not advance till infantry established in captured trench.
(*iv*) Line of advance of each gun selected.
(*v*) Heavy tripod brought up after.
(*b*) *Some to Cover Infantry Advance.*
(*i*) Fire on enemy parapet.
(*ii*) Keep down fire against flanks of attack.
(*iii*) Sweep ground behind enemy front line.
(*iv*) Some pushed out in front to help infantry out of the trenches.
(*v*) If attack fails, keep down fire against retiring infantry.
(*vi*) When fire masked, attack flanks.
(*vii*) Into reserve when covering role is finished.
(*c*) *Some in Reserve under Brigade Commander.*
(*i*) Retained as real reserve.
(*ii*) Used for long range fire if required.

7. If attack consists of more than one phase, make separate plan for each.

8. Arrange for ammunition supply and place officer in charge of arrangements.

9. Machine Gun Company Commander with brigadier, and provided with orderlies.

Appendix No. 7.

Lecture Notes.

TRAINING OF MACHINE GUNNERS.

1. Standard of Training Required.

(*a*) *Officers and N.C.O.'s.* A thorough knowledge of the Mechanical, Theoretical and Tactical side of their work.

(*b*) *Men.* Experts in the mechanical and practical side of training.

2. The Machine Gunner a Specialist.

(*a*) In order to reach the required standard.

(*b*) Because on the Machine Gunner (as for the Artillery Gunner) the success and safety of the Infantry depend.

3. Selection of Personnel.

(*a*) Intelligence or common-sense.

(*b*) Education.

(*c*) Physique.

(*d*) Mechanical, *i. e.,* logical mind.

4. Training (not including training of Range Takers, Grenadiers, Scouts, etc.).

Physical—Physical exercises, running, etc.

Mechanical (Indoors)—Mechanism, Stripping, Repairs, etc.

Practical (Open Country)—Drill, Visual Training, Judging Distances, Fire Orders, etc.

Tactical—Characteristics. Occupation of positions, etc.

5. Training with Other Troops.

(*a*) Training incomplete unless teams have been trained in combination with other troops.

This should not be done until foregoing training has been dealt with.

(*b*) The need for close co-operation between Gunners, Sections, Companies and own Infantry at all times cannot be too greatly impressed.

(*c*) The aspects of the various formations of other troops should be taught.

Appendix No. 8.

Lecture Notes.

ALLOCATION OF DUTIES.

1. General.

(*a*) The various duties of Officers, N.C.O.'s and Men, are enumerated in the *Machine Gun Training Manual.*

(*b*) All should be interchangeable.

2. Machine Gun Company Establishmments.

(*a*) Personnel.

(*b*) Material.

(*c*) Horses and Transport.

(*d*) Ammunition per gun.

3. Duties.

Company Commander. Responsible for—

(*a*) The training of his company.

(*b*) Tactical employment.

(*c*) Administration.

Section Officer. To command his section in accordance with orders from his Company Commander, and in absence of orders, in accordance with the Tactical situation.

In action, most important duties are:—

(*a*) Reconnaissance.

(*b*) Selection of Gun position.

(*c*) Selection of alternative positions.

(*d*) Observe and control fire.
(*e*) Regulate Ammunition supply.
(*f*) Issue instructions regarding movement of limbered wagons.

Sergeant.
(*a*) To supervise guns coming into action.
(*b*) Decides upon exact position for tripods.
(*c*) Assists in fire control.

Corporal.
(*a*) Superintends packing and unpacking of limbered wagons.
(*b*) Moves limbered wagon to suitable position.
(*c*) Responsible that ammunition, water, oil, etc., are supplied to guns as necessary.

No. 1 Firer.
(*a*) Responsible that Gun is "tuned up" ready for firing.
(*b*) Carries tripod into action.
(*c*) Repeats all orders.
(*d*) Observes fire when possible.
(*e*) Responsible for observing movements of his own troops to ensure their safety.

No. 2 Assistant to No. 1.
(*a*) Carries gun and spare parts case into action.
(*b*) Watches for, and passes signals, to No. 1.

No. 3. (*a*) Responsible for keeping the gun supplied with ammunition, water, etc.
(*b*) Carries out minor repairs.

No. 4. Responsible for keeping *No. 3* supplied with:—
(*a*) Ammunition.
(*b*) Water.
(*c*) Spare parts as required.

No. 5 (*Scout*), *No. 6* (*Range Taker*) and *Signallers* perform their own special duties as required, or act as *Spare Numbers, Reliefs, etc.*

Drivers. Act under the orders of the *Corporal* in belt filling, etc. They should *receive sufficient instruction* to enable them to replace *casualties in case of emergency.*

Appendix No. 9.

Lecture Notes.

VISUAL TRAINING.

1. Necessity for Invisibility and How Obtained.

Necessity on account of:—Accuracy of modern weapons.

Obtained by:—

(*i*) Close study and use of ground.
(*ii*) Suitable formations.
(*iii*) Night training.
(*iv*) Neutral tinted uniforms.
(*v*) Smokeless powder.

2. Trained Eyesight Necessary Owing to Invisibility of Enemy.

3. Difficulties to be Overcome.

(*i*) Difference of light; town and country.
(*ii*) Brain power not developed.
(*iii*) Lacks of words:—Military vocabulary.

4. Standard to Aim at.

(*i*) Ability to distinguish enemy from surroundings.
(*ii*) Ability to lay the gun accurately on service marks.
(*iii*) Ability to report on what seen.
(*iv*) Ability to recognize objects described.
(*v*) Establishment of self-reliance.
(*vi*) Study and use of ground.

5. System of Instruction.

Instruction must begin early and be progressive.

(*a*) *Barracks.*

Lectures.
Men taught to recognize their immediate surroundings.
Military vocabulary extended.
Training on landscape targets.

(*b*) *Open Country.*—Objects, to teach men to locate service targets up to 800 yards.

(*i*) *Silhouette Targets,* of different sizes, shapes and colors, arranged against various backgrounds.

Targets counted, their characteristics and positions being described.

(*ii*) *Fatigue Men.*—Instead of targets.

Movement quickly detected. Blank fired to train ear in locating sound.

(*c*) *Examination of Sound.*—Object, to enable men to make clear reports, to understand instructions, and to recognize features of military importance.

(*i*) *Definite Line in Landscape* described in detail.

(*ii*) *Areas of Ground.* Examined and described.

Large areas divided into Sections, *i. e.,* foreground, middle distance and background, etc.

(*iii*) *Road Work.*

(*d*) *Recognition.*

Object—To train the gunner to recognize targets described.

Dealt with in lecture on *Indication and Recognition.*

Appendix No. 10.

Lecture Notes.

INDICATION AND RECOGNITION.

1. Indication.

Definition—The shortest and most easily understood description of an aiming point by a Commander.

2. Why Necessary.

To ensure the cone of fire striking the target as required.

3. Method of Teaching.

Taught in two stages:—

(*a*) Normal method. Descriptions without aid.

(*b*) Description with aids.

A Front will always be pointed out. Objects must always be described as seen with the naked eye and not as seen through glasses.

4. Aids.

Only used when absolutely necessary.

(*a*) Reference objects.
(*b*) Finger breadths.
(*c*) Clock rays.

5. Recognition.

Definition—The gunner's understanding of the exact point at which his Commander wishes him to aim.

Military vocabulary and trained eyesight are essential factors in preparing men for Recognition.

Object.—To teach men to recognize aiming points on which to lay the gun.

Method of Teaching.

Elementary Stage.—Landscape, with or without guns. Recognition always checked.

Advanced Stage.—Open Country—Intervals between guns gradually increased.

Appendix No. 11.

Lecture Notes.

RANGING.

Ranging.—The means adopted for ascertaining the sighting elevation required to hit an object.

1. Necessity for Ranging.

2. Principal Methods.

(*a*) J. D.
(*b*) Instruments.
(*c*) Combination of (*a*) and (*b*) Range Cards.
(*d*) Observation of bullets.

3. Methods of Training in J.D.

Unit of measure.
Appearance.
Bracketing.

4. Lateral J.D.
Necessity for and how taught.

5. Range Taking with Instruments.
Special courses of instruction.

6. Range Cards—Attack—Defence.

7. Observation of Fire.
Value of observation.
Method of ranging by gunner.
Signals—Semaphore.

8. Other Methods of Ranging.
(*a*) Use of maps.
(*b*) Sound.
(*c*) Information from other troops.
(*d*) Forward or back reckoning.

Appendix No. 12.

Lecture Notes.

FIRE ORDERS.

1. General.
Machine guns can be controlled either:—
(*a*) Singly.
(*b*) By sub-section—*i. e.*, two guns.
(*c*) By section—*i. e.*, four guns.
(*d*) By sections.

2. Issue of Orders.
Orders may be issued as follows:—
(*a*) Direct to the Nos. 1.
(*b*) Through sub-section and section Commanders.
(*c*) By Orderlies to sub-section or section Commanders, or to Nos. 1.

NOTE.—The method of conveying an order may be verbal, signalled or written.

3. The Position of the Commander.

Must permit of

(*a*) Observation of fire.

(*b*) Observation of own troops and also enemy's movements.

As Orders are passed from left to right, the Commander should take up position on the left of the guns if possible.

If impossible, arrangements for getting orders and signals to the left gun must be made.

4. Method of Giving Fire Orders.

(*a*) Calmly—otherwise confusion.

(*b*) Loud—sufficient for everyone concerned to hear.

(*c*) Pauses—to allow each part to be understood, acted on, and if necessary repeat.

(*d*) Concise—telegraphic in nature.

The range, if necessary, given first.

Range and indicator may be given either before or after guns are in position.

Fire is usually opened and always stopped by signal.

5. Examples.

(*a*) Ranging fire.

(*b*) Rapid fire.

(*c*) Combined sights.

(*d*) Searching fire.

(*e*) Traversing fire.

During firing alterations of sighting elevation best made by ordering *"up"* or *"down"* the required amount.

Appendix No. 13.

Lecture Notes.

MACHINE GUN RANGE WORK.

General Machine Gun Course divided into two parts.

Part I. Fired on 25 yards Range.

Part II. Classification and Observation Practices.

Object of Part I.

1.

The practices of *Part I* are designed to embrace all points of elementary training, *i. e.,* laying, holding, traversing, searching, etc. They also emphasize the necessity for attention to points before, during, and after firing. By carrying out these points without assistance, and by remedying stoppages which occur, the essential quality of self-reliance is developed.

2.

No man fires until he has passed the tests of elementary training.

3. Instructional.

(*i*) No official records kept other than ammunition expended.
(*ii*) Section officers keep record of results of each man's firing.
(*iii*) No time limit
(*iv*) Repetition.

4. Method of Instruction.

(*i*) Instructor watches firer—not the target.
(*ii*) If mistakes are made, cease fire and criticise.
(*iii*) Criticism at target on conclusion of practice.
General procedure throughout—as at drill.

5. Range Discipline.

(*i*) Quiet instruction essential.
(*ii*) Safety regulations complied with regarding danger flags, etc.
(*iii*) No one permitted in front of socket during firing.
(*iv*) Before going to target, guns unloaded, locks raised.
(*v*) Before returning to quarters, points after firing attended to.

6. Objects of and Methods of Conducting Each Practice.

Part II contains:—
Ranging Practice. (No. 7.)
Classification Practice. (Nos. 9 and 10.)
Observation Practice. (No. 13.)
Firing from Successive Positions. (No. 14.)

2. Time Limit Imposed.

3. Method of Conducting.

4. Method of Scoring and Classification.

5. Duties of Supervising Officers.

Appendix No. 14.

Lecture Notes.

FIRE DIRECTION.

1. Definition.

The term "Fire Direction" as applied to machine guns includes all duties of M.G. Commanders which ensure that the fire from their guns is applied to the best tactical advantage.

2. Most Important Technical Terms.

(*a*) Line of sight.
(*b*) *Trajectory.* Culminating point. First catch, first graze, dangerous space.
(*c*) Cone of fire—beaten zones, danger zone.
(*d*) Angle of sight.
(*e*) Angle of tangent elevation.
(*f*) Angle of quadrant elevation.

3. Method of Fire.

Guiding principle of M.G. fire—produced and applied in groups varying in volume according to the nature of target and the position from which engaged.

4. Application of Fire.

Dependent on appreciation of, and allowance for:—
(*a*) Climatic conditions.
(*b*) Permissible and probable errors in ranging.
Regarding (*a*), necessary to study Elevation and Wind Tables.

ELEVATION TABLE.

More.	*Less.*
Extreme Dryness	Wet.
Extreme Cold	Hot.
Head Wind	Rear Wind.
Bright Light	Dull Light.

WIND TABLE.

(Approximate Allowances.)

Range.		*Fresh.*	*Strong.*
		For Right angle winds	
Yds.	*Mild.*	*allow*	
500	2	4	6 ft.
1000	3	6	9 yds.
1500	6	12	18 yds.
2000	*12	*24	*36 yds.
2500	*24	*48	*72 yds.

5. Devices for Overcoming Errors in Ranging.

(*i*) Combined sights.

(*ii*) Searching.

6. Combined Sights.

(*a*) Definition.

(*b*) Rules governing use of

(*i*) Minimum range.

(*ii*) Differences of elevation.

(*iii*) Ground to be searched.

(*iv*) Number of guns required.

(*v*) Sighting elevation to order.

7. Practical Examples to Exemplify.

(*i*) Correct overlap of zones.

(*ii*) No overlap.

(*iii*) Overlap too small.

8. Control of Guns Using Combined Sights.

(*a*) Using one aiming mark.

(*b*) Using separate aiming mark for each gun.

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*Theoretical.

9. Searching.

(*i*) Definition.
(*ii*) Principle of.
(*iii*) When used.
(*iv*) Examples.

NOTE.—Both devices are suitable for engaging target of great depth.

Example.—Bridges, *Roads,* etc.

10. Traversing.

Definition—A device for engaging linear targets.

Methods.

(*a*) Group traversing.
(*b*) Swinging traverse.

As regards (*a*). A slow method requiring careful training. When engaging linear targets, effect should be sought by bringing oblique fire to bear, thus reducing traversing to a minimum. At ranges up to 1000 yards, one gun, firing one belt, can cover approximately 25 yards of front in one minute.

As regards (*b*). At a range of 300 yards, one gun will cover approximately 30 yards of front in 5 seconds.

NOTE.—Searching and traversing may be combined as required.

11. Auxiliary Line of Sight.

(*a*) Definition.—A line of sight to an aiming mark, other than the target to be engaged.
(*b*) Object.—To enable the firer to maintain elevation and direction, when the target engaged is not visible, *e. g.*, during a gas attack.
(*c*) Example.—Auxiliary line of sight.

12. Night Firing.

(*a*) When gun is laid by day and can be left in position.
(*b*) When gun is placed in position by night.
  (*i*) Laid by day and removed for firing eleswhere.
  (*ii*) Brought into position for first time by night.
(*c*) Devices—Mirrors, luminous stones, etc.

13. Overhead Fire (Direct).

(*a*) Rules for.
(*b*) Safety angles—How obtained.

(*c*) Methods of applying safety angles.
(*i*) Card and string.
(*ii*) Tangent sight.
(*iii*) Combination of (*i*) and (*ii*).

Appendix No. 15.

Lecture Notes.

INDIRECT OVERHEAD FIRE.

1. Value of.
(*a*) With observation.
(*b*) Without.

2.
Officers to be thoroughly conversant with all factors.

3. Rules for.
(*i*) Friendly troops never more than 1500 yards from guns.
(*ii*) When 1000 yards or under centre of cone 25 ft. above their heads.
Over 1000 and up to 1500, 75 feet.
(*iii*) Range to friendly troops accurately obtained, viz.: within 5%.

4. Necessity for Adherence to.
(*a*) Distance of friendly troops from guns.
(*b*) Heights of cones when passing heads of F.T.
(*c*) Accurate ranges.

5. Minimum Range for Engaging Target.

6. Size of Safety Zones on Level Ground.

7. Loss of Safety Zone Due to
(*i*) Worn barrels.
(*ii*) Worn mountings.
(*iii*) Bad holding.
(*iv*) Errors in calculation.
(*v*) Climatic conditions.

(*vi*) Clinometer or dial reading.
(*vii*) Bad laying on auxiliary aiming mark.
(*viii*) Target below gun.
(*ix*) Height of friendly troops above gun.
(*x*) Traversing.

Appendix No. 16.

Lecture Notes.

FIRING WITH THE AID OF MAP AND COMPASS.

1. General.
(*a*) Scale of map suitable.
(*b*) Necessity for map being contoured.
(*c*) Information required from map.

2. Finding Position of Gun.
(*a*) Necessity for *exact* position to be known.
(*b*) Method of overcoming errors due to inexact position.

3. To Find Position of Gun on Map, When in Position on Ground.
"Resection" using three points.

4. To Find Position for Gun on Ground, When Position Has Been Marked on Map.
Use of compass bearings, obtained from map, on ground.

5. To Find Direction of Target from Gun.
(*a*) Using direction dial without compass.
(*b*) Using direction dial with compass.
(*c*) Using a compass only.

6. Practical Points.
(*a*) Deciding on area to engage.
(*b*) Number of guns to employ.
(*c*) Advantages of dispersing guns.
(*d*) Selection of actual gun positions.
(*e*) Arrangements and safety of own troops considered.
(*f*) If guns outside own area arrangements necessary.
(*g*) Provision of strong and invisible emplacements.
(*h*) Checking readings on reference object, when using dial, especially at night.

Appendix No. 17.

Lecture Notes.

EMPLOYMENT OF MACHINE GUNS IN OPEN WARFARE.

No. 1.

General Principles.

1. Reconnaissance.
2. Co-operation.
3. Observation.
4. Justification for opening fire.
5. Targets.
6. Movements.
7. Positions Selected and Alternative Positions.
8. Concealment.
9. Artillery.
10. Escort.
11. Boldness.

Attack.

1. Close support of infantry.
2. M. G. C. C. fully informed plan of operations.
3. Reconnaissance for attack.
4. Definite orders issued to M. G. officers.
5. Definite task allotted to guns.
6. Non-interference by other officers.
7. Methods of Supporting Infantry.
8. Distribution of guns and arrangements necessary.
9. Observation.
10. Enemy Machine Guns.
11. Limbers and Ammunition Supply.
    Examples from Battle Actions.

Defence.

1. Method.
2. All guns under one command.
3. Reconnaissance for defence.
4. General plan of action.
5. Distribution of guns and arrangements necessary.
6. Inter-communication.

7. Special arrangements for night.
8. Limbers and Ammunition Supply.
   Examples from Battle Actions.

Advanced Guards.

1. Duties.
2. Position.
3. Distribution.
4. Special points.
   Examples from Battle Actions.

Rear Guards.

1. Duties.
2. Position.
3. Distribution.
4. Special points.
   Examples from Battle Actions.

Village Fighting.

1. Duties.
2. Flanks.
3. Cross Streets.
4. Exits of Village.
5. Houses.
   Examples from Battle Actions.

Wood Fighting.

1. Duties.
2. Position.
3. Distribution.
4. Special points.
   Examples from Battle Actions.

Appendix No. 18.

Lecture Notes.

MACHINE GUN FIELD WORKS.

1. General

1. Time, labor and material, chief factors.
2. Working parties provided by brigade.

3. Work supervised by a M.G. officer.
4. When elaborate work required, aid obtained from R.E.
5. Obstinate defense of front trenches, depends on M. guns, therefore gunners must be at their posts during bombardment.

2. Sequence of Work.

1. Dug-outs.
2. Open emplacements.
3. Splinter-proof look-out posts.
4. Splinter-proof emplacements.
5. Concrete emplacements.

(*i*) *Strong Dug-outs.*
- (*a*) How sited.
- (*b*) Construction, method of.
- (*c*) Minimum size.
- (*d*) Distance from gun position, etc.

(*ii*) *Open Emplacements.*
- (*a*) When and how constructed.
- (*b*) Dimensions.

(*iii*) *Splinter-proof Look-out Posts.*
- (*a*) Object of.
- (*b*) Construction.

(*iv*) *Closed or Splinter-proof Emplacements.*
- (*a*) Necessity for.
- (*b*) Minimum dimensions.

3. Siting of Emplacements.

(*a*) Dependent on position of guns.
(*b*) Guiding rules.

4. Concealment of Emplacements.

(*a*) Assimilation with surroundings.
(*b*) Loopholes masked or defiladed.

5. Positions of Emplacements.

(*a*) In front of own obstacles.
(*b*) In front of parapet.
(*c*) In the parapet.
(*d*) Behind the parados.

6. Concrete Emplacements.

(*a*) Where applicable.

(*b*) Additional material required.

Depends on Quality of Lime.

(*i*) One of quick-lime to four of ashes.

(*ii*) One of slaked lime to two of pounded brick.

(*iii*) Cement if obtainable.

(*iv*) Ration boxes for molds.

Miscellaneous Headings not Dealt with in the Lecture.

1. Tunnelling.

(*i*) Tunnels may be used—

(*a*) As covered emplacements.

(*b*) As passages to an emplacement.

(*c*) As a dug-out.

(*ii*) *Methods of Construction*—

(*a*) Architectural with—

Sole piece.
Uprights.
Lintel.
Wedges.
Dogs or stops.

(*b*) Coal mining method with—

Feet.
Legs.
Bars.
Wedges.
Lids.

(*c*) Combination of (*a*) and (*b*).

4. Constructional Details.

(*i*) *Protection.* Necessary for guns and teams from rifle, shell, shrapnel, splinter, bombs, and small H.E.

(*a*) Parapet.

(*b*) Headcover.

(*c*) Overhead cover.

(*ii*) *Material.*

(*a*) Loophole boxes.

(*b*) Posts and sleepers.

(*c*) Corrugated iron.
(*d*) Sandbags, rabbit wire, nails, etc.

The Staff Captain of the brigade responsible for producing material on demand.

Appendix No. 19.

EMPLOYMENT OF MACHINE GUNS IN TRENCH WARFARE.

1. General Principles.

Same as in open warfare. Co-operation essential.

(*a*) Between guns.
(*b*) Between sections.
(*c*) Between companies.

Where the enemy are very close, co-operation of guns from a flank must be arranged.

2. Taking Over Trenches.

(*a*) Company Commander's reconnaissance.
(*b*) Order by Company Commander to section officers.
(*c*) Section officers reconnaissance.

3. Reliefs.

(*a*) Responsibility for proper reliefs.
(*b*) Number with each gun.
(*c*) Position of reserve numbers.
(*d*) Relief of sections.
(*e*) Assistance from infantry in transporting guns, etc., in trenches.

4. Occupation of Trenches.

Points to be considered—

(*a*) Bombardments.
(*b*) Ammunition.
(*c*) Emplacements.
(*d*) Control of guns.
(*e*) Cleaning of guns.
(*f*) Periscopes.

(*g*) Position of Company Commander, Sections Officer, guns, etc., known to gunners.
(*h*) Traversing fire.
(*i*) Firing without tripods.
(*j*) Shovels.
(*k*) Opening fire.
(*l*) Very pistols.
(*m*) Grenadiers.
(*n*) Order boards.
(*o*) Gas attacks.

5. Communication in Trenches.

Means available—

1. Telephone belonging to infantry.
2. Orderlies.
3. Visual.

6. Miscellaneous.

1. Overhead and indirect fire.
2. Enemy machine guns.
3. Subsidiary line of trenches.

The Defense.

8. General.

(*a*) All guns under direction of one officer.
(*b*) Position of Lewis guns of battalions known to this officer.

9. Duties of Machine Guns.

1. Prevent enemy leaving his trenches.
2. Sweep all ground between enemy's and our trenches.
3. Prevent enemy entering our trenches.
4. Isolate portions of our trenches if captured.
5. Sweep communication trenches leading from our front line to support line.
6. Sweep all ground between our front and support line.
7. Provide emergency belts of fire from rear to replace broken belts.
8. Engage enemy when concentrating for assault.
9. Sweep covered approaches to enemy's defensive line.

10. Engage enemy machine guns.
11. Sweep ground in rear of enemy's lines.
12. Provide covering fire for counter attacks.

10. Distribution of Guns.

1. In the front line trenches.
2. In or near support trenches.
3. In position in *Rear*.
4. In strong places just in rear.
5. In reserve.

The Attack.

11. General.

1. M. G. Commander to know plans early.
2. All machine guns and Lewis guns under M. G. Commander's orders.
3. Conference of Company Commander and Section Officers, and detailed plans made, based on reconnaissance.
4. Allot each gun, or group of guns, definite task.
5. All must know their duties and object in view.
6. All guns to be in position before preliminary bombardment.
7. No officer other than M. G. Commander to allot tasks.
8. If attack consists of more than one phase, separate plan necessary for each.

12. Duties of Machine Guns.

1. To cover the infantry advance:—
   (*a*) Firing on enemy's parapet.
   (*b*) Keep down fire from flanks.
   (*c*) Sweep ground behind enemy front line.
   (*d*) Help our infantry out of trenches.
   (*e*) If attack fails, keep down fire.
   (*f*) Engage hostile flank attacks.
2. To go forward with attacking infantry to make good ground won.
3. In Reserve.
   (*a*) As a reserve of fire power in hands of Brigadier.
   (*b*) For long range firing if required.

13. Ammunition Supply.

Officer to be in charge of arrangements.

14. Position of Company Commander.

With the Brigadier.

Appendix No. 20.

ACTION FOUGHT ON THE MARNE,

SEPTEMBER 8th, 1914.

After a preliminary reconnaissance by Brigadier, 2 Battalion Commanders, Company Commanders and Machine Gun Officers.



The Commanding Officers told their Machine Gun Officers to move to the left flank and take up a position to protect the left flank. No escort was asked for, and none was given (nobody thought about it).

(*a*) Two battalions of our infantry advanced to line A-B under heavy shrapnel fire, suffering very considerable casualties. Up to this they never came under rifle fire. They made very slow progress from this point owing to heavy shrapnel fire.

(*b*) The two machine gun sections took up a position at X in the fringe of a wood, where they had good command, where they were well concealed and could fire at any enemy who attempted a flank attack on our troops.

(*c*) There was a high ridge on our front and left front, and a valley between that and our position. This ridge was held by Uhlan patrols, these were fired on and dispersed, each Section Officer working his own Section but previously came to an arrangement as to which part of enemy's line they would take on. The range varied from 1,200 yards to 1,800 yards.

(*d*) A party of gunners (without guns) acting as M. I. came through our position and disappeared into the valley below. Seeing these, I suppose about 30 enemy, who had been concealed behind a hedge C-D advanced. They were allowed to come well into the open, and then traversed with 2 guns at 700 yards.

Those who got away retired behind the same hedge, and immediately 4 guns traversed this hedge two or three times, and then put up the sights and vertically searched the wood (E) behind.

Over a hundred dead Germans were buried in this spot next day, and the only fire directed at this area was from these four machine guns.

(*e*) The machine guns having fired a great many rounds from this position were moved to K and fired at enemy moving through wood E towards left flank of D. C. L. I. However, the machine guns were located here and forced by well-directed rifle fire to move, and went back to X.

(*f*) Enemy counter-attack had now developed in some strength at Z and was forcing back the left flank of our infantry. M.G.'s at X fired at enemy counter-attack and drove them back, enabling the infantry to advance again.

(*g*) Ranges were taken by Barr and Stroud, and Range-cards were made previous to coming into action.

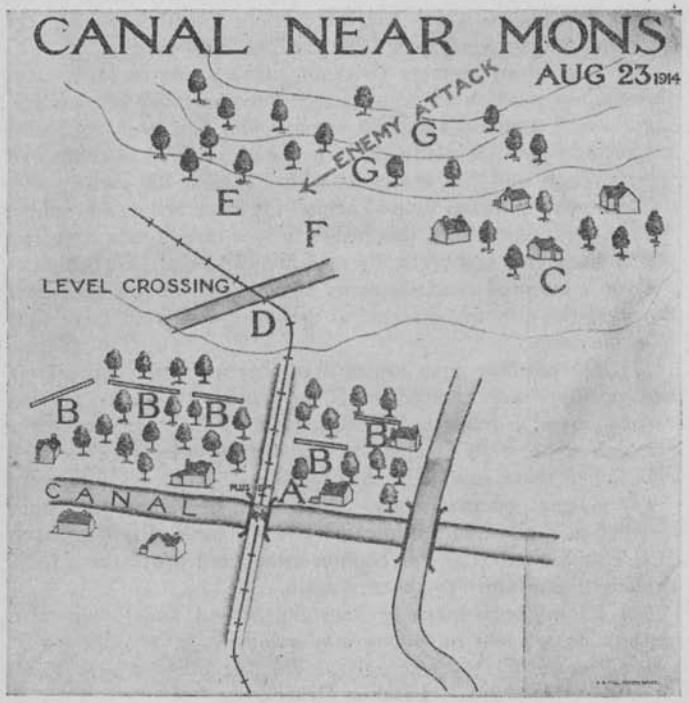
Lessons Drawn.

1. Value of Range-cards.
2. Escort to isolated M. G. on flank should have been provided.
3. Mutual support between M. G. Officers.
4. The M. G.'s protected the flank of infantry against counter-attack. It would have been a different story had M. G.'s not been there.

Appendix No. 21.

ACTION ON THE CANAL NEAR MONS, AUGUST 23rd, 1914.

(*a*) Guns were placed at barricade on railway bridge (A), 15 feet above level of infantry trenches (B).



About 12 hours were available to prepare the position, and a strong barricade of railway sleepers was made and the front was well wired. Range Cards were made out. Overhead fire field of fire 1,000 yards.

(*b*) Enemy brought machine gun into house (C).

Orders: Combined sights, 800 yards; 100 yards differences.

Right gun hit top of window, and left gun fired through window where gun was located. Enemy gun never fired.

(*c*) Enemy shelled all houses round bridge but did not locate our machine guns.

(*d*) Enemy infantry started to dribble across level crossing at (D).

Orders: 500 yards; level crossing; outwards traversing.

All cover near the crossing was also searched and enemy movement was stopped.

(*e*) Enemy Staff Officers made reconnaissance at (E) 1,000 yards. One gun fired at them and they withdrew.

(*f*) The bridge was heavily shelled by shrapnel shells, and heavy machine gun and rifle fire was concentrated on it. The latter was badly directed and all bullets were well over. By lying close under the barricade we suffered no ill effects, but one gun was temporarily disabled.

After about half an hour the enemy stopped shelling, evidently thinking that guns were out of action.

(*g*) Two battalions, enemy in close formation then advanced over open ground at (F) about 600 yards. Traversing fire backwards and forwards, up 100 more traversing, up 100 more traversing, down 100 more traversing, etc. Five belts were fired by the one gun at the time in action. Long bursts of fire were used. Heavy loss was inflicted on the enemy, and they scattered in a regular panic. The section was delighted and shouted with glee at the enemy's discomfiture.

(*h*) The limber was 200 yards in rear of position, behind a bend in railway embankment.

Lessons Drawn from this Action.

(*a*) Value of Barr and Stroud, which enables M.G. to turn on to any target that appears, at once.

(*b*) Easy control of gun in this case.

(*c*) Caution in selecting houses as M. G. positions, good work may often be done from a house, it gives good command. But long stays in these should be avoided.

(*d*) By keeping quiet, saved being knocked out.

(*e*) Effect of M. G.'s on massed formation.

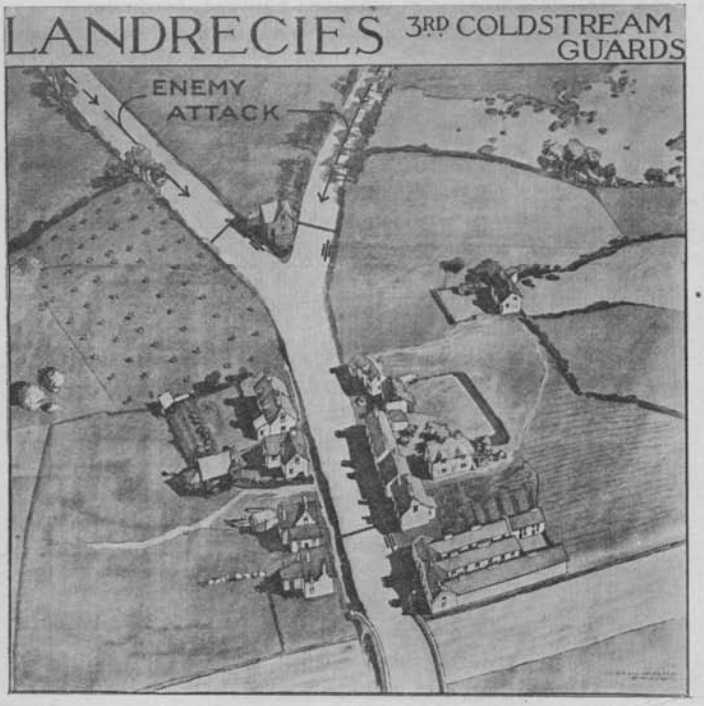
(*f*) Limber close up to carry out repairs quickly and fill belts.

(*g*) Good moral effect of M. G. support on own troops.

Appendix No. 22.

ACTION AT LANDRECIES, AUGUST 25th, 1914.

On August 25th, the Third Battalion Coldstream Guards marched into *Landrecies,* arriving there about mid-day. They



were billeted in French barracks just north of the canal, and on the outskirts of the town. To the north of the town was a long straggling street about 700 yards long and beyond this was the open country, across which the road ran away to the north. At about 5 p. m. a report was received that German troops were advancing towards the town with the result that one company and the machine guns of the Third Coldstream Guards were

sent to guard the northern end of the town. About 300 yards from the farthest end of the straggling street there were two forked roads both leading towards the enemy, with a small house at the junction. It was here that the machine guns and the company took up their position, with one gun guarding each road—strands of wire were stretched across the road. At about 7 p. m. an English Mounted Patrol, passed through the wire coming from the direction of the enemy and informed the officer in command of this company that French Infantry were coming along the road a short distance behind him. The captain of the company thereupon began to move the wire to let the body of infantry through and while he was doing this he heard the infantry advancing, singing French songs as they came along. When they got sufficiently close they were challenged and answered back that they were French troops. In front of them were marching men dressed in French uniforms. On getting quite close they threw the captain of the company on the ground and the fight began. Pte. Robson who fired the left gun, rushed to his gun and attempted to fire, but was at once bayonetted by the enemy; but the right machine was quickly brought back to the end of the straggling street. Our men were gradually pushed back to the end of the village and began rapid fire, driving the Germans back. Throughout the night the Germans continually charged this thin line of men, but owing to the steadiness of the fire and the use of the machine gun, they were mown down before they could reach us.

They brought up two guns, probably small ones, throwing bombs of high explosives, but still they never could approach. During the night these guns, for we borrowed one from the Grenadier Guards, fired about 18,000 rounds of ammunition. The men were never allowed to fire indiscriminately, but were kept well in hand by Major Matheson, who, each time gave the order for three rounds rapid, and then there was dead silence, so that we were able to hear the Germans approaching, for owing to the darkness of the night they could see nothing. The men were behind no cover, but were lying across the open street.

The village was occupied in the following manner:—

(*A.A.*) First position of Coldstreams with 2 Maxims guarding forked roads.

(*B.*) Second position, the second gun is one borrowed from Grenadier Guards.

(*C.C.*) Position at level crossing held by Grenadier Guards.

(*D.*) Skyline.

(*X.X.X.*) Pickets guarding flanks of village.

The Germans also advanced towards Red Lamp, as shown by red line and arrow. At D they became visible on skyline to the troops and M. gun at C, and their advance stopped with heavy loss.

There is little doubt that their intention was to cross the canal by the barge, moving to it via the red lamp.

The placing of the barge being obviously the work of spies.

Lessons Learned.

(*a*) Effect of rifle and machine gun fire when properly controlled, and correct fire orders given.

(*b*) Effect of machine gun fire on a mass in a confined space.

(*c*) Exact position of machine guns not disclosed to Germans owing to the machine gunners taking their orders to fire from the Infantry Fire Orders, and therefore firing at the same time as the infantry.

Appendix No. 23.

ACTION AT NERY, SEPTEMBER 1st, 1914.

1st Cavalry Brigade.

On the night August 30, 1914, the First Cavalry Division was billeted in Nery and were told French Cavalry were holding the high ground to the N———, therefore local protection only was arranged.

At 3 a. m. September 1st a patrol was sent from the Eleventh Hussars in the direction of *Sainimes* and the N. C. O. i/c Patrol reported a German Cavalry Division advancing down the road. The Eleventh Hussars and Fifth D. G. at once saddled up, but before the *Bays* and L Battery was warned, the German artillery opened fire. There was a thick fog and the Germans had moved guns with escort to within 400 yards of L Battery.

The position of the bivouacs was given away by smoke rising from the camp fires. L Battery and 2 squadrons of the Bays

were cut down in their lines and limbers were smashed up—one gun of L Battery managed to come into action and 2 men, though wounded, continued to serve the gun until ammunition gave out—this gun accounted for four (4) out of the eleven German guns on the ridge opposite. The situation was still critical and the M. G. Section of the Bays came into action on



the side of a sunken road. Soon after the M. G. Section of the Eleventh Hussars came into action further to the left and could see through a gap in some trees the left guns of the Germans. Dismounted cavalry by this time were occupying the outskirts of the village. The Germans after this could produce practically no fire and it was the Bays Machine Gunners who did them the most damage; for by this time the fog had lifted and the eleven guns could be seen 400 yards in front.

Later J Battery came up, and afterwards the Middlesex Regiment relieved the cavalry and went forward and captured 8 abandoned German machine guns.

(It is stated, that the German Commander of this force reported that he had been attacked at dawn.)

It has also been reported that the Germans had machine guns mounted on high carriages between their field guns but there seems some doubt about it and nothing is said of what these machine guns were able to achieve.

The lesson to be learnt from this action is the deadly effect of the fire of concealed machine guns against artillery in the open at close range.

Appendix No. 24.

ACTION AT VENDRESSE, SEPTEMBER 14th, 1914.

Black Watch.

The guns were with the advanced guard and the enemy was discovered holding the *Vendresse Ridge*. The advanced guard deployed and attacked. The guns were ordered to support the attack and moved to a quarry B and supported the attack by searching the wood A. The gun was covered by a small party of infantry at C. in some scrub; this party drove some 30 or 40 Germans out of the scrub, who were nearly all killed by M. G. fire at 50 yards range as they fled towards the village. The attack was held up by heavy artillery fire and was unable to progress far. The enemy, about 2 battalions very bunched, counter-attacked from wood A, and were allowed to come right through wood, and then fire was opened with great effect, catching the enemy in enfilade. Fire was kept up till enemy retired right through the wood in disorder, leaving many dead in the wood.

Ranges were between 950 yards and 1,250 yards, and were taken before the action by one man rangefinder.

Lessons Drawn.

1. Value of Rangefinder.
2. Deadly effect of M. G. on troops in close formation.



3. M. G.'s in a forward position on flank to support attack.
4. Escort to machine guns pushed out to protect the exposed flank of the guns.

Appendix No. 25.

ENCOUNTER ACTION NEAR RICHEBOURG L'AVOUEE, OCTOBER, 1914.

Description of Action.

The regiment passed through a regiment of *Alpine Chasseurs* and got to the line A-B where the Germans were encountered following up the French.

One company and three machine guns occupied the enclosure A B, another company continued the line to the left and joined up with Third Division on the left.

Germans brought three machine guns with steel cupolas to haystacks at X out in open, 400 yards from our position, and opened fire on our reserves on the road behind our front line. One enemy gun caught with oblique fire a half company of regiment advancing on our left in extended order and annihilated it. Our machine guns were placed behind the hedge to fire through, but the center gun, not getting a good field of fire, moved to attic of Cottage C, and from this position took on each German gun in turn, killed all the gunners, and during daylight frustrated the attempts of the enemy to take their guns away, on three separate occasions.

The German Infantry near X suffered severely from our machine gun fire and were forced to withdraw. Their supports were caught about Y and considerable loss was inflicted on them.

Lessons Drawn.

1. Value of Barr and Stroud Rangefinder and use of Range Charts.

2. Steel cupolas proved a trap to Germans rather than a protection.

3. Our guns were concealed behind a hedge, and enemy unable to locate exact position.

4. Deadly effect of oblique machine gun fire on an advancing line.

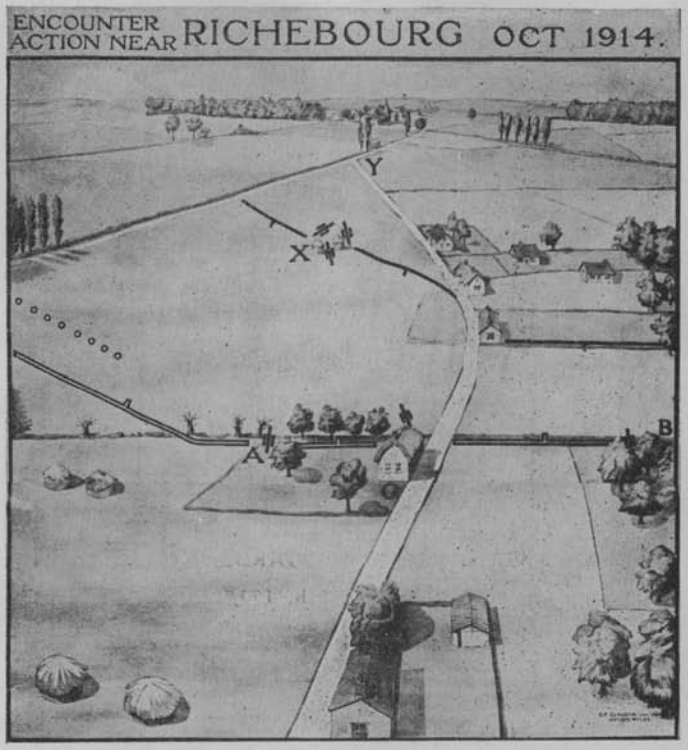
German Attack on Trenches, Richebourg, October, 1914.

The enemy had been bombarding our trenches for several days. On the day of this attack they shelled our trenches from early morning until just before dark; during the last hour the intensity of the bombardment increased considerably.

A point of interest, noticed during this shelling, was the fact that the enemy shelled in depth the whole time and was so con-

sistent in his methods that we always knew where the shells were coming next; this enabled us to move our men along the trenches and avoid the shells.

We had one M. G. in front of the trenches hidden in a thick hedge at A. It was able to enfilade any attack on the trenches to the left of the hedge. The exposed side of the gun was pro-



tected by means of sandbags. In addition to this an infantry post entrenched in the ditch 20 yards further up the hedge was able to prevent the M. G. being rushed from that direction. The trenches on the right were flanked by another M. G. some 400 yards to the right.

The enemy had crawled up through a thick cabbage field under cover of their artillery fire; their further advance was covered by an enemy M. G. which had been pushed right forward in the cabbage field, and which was sweeping our parapets. The fire of this gun enabled them to advance within 50 yards of our trenches, we were then able to see the flash of their bayonets as they crawled forward.

On the command "Rapid Fire" the men in the trenches and our M. G. poured a hot fire into the enemy and drove them back with heavy loss. A party of Germans under an officer in trying to rush our M. G., along hedge was almost annihilated.

The observer posted in the fire trench saw this rush and shouted to the Corporal in charge of the gun, who at once swung his gun round to meet the attack. The post entrenched further up the ditch should been able to deal with this rush, but could not have been looking out.

Points Brought Out.

1. Machine guns covering advance from forward position.
2. Machine gun placed in front of trenches to get better enfilading fire.
3. Observer placed in position where he could also see exposed side of machine gun.
4. Loss of life was avoided by paying intelligent attention to enemy's shelling.

Appendix No. 26.

ACTION OF THE 1st IRISH GUARDS, AT CUINCHY, FEBRUARY 6th, 1915.

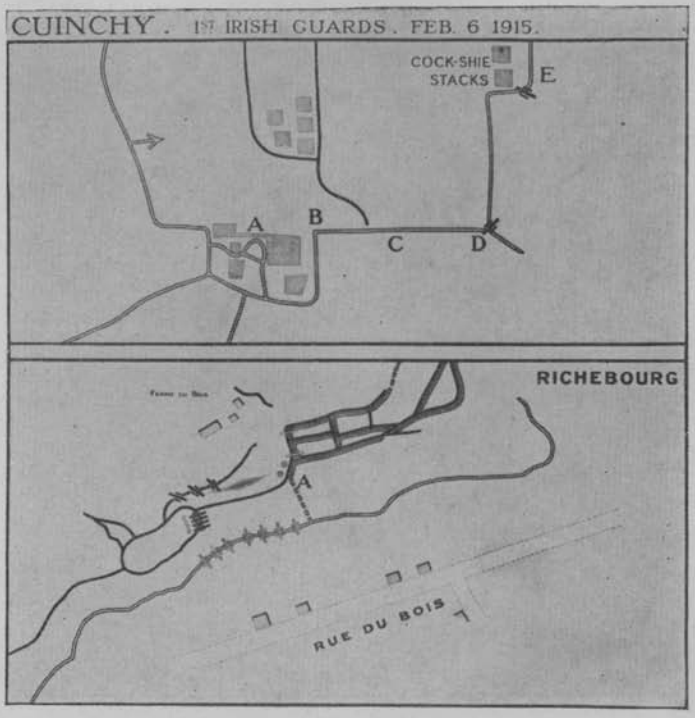
Orders: 1. To take measures to shoot Germans retiring in open.
2. To keep one surprise gun in position to stop German counter-attack.

One gun placed at A to carry out 1.
One gun placed at B to carry out 2.

Gun at B, was not to fire unless heavy counter attack developed and then to allow enemy to get within 40 yards.

Gun A, was taken by Section Officer, only one German showed himself, though bayonets of others were seen while they were filing out of their trenches during bombardment. Section

Officer then saw from position A, that the attacking party were overrunning the objective "marked blue" and nearing the "Cock shie stacks." As it seemed possible that they would be overcome if counter-attacked (they were straggling by this time) gun at A was dismounted and placed ready at C, to cover their retreat to line marked blue, and gun at B, was warned to look out for counter attack.



The attack however, gained line C, D, E, and gun at C, was moved to D, and B gun was ordered up to D. One gun was then moved to E. All this took half an hour.

In this action the Grenadier Guards on the left, who were on high ground, caught the Germans with machine gun and rifle fire as they retired from their trenches, and inflicted severe loss on them.

Points Brought Out.

1. Careful preliminary arrangements.
2. Initiative of Machine Gun Officer in
   (*a*) Appreciating situation.
   (*b*) Rapidly consolidating ground won.



Appendix No. 27.

ATTACK ON HILL 60, APRIL 17th-21st, 1915.

In the attacks on April 17-21, 1915, and the counter attacks against *Hill 60* from April 17 to April 21, 1915, the greatest use was made of machine guns, no less than 35 co-operating. They supported the attack, and were largely instrumental in beating off

the enemy's big counter-attacks on April 21st when splendid targets were offered and many Germans killed.

Arrangements.

Before *Hill 60* fighting, the Brigadier and the B. M. G. O. went round with Sector Commanders and settled where guns should



be placed to bring fire to bear on special places, with a view to keeping down the enemy's fire and bringing fire to bear on the enemy's approaches and likely lines of advance to counter attack. Details were then worked out by B. M. G. O. and M. G. O.'s.

Alternative emplacements were made for frontal and oblique fire in required directions. Range charts were made out—ammunition supply augmented, extra belts in dug outs and at hand.

Action.

Nineteen guns were placed in right Sector, 8 in Center Sector with the assaulting party. Eight guns were in Left Sector. During the attack the 19 guns in Right Sector, and 8 in the left, were concentrated on the rear slopes of *Hill 60,* the *Caterpillar,* the neighborhood of *Zwartellen,* and the enemy's parapets to the right and left of the portion assaulted.

During the counter attack especially on *April 21st,* the 19 guns in Right Sector proved to be splendidly placed. From the Dump and from fire trenches 36 and 37, Germans moving up and across the railway cutting and trying to advance from their trenches behind *Hill 60* were caught and knocked over in large numbers.

Lessons Learned.

1. Careful arrangement by B. M. G. O.
2. Use of Range Charts.
3. Ammunition supply augmented before operations, and arrangements made for belt filling, etc.
4. Advantage of oblique emplacements over those giving frontal fire, the latter were easily located and knocked out by artillery or snipers.
5. Use of Machine Gun fire against enemy trenches on flanks of assault, thereby preventing the enemy from directing flanking fire against assaulting troops.
6. Fire against ground in rear of enemy lines to prevent movement of reinforcements, etc.

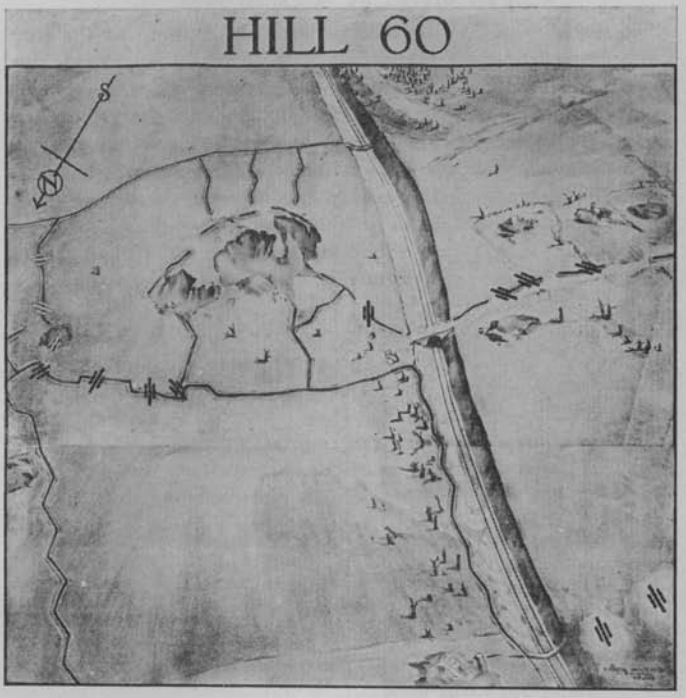
Appendix No. 28.

GERMAN ATTACK ON HILL 60, APRIL 21st, 1915.

The East Surreys held the trenches on the Hill and immediate vicinity of Hill, and took over the position early on the 20th. The Norfolks held the trenches on the immediate right on the railway cutting.

A good solid 24 hours' work was done on the trenches which were organized and made strong. About 5 p. m. on the 20th, the enemy opened intense bombardment on our trenches for half an hour, but no infantry attack followed. Early on the 21st the enemy bombarded with heavy howitzers, the rear of the Hill,

communication trenches on the hill, and support trenches. This was kept up all day and these shells enfiladed our position, so that practically every shell took effect. The communication trenches to the hill and the support trenches immediately behind were destroyed. Enemy machine guns were in Sap A co-operated in firing on the breaches made in the trenches and attempted to isolate the hill by firing across the rear of it.



About 4.30 p. m. the enemy opened probably one of the most intense bombardments of the war on the hill positions and ground in rear. This lasted two hours, and to all intents the trenches on the hill and immediately in rear of the hill ceased to exist. All this time the enemy's machine guns were co-operating and attempted to prevent reinforcements reaching the hill. The enemy, during this bombardment in which it has been estimated

50 batteries took part, withdrew their troops from their front line trenches. After two hours the enemy increased the range of their guns to prevent reserves and reinforcements arriving.

As soon as the bombardment commenced, our field guns kept up a continual fire, thereby forming a screen of shrapnel behind the German lines to prevent the enemy reinforcements arriving.

Part Played by Machine Guns.

The B. M. G. O. visited our guns on the evening of the 20th and approved of their placing, and also made arrangements for support by the guns of the Norfolk Regiment.

Guns 1 to 5 used a large amount of ammunition and knocked over large numbers of the enemy moving up from the railway cutting over the rear slopes of Hill 60 to the assault.

Gun 6 commanded the railway cutting, and on two or three occasions caught the enemy in the cutting near the *Caterpillar.*

Guns 7 and 10 protected the left flank of the Hill, they got no definite targets but effectively swept the ground with fire during the German attack.

During the bombardment the guns were kept in the "dug-outs." Only once a small party of the enemy succeeded in gaining a footing in one trench on the hill, and then were driven out easily.

The Germans made five infantry attacks on the Hill and there is no doubt that the breaking of the enemy attack was to a great extent due to the concentrated cross-fire of machine guns.

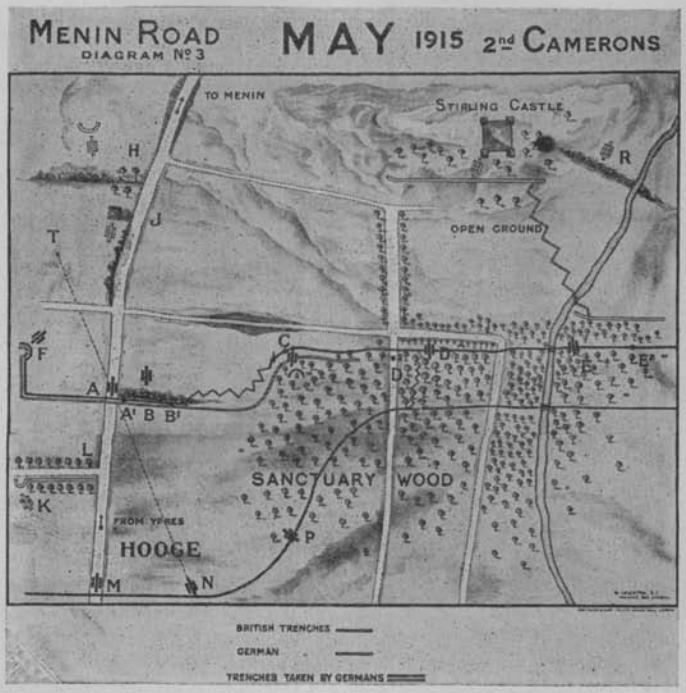
Lessons Drawn.

1. Careful arrangement by B. M. G. O.
2. Guns were kept under cover during bombardment. Tripods were kept in position and two were damaged by shell fire.
3. Four gunners were kept with each gun and remained in reserve about 500 yards back.
4. Some guns in front line and some on commanding positions in rear.
5. Heavy expenditure of ammunition.
6. Defense of a dangerous salient by cross-fire of machine guns placed on the flanks.
7. Use, by enemy, of machine guns for isolating the hill and preventing the advance of reinforcements.

Appendix No. 29.

ACTION ON MENIN ROAD, NEAR HOOGE CHATEAU, MAY, 1915.

FOUGHT BY 2nd CAMERONS.



General Nature of Action.

During the night the British withdrew a distance of 1,000 yards and occupied the entrenched line A, B, C, D, E.

The Germans advanced, and attacked this line under cover of gas and a heavy artillery bombardment.

During the fight, the troops on the left were forced to retire. This necessitated the abandonment of the line A, B, C, and the occupation of M, N, P, D, E.

Arrangement.

The line A, B, C, D, E to which we withdrew, had been prepared beforehand, but no machine gun emplacements had been dug. The line had been prepared under R. E. supervision. There were only five hours in which to prepare emplacements before the line was occupied.

Machine gun emplacements were made at A, B, C, D, and E with alternative emplacements at A1, B1, C1, C2, D1 and E1.

A was on a barricade across the road, B fired through a close set hedge. A and B could cover the road, B could cover it beyond the bend.

C was on a high corner and could cover the open ground between *Stirling Castle Ridge* and our own trenches. D and E were intended to bring cross fire to bear across the open ground in front of *Stirling Castle.*

F belonged to the Regiment on the left.

All guns were in action frequently—the gun at C put a German machine gun at R out of action; guns at A and B caught the enemy behind a hedge near house J. The Germans had a gun at J until it was blown to bits by our artillery. The gun at C fired 10 belts at infantry attempting to advance from *Stirling Castle* against the regiment on the right. The trench in front of C could produce very little fire, owing to casualties, and this gun single handed checked a German advance at 800 yards.

The gun at E enabled the *Royal Scots* to reinforce our line by keeping the heads of the enemy down.

All guns had to change their alternative emplacements on account of shell fire.

Had an adequate number of first class emplacements been made when the line was originally dug, this Section would not have lost 20 machine gunners in two days' fighting.

Ammunition supply was found a difficult problem. Twenty-five belt boxes were buried by shell fire, and when dug out were damaged too much for use. This brings out the necessity for good dug-outs for ammunition, etc.

When the line was swung back the new front occupied was M, N, P, D and then to E as before. The guns at A, B and C were moved to M, N and P respectively.

A conspicuous blockhouse had been made at M for a machine gun, and had to be pulled down as it was a mere shell trap.

The gun at M engaged an enemy machine gun at A1.

Gun at N caught a company of Germans at T and inflicted severe casualties on them. This gun was then shelled and had to move into another emplacement.

German Guns.

The Germans placed their guns at H in a mustard field, at J, in front of *Stirling Castle*, and at B.

When the line was swung back, the Germans brought a gun to K in some bushes, the exact position was not located. They also brought a gun to A1, but it was put out of action by the gun at M.

Lessons Drawn.

1. Great stopping power of well directed machine gun fire.
2. Necessity for machine gun emplacements to be prepared in reserve lines. At the time of their construction these emplacements should be made under the direction of a trained Machine Gun Officer.
3. Necessity for good "dug-outs" for ammunition, etc.
4. Necessity for many alternative emplacements.

Appendix No. 30.

NIGHT ATTACK, NEAR RICHEBOURG, BY 5th INFANTRY BRIGADE DURING OPERATIONS BETWEEN 15th AND 17th MAY, 1915.

Report by Brigade Machine Gun Officer.

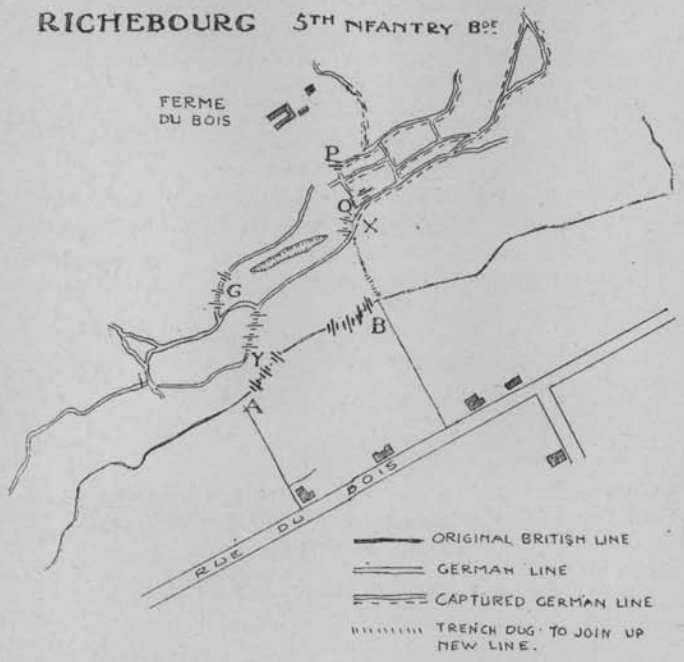
Orders were given for the brigade to attack by night without previous artillery bombardment, a certain frontage of enemy trenches, Sixth Infantry Brigade being on the right and Indian Corps on the left. Our first objective was the second line of German trenches. Owing to there being a wide ditch between the first and second enemy lines in the center of the part to be attacked by the brigade, orders were given that the following procedure was to be taken against this part of the line:

On the German front trench being taken, the four machine guns of the left battalion were to be rushed up to the trench XY, and

were to open a heavy fire on the German second line, whilst parties from the right and left bombed along it.

On the extreme right there was no ditch between the lines and the machine guns were ordered to go forward directly they had news of the taking of the German line, so as to hold it against a counter-attack.

The left attack failed, but the right managed to gain the Ger-



man first and second lines. The machine guns of this battalion were pushed forward, but suffered very heavily doing so, losing their officer and about half the team.

In getting to the German trenches, they found great difficulty in getting a suitable position for their guns, being much hampered by the narrowness of the trenches. The guns were placed at P and Q, to enfilade uncaptured German trenches.

The guns of the left battalion, together with those of another battalion, kept up a continual traversing fire along the German

parapet YX from between A and B. This kept down, to a great extent, the rifle fire directed on our working parties, who were making a communication trench from X to B.

The enemy parapets were very much knocked about, and it is difficult to say where enemy machine guns were placed, but it is thought that 4 guns were at Y placed on ground level and so as to enfilade our attack.

At least 2 other guns were at X, these also enfiladed our attacking troops. One of these latter was captured. Some guns were also at G, in the second line.

Enemy positions always appear to be laterally flanked, so as to enable guns to get enfilade fire. The height of the parapet seems to be arranged, so that from the front it is very difficult to see where a flanking part in the line actually commences. Enemy do not seem to traverse guns much, but rather to effect a wall of fire along a particular line, by doing this they can afford to have a very small loophole which is inconspicuous. Saps forward were found in the enemy's lines, with emplacements at the end of the trench to fire along the ground level. No machine guns were found in these places, and it has been suggested that they were drains, but the fact remains that they were placed just outside the wire and in such a position that fire could be opened along the wire without cutting it.

From experience gained in this action, it would appear to be extremely difficult to make an emplacement in a captured trench as it is bound to be very congested, and yet it is very necessary to bring up some weapon that gives great fire effect from a narrow front. The solution would appear to be the Lewis gun or a portable shield, for use with machine guns, which could be mounted quickly, and allow the gun to be placed on the back of the trench, parados or even in the open.

Lessons Learned from this Report.

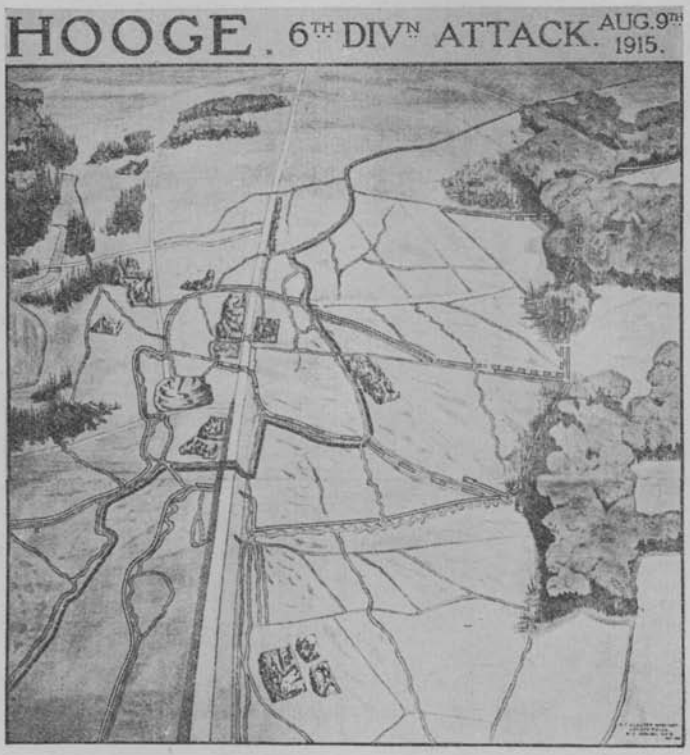
1. Careful arrangements made for the employment of the machine guns according to a definite plan.
2. Suitability of Vickers guns with light tripod mounting, or Lewis machine rifles to move forward and consolidate the position as soon as the infantry have captured it.
3. Use of machine gun fire to beat down enemy fire from the uncaptured part of the trenches.
4. Placing of enemy guns to enfilade our attack.
5. Placing of enemy guns in second line.

Appendix No. 31.

ATTACK ON HOOGE, AUGUST 9th, 1915, 6th DIVISION.

Extract from orders by G.O.C., 6th Division.

"The G. O. C. considers that our best chance of success is to reduce the men in the front line to a minimum, hold impor-

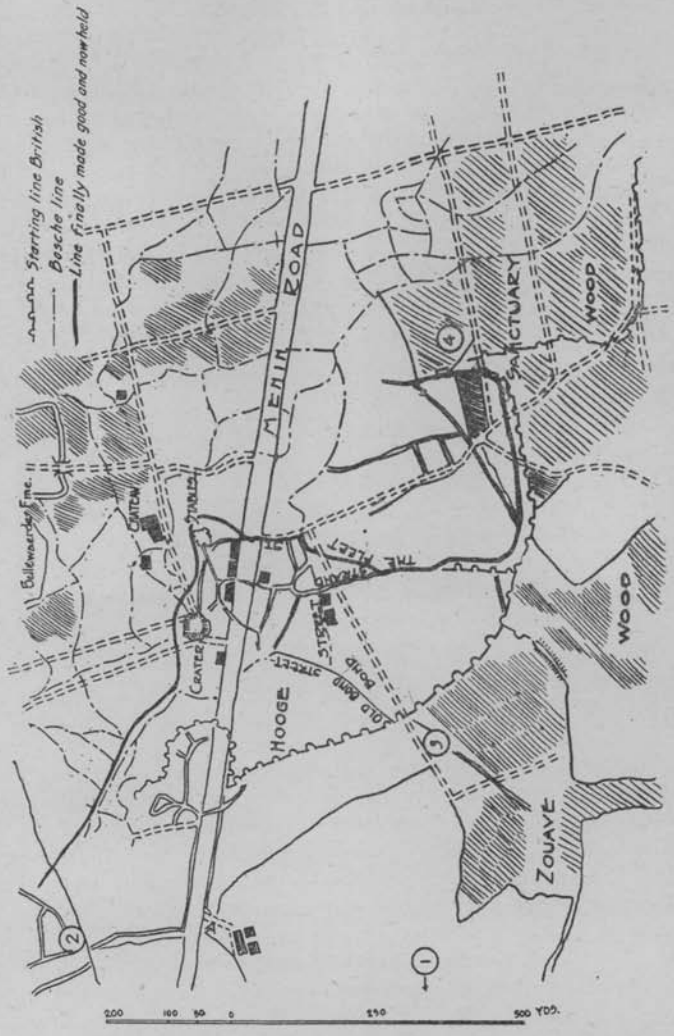


tant points with machine guns, establish communications, and relieve men in front line as opportunity offers."

Extract from 16th Brigade orders, *Left Attack.*

"Machine guns and trench howitzers are to be brought up to the captured line at once."

No orders for machine guns were issued by 18th Brigade.


Starting line British
Bosche line
Line finally made good and now held
MENIN ROAD
SANCTUARY WOOD
WOOD
ZOUAVE
HOOGE
CRATER
OLD BOMB STREET
THE FLEET
CANTON
Bullecourt Fme.
200 100 50 0 250 500 YDS.

Right Attack.

Extract from report of operations by 16th Infantry Brigade.

"Very few German machine guns were apparently left in front line fit to fire. Two or three were found destroyed, and at least one was destroyed by our own men. Later, machine guns opened from places in *Bellewarde Wood,* and from a house at west end of *Hooge*—this was knocked out by our trench howitzer.

"Neither balttalion found any difficulty in getting up their machine guns. There was a little difficulty in getting the team together on arrival in German lines, and also in finding suitable positions for the guns, but they came into action almost at once. The 2d York and Lancaster Regiments' guns got a good target at Germans in the wood."

Extract from report of operations by 1st East Yorks Regt., *Right Attack.*

"1. Disposition of machine guns at commencement of operations at 2.45 p. m.

"2. Machine guns in front line.

"1. Machine gun in left support trench.

"1. Machine gun in redoubt at Battalion Headquarters.

"At 6.45 a. m. one machine gun was sent up to the crater, but returned to *Zouave Wood,* as it was not required, and was placed in the left support trench on its right flank."

Extract from report of operations by 2nd Durham L. Infy. *Right Attack.*

"Three machine guns were sent with the leading line, and three with the second line.

"Four guns reached their destination. One gun was brought down, but 3 were left up—they were buried more than once.

"3.15 a. m. Battalion advanced to the attack. The line *Crater Stables-Menin Road* was reached without much loss. The enemy held the line in some strength, and with machine guns at Q, 17, Fleet Street and Menin Road, also at entrance to the *Crater.*"

General Course of the Action.

The right attack started from *Sanctuary Wood* with the left on the *Strand;* its objective being a line just north of the *Crater* through the *Stables* to the *Menin Road.* This objective was gained.

One machine gun was placed between the *Stables* and the road, had a good field of fire and scattered a large party of the enemy collecting in the wood just north of the road.

The remainder had practically no targets to fire at.

At least two machine guns occupied positions in the *Crater* itself from which they could obtain no view and in which they were at once buried by shell fire. The Machine Gun Officer reported that most of his men were hit as they crossed the ridge in the assault.

The C. O. Sherwood Foresters, who were in support to the right attack had four machine guns under his control—two of them he sent to the right of G1, where they had an excellent field of view and assisted materially in scattering Germans collected for a counter attack.

During the course of the day the enemy's shelling was intense and G1, G2, G3 were blown in, and our troops were forced to evacuate them.

In this attack there was a continuous cry for reinforcements and the front trenches got overcrowded and heavy casualties were suffered. This was contrary to G. O. C.'s orders that as soon as it was captured, the line was to be thinned out and held chiefly by machine guns.

The left attack gained its objective and in this case as soon as it was captured the line was thinned out and held by a minimum of men supported by machine guns.

The Germans collected for a counter attack, but this was dispersed by artillery and machine gun fire, before it materialized.

Points Brought Out.

(*a*) Divisional operations orders defining the role of the machine guns. Sixteenth Brigade operation orders *re* machine guns and their successful employment.

No orders for machine guns in the 18th Brigade orders.

(*b*) Machine guns moved forward with the assault and so suffered unnecessary casualties.

(*c*) Machine guns were well placed by 16th Brigade; some guns of the 18th were badly placed in the Crater, where they had no field of fire; two guns were well placed by the C. O. of the Sherwoods near the right end of C1.

(*d*) The approximate locality which machine guns are to take up in the captured position should be stated in Brigade operation orders in an attack of this nature. This was not done.

(*e*) The enemy counter attack was dispersed by artillery and machine gun fire before it developed.

(*f*) The enemy machine gun fire was very heavy from a commanding fort behind their lines.

(*g*) Large number of enemy machine guns destroyed by our artillery during the preliminary bombardment, which took place at night.

Right Attack.

Report of 2d Lieutenant C. L. Wicke, M.G.O., 2nd D.L.L.

"In the attack on *Hooge* on August 9, 1915, I noticed the following points regarding German Machine Guns:—

During the bombardment of the enemy's trenches by our guns it seemed that the German machine guns were in no way protected in bomb proof shelters, for when the trenches were captured I saw a gun lying completely in the open, practically unharmed but not in or near any position.

In this case the gunners had been sheltering some distance from the gun, and were all killed. There we no traces of any ammunition lying near the gun.

I saw a broken gun in position which had undoubtedly been a machine gun. It commanded the approach along the bank of the *Etang Bellewaarde* near the *Stables*. Near this position was a recess for ammunition but this was empty,—to the left of the position was a bomb proof shelter. This did not seem to have suffered, except for a severe shaking, as a shell had destroyed the supposed gun emplacement. The shelter was made of very strong supports upon which were laid iron sheets about ½ inch thick. On these sheets were concrete sandbags, and finally earth to a height of about 3 inches or 4 inches. The shelters were dug down about 2 inches below the bottom of the trench and the aperture was roughly 2 inches above the bottom of the trench. The parapet and parados was made chiefly of concrete sandbags, chiefly the parados.

There were strong bits of timber supporting the roof. On the 10th this shelter had suffered, but if a few men had been inside, none would have been killed as it did not wholly collapse.

Undoubtedly a well constructed shelter of this description would stop a great deal of hammering with shells of smallish caliber.

In this engagement, if the enemy had made a proper counter attack, which would have been delivered by means of bombing

parties, our machine guns would have been almost helpless, as the land was a mass of communication trenches. This diffculty I overcame by having a couple of bomb throwers near each gun. It seems as though reserve machine gunners should be trained bomb throwers, for the purpose of protecting the gun.

I experienced great difficulty in getting the ammunition boxes up, for 4 Maxims I managed to collect about 20 boxes (belts). The two Lewis guns received no ammunition at all. All ammunition carriers were hit, except a few who collapsed from sheer fatigue, each man being rather heavily weighted.

There were roughly 12 men per gun.

At 8.30 a. m., 10th August, there were 13 men including N. C. O.'s in the whole section. The majority were hit on the ridge during the assault. The guns found practically no targets to fire at. One gun, in front of the *Stables* near the road scattered a large group of the enemy in the wood; this gun commanded a path through the wood, marked by red rings on the trees."

2. Lieutenant Wiche was very much struck with the solidity of the German Machine Gun Team dug-outs, but apparently they did not keep their guns in them at night—most of their guns, therefore, suffered in the bombardment. This rather suggests that in positions in the line where one can be heavily bombarded, machine guns or at any rate some of them should be kept under cover by day and night, but in those portions of the line where the enemy are so close that a bombardment is impossible, and one's only fear is a sudden rush, machine guns should be mounted in position ready loaded, at night.

I think the principle of very strong dug-outs for Machine Gun Teams is of the first importance, as from what I understand if the Germans had had their guns under cover in their bomb-proof dug-outs, they might have made it very unpleasant for our men if they had mounted them and come into action when our bombardment lifted.

The floors of these dug-outs must be below the level of the trench to get sufficient covering on top, and will have to be provided with a pump and proper arrangements for keeping them from being flooded.

Preliminary Arrangement by K.S.L.I.

Prior to the attack, the Machine Gun Officer collected all his N. C. O.'s and men together and carefully explained to them

the nature of the ground and the position of the enemy's trenches relative to their own.

He had five guns under his command, two were to closely support the attacking infantry, one was to be near the C. O.'s battle position and two were to remain in a strong dug-out near *Zouave Wood.*

As regards the first two, one was to go to each end of the line assaulted by his battalion; they were to move up as soon after the support line as possible.

He himself was to accompany the right gun and the sergeant the left gun. It was arranged that each man should have some cleaning material, some of the spare parts were also distributed.

The day before the attack, he took his N. C. O.'s and explained to them the situation on the ground, pointing out the importance of cross-fire.

These arrangements were slightly altered on account of an order from the Brigade Machine Gun Officer that the two leading guns were to accompany the front assaulting line.

Although the M. G. O. was killed in the assault, there was no confusion among the machine guns. The three, that eventually consolidated the captured line, occupied good positions giving flanking fire.

Appendix No 32.

NOTES ON THE EMPLOYMENT OF MACHINE-GUN BATTERIES DURING RECENT OPERATIONS, SEPTEMBER, 1915.

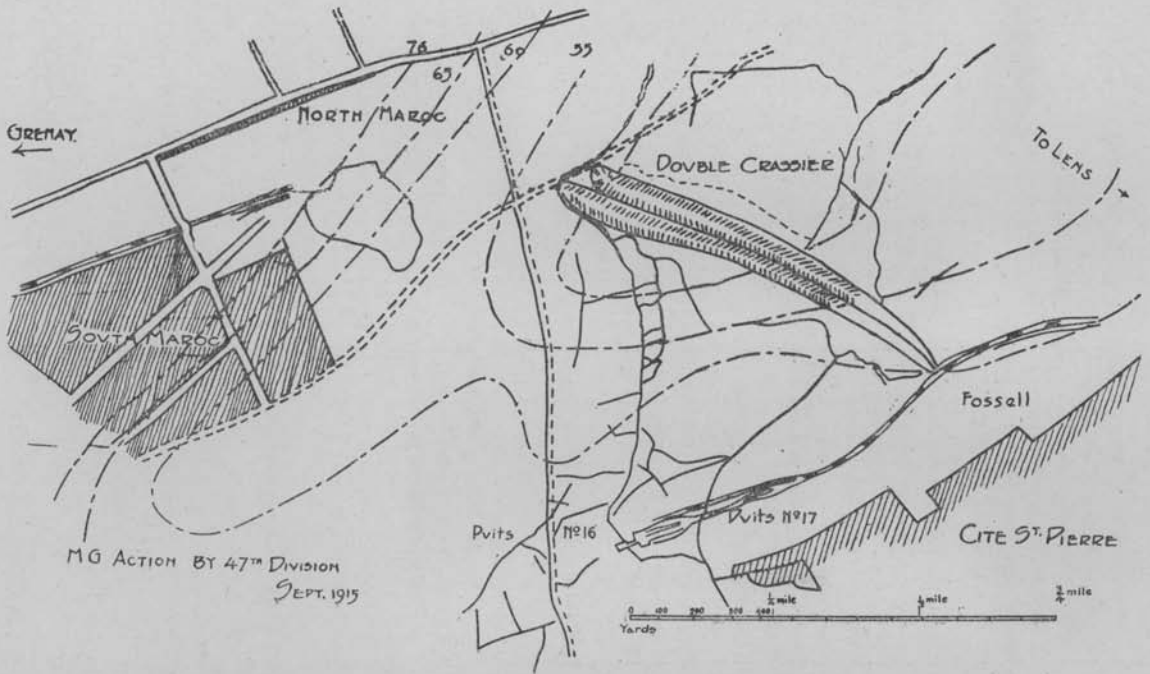
47th (London) Division.

The following notes on the employment of brigade machine-gun batteries are compiled from the reports of the officers commanding machine-gun batteries of the infantry brigades of the division:

1. Organization.

The batteries consisted of 6 Maxim guns, divided either in two sections of three guns each or three sections of two guns, the latter would appear to be the more suitable arrangement.

The battery was commanded by the brigade machine-gun officer and the personnel consisted of the detachments which normally worked the guns detailed to form the batteries.


78
63
60
55
GREMAY
NORTH MAROC
SOUTH MAROC
DOUBLE CRASSIER
TO LENS
Fossell
Puits Nº16
Puits Nº17
CITE ST. PIERRE
Yards
MG ACTION BY 47TH DIVISION
SEPT. 1915

The following additional equipment was provided:—
1 Seige lamp per gun.
1 Set of telephone and 1 mile of wire per battery.
1 Abney level per battery.

2. Functions of the Batteries.

In the case of the batteries supporting the two attacking brigades (the 140th and the 141st Infantry Brigades) their functions were to cover the advance of the attacking troops by bringing fire to bear on the enemy's second line and communication trenches, to sweep with fire places where he was likely to mass for a counter-attack, to take advantage of any favorable targets offered and generally to control the area attacked by their brigade and its approaches.

The third battery was intended to control the area 2 of the *Double Crassier,* to prevent enfilade fire from the hostile trenches in this area and to break up any hostile counter-attack from the line *Puits* 16 to *Puits* 11.

3. Positions.

Positions were selected for the two batteries supporting the attacking brigades slightly behind the reverse slope on the east side of *North Maroc,* and for the third battery in houses in the eastern portion of *South Maroc.* The emplacements for these latter were made on ground level, the personnel being under cover in the cellars of the houses while working the guns.

Alternative emplacements were made for each battery and dummy emplacements to draw the enemy's fire.

4. Type of Emplacements.

The emplacements were of the platform type in all cases and were not provided with loopholes or overhead cover. The communication trenches leading to the emplacements were covered to render them as invisible as possible on air photos. Bombproof shelters and recesses for ammunition were provided. It was found advisable not to use ordinary working parties for the construction of the emplacements, etc., but to construct them by means of the personnel of the batteries, assisted by

other machine gunners, when available. The 142nd Infantry Brigade on the defensive front took 5 days to complete their emplacement communication trenches and to link cellars.

5. Control of Fire and Communications with Infantry Brigades.

On the attacking front, the officer commanding each machine-gun battery was connected by telephone with the G.O.C. Infantry Brigade which he was supporting.

In the case of the defensive front, each section was connected by telephone with the officer commanding the sector and with each other.

Range charts were prepared and zones allotted to sections and guns.

Fire was only opened at the last moment when the enemy's fire made it certain that the assault had been launched and observed. The range was increased and targets altered as the attack progressed.

Control of fire was difficult, and would be facilitated by increasing the number of the telephones so as to enable each section to be connected with the Battery Commander.

6. Ranges and Method of Fire Adopted.

Though direct fire could be normally employed from each battery, it was considered wise to provide against targets being concealed by the smoke cloud during and after the gas and smoke attack. For this purpose, elevations were taken by level and clinometer and aiming posts were placed in position for day and night firing (with siege lamps). Clinometer elevations were taken direct off the gun beforehand, and charted for use in the attack. The screws controlling the elevation gear and tangent sight, were tightened previous to the action.

These precautions proved invaluable, as direct aiming and observation were impossible for some time owing to the smoke.

In one case an aiming was disturbed by a German shell. It was replaced as near as possible in the same position and the elevation checked by clinometer.

7. Targets.

When the assault was delivered the batteries supporting it opened fire on suspected strong points and machine-gun emplace-

ments in the second line, firing bursts and traversing for 50 to 100 yards, in each direction. Next the communication trenches leading to the second line were vertically searched, traversing fire being employed. Finally the line of the railway to *Fosse 11* was dealt with.

Targets were detailed to sections, and the bursts of fire lifted so as to keep them ahead of our advancing infantry.

At the opening of the attack the battery covering the defensive front, concentrated fire on selected points where machine guns were suspected. The front line and communication trenches south of the *Double Crassier* were traversed and searched and the *Mine Buildings* of *Puits 16, Cite St. Pierre* and roads in rear of the German line were fired on, range being taken off the map.

Fire was concentrated for a period on the communication trenches leading to the eastern end of the Double Crassier at the request of the O.C. Sector, as it was reported that a counter attack was being launched through them.

8. Observation.

Observation of fire was difficult owing to the smoke cloud, and when that cleared owing to the ground being still wet. Observation was, however, possible from time to time on loopholes, wooden posts, brick walls, etc.

9. Movement of Guns Forward.

Two batteries remained in their original positions covering the front, but that of the 141st Infantry Brigade, whose final objectives were found situated furthest from our line, was pushed forward early. Its sections were broken up and employed to strengthen the firing and support lines.

10. Ammunition Expenditure.

The expenditure of ammunition by the battery of the 142nd Infantry Brigade covering the defensive front was about 8,000 rounds per gun during the period, September 25th to the night of October 1-2.

No figures have been received from the other brigades.

11. Moral Effect.

Both the 140th and 141st Infantry Brigades report that the sound of the machine gun battery firing over the heads of our

advancing infantry had an encouraging effect and added greatly to the confidence of the latter.

(Sgd.) H. HUBERT HITCHCOCK,
Lt. Colonel, 47th (London) Division.

G/503. 13/10/15.

Appendix No. 33.

ATTACKS OF THE GUARDS DIVISION NEAR LOOS.

During the night (26th-27th) the 2nd Guards Brigade relieved portions of the 21st Division, that were holding the trenches near the *Loos-La Bassee* road.

Monday—Supporting Attack.

In the morning the B.M.G. Company Commander had 12 machine guns on a front of just over 400 yards just to the north of the village; their rôle was to give covering fire on to Puits No. 14 bis and "B." Four guns, which were further to the north, had orders to closely support the attacking infantry, when the latter had gained their first objective, namely, Chalk Pit Wood.

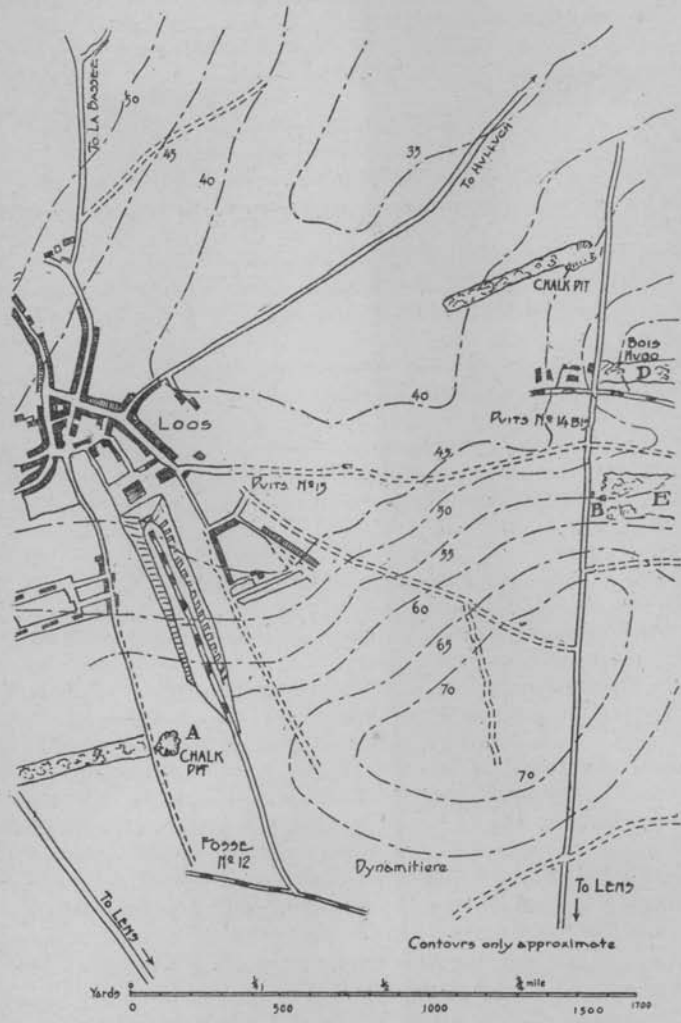
Consolidation of Position.

After various fluctuations the attack finally came to rest slightly in front of and parallel to the southeast edge of Chalk Pit Wood.

The four machine guns, whose teams had advanced across the open in extended order, to simulate the formation adopted by the infantry, were placed as follows:

Two guns on the left, the exposed flank; they had alternative positions to enable them to cover a gap of about 900 feet which lay between Chalk Pit Wood and the troops further to the north. The third gun was by the southwest corner of the wood. The fourth was further to the southwest. In siting the guns care had been taken to avoid the single house; one gun was knocked out, because, as was afterwards noticed, its position was in line with the edge of the wood along which the enemy were traversing with shell fire.

During the same afternoon the 3rd Guards Brigade advanced through *Loos* and by 6 p.m. commenced its attack on Hill 70, the 1st Battalion Welsh Guards leading.


To La Bassee
50
45
40
35
To Hulluch
Chalk Pit
Bois Nuoo
D
40
Loos
Puits No 14 Bis
45
Puits No 13
30
E
B
35
60
65
70
70
A
Chalk Pit
Fosse No 12
Dynamitiere
To Lens
To Lens
Contours only approximate
Yards
0
500
1000
1500
1700
mile

Supporting Attack.

Two machine guns went in close support of the attack. They kept away to the right flank in order to be able to bring cross fire on to the enemy's position.

Consolidating the Position.

While the battalion was reorganizing on the northwest slope of the Hill, the machine gun officer sent back for his other two guns. These four guns were placed about 60 to 80 yards apart to guard the right end of the line; this end was supported by a gun of the 10th Hussars echeloned in rear.

During the night two more machine guns were brought up; they were placed to flank the centre and left of the line.

This end was supported by the guns of the 6th Cavalry Brigade in *Loos*. The remainder of the machine guns of the 3rd Guards Brigade were in or about the village.

Tuesday, 3.45.

Two companies of Coldstream Guards and a party of bombers were ordered to attack Puits No. 14 bis and Bois Huge at 3.45 p.m.

The attack was covered by the machine guns near Chalk Pit Wood, by those along the *Loos-La Bassee* road and by those of the 6th Cavalry Brigade.

As soon as the infantry left their trenches, they were engaged by German machine guns at Bois Huge. The flash of an enemy gun firing due west was seen in the building near the Puits. Our magazine gun near the Chalk Pit opened fire on certain points in *Bois Huge,* at which movement had been noticed in the morning; this caused the enemy machine gun fire to slacken.

Arrangements had previously been made for the two left hand guns (near the Chalk Pit) to move up in support of the attack, should it be successful. One of the guns at the right end of the line was to move along to replace the former. The attack, however, did not succeed. Our machine guns fired long bursts of fire to cover the retreat of the survivors.

Appendix No. 34.

ACTION NEAR THE HOHENZOLLERN REDOUBT.

1. The following account of a bombing fight which took place near Huise and Hohenzollern Redoubt on October 8th, 1915, was

received from an officer of the 1st Guards Brigade M. G. Company.

At 4 p.m. the Germans began a bombing attack and succeeded in driving the regiment nearly out of 200 yds. of trench. I managed with a Corporal and a man to fix up a gun in a handy latrine where it was hidden from the Slagging and from where I could see their bombers down to their waists as they got up on to a firing step, presumably to throw (they got up in threes). I got on to them at 100 yds. in short berths and could see them falling back into a trench. Another of my guns was on the same target from another point. This seemed to check their bombing and allowed our bombers to get going.

2. Near the same locality our men were ordered to bomb the Germans out of part of an international trench; this attack was to begin at dawn. Just before daylight a machine gun on a light tripod was brought up level with the barricade into a position where it was screened from rifle fire from the flank. When our bombers crept into the neutral portion of the trench the German bombers stood up on the firing step to throw direct on to our men. On each occasion they were knocked out by the machine gun. The M.G.O. stated that a Lewis gun would have been preferable for this job, as it could have more easily followed up the advantage gained.

3. For the purpose of boring loopholes through traverses to enable Lewis guns to co-operate with bombers, a M.G.O. states that he used a 3″ x 2″ square revetting stake pointed at one end. On one occasion he made a loophole 12 feet long: he found it advisable to keep dipping the sharp end of the stake in water.

4. Instances have occurred where it has been found inadvisable for machine guns to try to assist attacking bombers, from positions in rear. On one occasion several casualties were caused amongst our men by one of our guns.

5. The following ruse was noticed near the Hohenzollern Redoubt. A communication trench had been barricaded by us and by the enemy, the latter then filled the trench in for a few yards behind their barricade and retired, making another just out of range of the former one. The block in the trench was covered by a machine gun placed in the eastern side of the Dump of Foss 8 at a range of 500 yds. Our men finding no enemy

opposition as they crept into the neutral portion of the trench, tried to rush the dummy barricade.

Each time they were knocked out by a fire from the machine guns as they scaled the block in the trench.

6. During our attack on *Loos* a sergeant with a party of bombers managed to enter a fortified house containing a German machine gun, and destroyed it.

Appendix No. 35.

ORDERS FOR SENTRY AND GUN TEAM COMMANDER AT NUMBER —— GUN POSITION.

1. Fire is only to be opened by order of the Gun Commander unless a sudden emergency arises, in which case the sentry will use his own initiative.

2. When relieving another gun team or sentry, the following facts will always be ascertained:—

(*a*) Whether the gun has been fired during the relief.

(*b*) If fired, what the target was.

(*c*) If fired, the emplacement from which it was fired.

3. The sentry will always inspect the gun when taking over the position.

4. The sentry on duty must have an accurate knowledge of the points shown on the range card.

5. In case of alarm, or a gas attack, the sentry will wake the gun team.

6. The gun will not be mounted in an emplacement, except during the hours of darkness, and unless the situation makes it imperative.

7. The gun will be cleaned daily, and the weight of the fuzee spring noted, both morning and at night.

8. Ammunition, spare parts, and hyposulphite solution will be inspected daily.

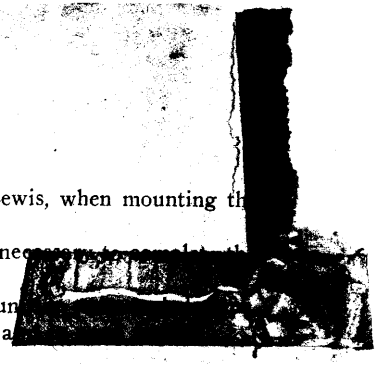
9. The lock spring (return or hammer spring) will never be left compressed.

It is generally sufficient to half-load, and press the double button with the Vickers or Maxim, to press the trigger and then enter the belt in the case of the Colt, or to place a magazine in

position on the magazine post of the Lewis, when mounting th
gun at night.

In order to meet an attack, it is only ne
loading motion.

10. All dug-outs, emplacements, ammun
to the Gun Position must be kept clean a

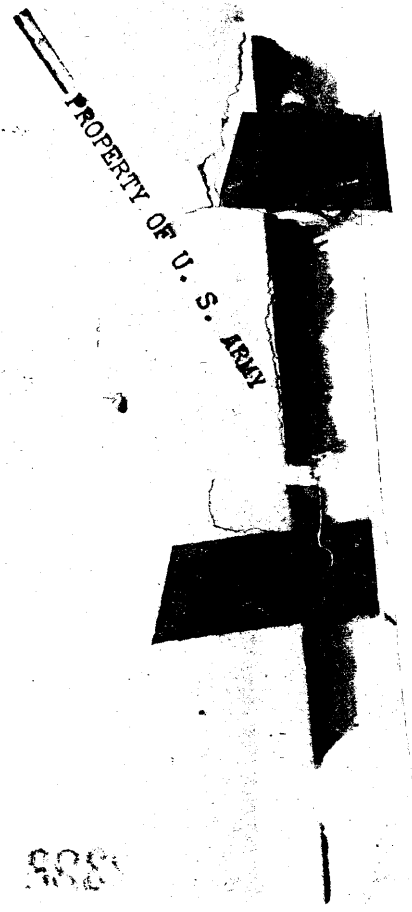


Special Orders for this Gun Position.

11.
12.
13.
14

Date :

Machine Gun Officer.



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LIBRARY REGULATIONS

1. Books, pamphlets, and periodicals must be charged at the loan desk (signature on book-loan card) before being taken from the Library.

2. Any item drawn from the Library must be returned within one month.

Exceptions to this regulation are as follows:

(1) Material issued to classes as a whole.

(2) Material issued to instructors for professional use.

(3) New books which are in demand must be returned within one week.

(4) Books required for faculty use are subject to recall at any time.

(5) All persons having library material in their possession will return same before leaving the post permanently.

(6) Books loaned outside the School must be returned within two weeks.

3. Reference books and current periodicals will not be removed from the library.

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M.G. BARRAGE

COVERING ATTACK AT

MESSINES

23 BATTERIES – 144 GUNS

B/27

NOTU

MESSINES

WULVERGHEN RIDGE

25th. DIVISION

STEENEBEEK RIVER

RIVER DOUVE

RIVER DOUVE

HILL 63

PLOEGSTEERT

LEGEND.

Blue Line	BRITISH FRONT LINE TRENCH.
Red Lines	ENEMY TRENCHES
Blue Barrage	BARRAGE OF 25th. DIVISION
Yellow "	BARRAGE OF 3d. AUSTRALIAN DIVISION
Green "	FRONTAGE & BARRAGE OF NEW ZEALAND DIV.
Red "	CO-OPERATION BARRAGE OF 9th. CORPS.
Green Ovals	ENFILADING MACHINE GUN BARRAGE OF N.Z. DIV
Yellow "	ENFILADING MACHINE GUN BARRAGE OF THE AUSTRALIAN DIVISION

M.G.S. M.G.T.C.

The green and yellow barrages creep forward at an average rate of 100 yards in four minutes