The Value of Artillery in the Field

Major-General C. H. Owen late R.A.

To cite this article: Major-General C. H. Owen late R.A. (1889) The Value of Artillery in the Field, Royal United Services Institution. Journal, 33:147, 81-120, DOI: [10.1080/03071848909441230](https://doi.org/10.1080/03071848909441230)

To link to this article: <http://dx.doi.org/10.1080/03071848909441230>

Published online: 12 Nov 2009.

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

Article views: 3

View related articles [↗](#)

Friday, February 8, 1889.

GENERAL SIR J. A. LINTORN SIMMONS, G.C.B., G.C.M.G., R.E.,
in the Chair.

THE VALUE OF ARTILLERY IN THE FIELD.

By Major-General C. H. OWEN, late R.A.

THE value of artillery in the field as a powerful instrument of destruction has been long recognized, at any rate since Napoleon, and his able artillery commanders Senarmont and Drouot, showed what better organization and increased mobility enabled them to accomplish with their guns at Friedland and in other battles.

During the long peace succeeding the Battle of Waterloo little attention was paid to artillery tactics, and in this country field artillery had been reduced to such a low point, that a few years before the Crimean War it would have been difficult to collect more than half a dozen batteries for any expedition abroad. It was only in 1848 that our troops of horse artillery were increased from two to four guns, and in 1852 both horse and field batteries were raised to six pieces, and the latter augmented to twenty batteries. This augmentation was obtained by Lord Hardinge, who had seen the great effect of artillery fire at Soobraon in 1846, and who acknowledged that "if the thirty-six heavy guns had not been brought to bear we should have been repulsed." The Russians maintained their belief in the power of artillery, and crushed the Poles at Warsaw in 1831 by the fire of a large mass of guns. They practised the same tactics on ourselves at Inkerman, bringing a mass of guns on our flank, the fire of which would doubtless have enabled their infantry to drive us from our position had they not been entangled in the ravines leading up to the heights.

The formidable power of artillery was demonstrated clearly in the Crimea, and after it very great interest was taken in all artillery matters, the fruits of which appeared in the use made by ourselves in India and China and by the French in Italy of artillery, and in the commencement of an unparalleled series of artillery experiments in this and other countries. It is true that the Prussians in the war of 1866 were much behind the other Powers in these respects, their field artillery, partly smooth-bored guns, struggled along at the rear of the other troops, they could not be brought up in sufficient numbers into action, and were not able to shoot when

there. The enormous improvements made after the war enabled it to render very great service to the other arms in 1870, and since that time there is a tendency to attribute every advance in artillery practice or tactics to Germany. Well, many of us have been told to copy the French, Germans, or others in military matters, but we are apt to forget that these have often copied ourselves, and learnt a good deal from our Schools of Instruction, our experiments, our military literature, and even from our small wars. Fortunately for us as a nation, but unfortunately for our *experience* as soldiers, our troops have never been engaged against European armies since the Crimean War, and neither Officers nor men, except a few of the former who served in the Crimea, have ever been under a heavy fire from artillery; this may account for the low estimate of field artillery now apparently held.

After all the instruction so lavishly given to British Officers of the present day, I was under the impression that the increased power of the guns now used would be recognized, and that the idea of the effect of artillery fire being chiefly moral had been exploded a good many years ago. I found, however, a short time since that I was mistaken. In an able lecture delivered at Aldershot last April by Colonel Lonsdale Hale (late R.E.), I was not a little surprised to hear him use these words: "As regards the man-killing power of artillery, I am, I know, one of a few, a very few, who believe in it;" and, when he goes on to say that this disbelief is in his opinion fraught with danger to the Army, I feel sure many of us will share his opinion. For this disbelief Colonel Hale gave the following reasons:—(1st.) That few Officers of infantry have not, in preparing for promotion examinations, imbibed their artillery ideas from Clery's "Minor Tactics," which gives instances of artillery fire practically out of date. (2nd.) Impression produced by statistics of relative effects of infantry and artillery fire given in Colonel Home's "Précis of Tactics," and Lord Wolseley's "Soldier's Pocket Book," and other works on tactics, the artillery fire being credited with only 5 per cent. of the losses against 90 due to infantry fire. (3rd.) That many artillery Officers don't believe in the man-killing power of their own weapons; and (4th, perhaps the greatest) Lord Wolseley's opinion in his "Soldier's Pocket Book" that "the effect of artillery is more moral than actual; it kills but few." I think I may safely say—that the instruction to be derived respecting the use of artillery as an arm, from some of the works on tactics generally used, is of a very meagre kind.

As for the statistics of losses, I confess to have no faith in them. Colonel Brackenbury, R.A., in his able lecture at Aldershot in June last, on the "Use and Abuse of Field Artillery," gave a long table published in the *Revue Maritime et Coloniale*, and, as he said, it has been since used by many writers. It professes to give the respective losses caused by firearms and steel in the wars of '64, '66, and '70. But we should like to know how the numbers were obtained? Whether they included killed and wounded, or only the latter, as suggested by Major Walford, R.A., in the discussion after the lecture? There are some manifest absurdities; e.g., the Prussians suffered as much from

mitrailleuse as artillery (i.e., 5 per cent.); this would hardly be admitted by them: it would also appear that they had no losses from the sabre. Does this table include losses in siege as well as field operations? If so, the figures are of little value, as there were no sieges in 1866.

The Prussians by their artillery caused, according to the table of losses, 10 per cent. of the Danish losses in 1864, only 3 per cent. of Austrian losses in 1866, but 25 per cent. of French losses in 1870, showing that the effect of their fire had declined and reached a very low ebb in 1866, but had improved greatly in 1870. So far it agrees generally with the accounts given by those who took part in these wars, but it rather looks as if the table had been made to square with the accounts. Prince Kraft, speaking of the losses suffered by the large mass of artillery, 210 guns, at Vionville (Mars-la-Tour), where it was constantly within range of energetic infantry fire, says: "I have no means of knowing how large a part of the enormous losses of this artillery, in that battle, was due to artillery, and how much to infantry fire." If the table had been compiled from accurate statistics, Prince Kraft would have had the means of knowing. But he goes on to say that, as it had alone to repulse many infantry attacks, the greater part of its loss was due probably to the Chassepot fire. He makes a guess from his experience at Saint Privat, where the batteries of the Artillery of the Guard, which lost 25 per cent. of the horses and 20 per cent. of the men present in the battle, attributed 75 per cent. of this loss to Chassepot bullets. This percentage does not agree with that in the table, which gives 88 as the percentage of losses caused by French infantry fire, and this was a case most favourable to it, for, "whilst these batteries were, from 2 P.M. until nearly 6 P.M., standing in position under fire in front of Saint Privat, three French battalions, all extended in skirmishing order, lay in their front at a range of from 900 to 1,000 paces, all their men being covered by the fences between the fields. A similar line lay 100 yards in rear, and a third farther back still. The foremost of these three lines fired without ceasing at the batteries." If we take a case favourable to artillery fire, as Sedan, we find military writers, both German and French, just after the war attribute the great losses of the French especially to artillery fire; and the correspondent of the "Daily News," riding over the field the day after the action said: "The ghastly wounds inflicted on most of the French dead whom I saw upon the hill showed that they had fallen under an artillery fire; and the ground was in many places so ploughed up that a blanket could scarcely have been laid on it without covering some spot where a shell had exploded."

If I have dwelt on this table of losses longer than may seem necessary, it is because, in the discussion on Colonel Brackenbury's lecture at Aldershot on the "Use and Abuse of Artillery," it was quoted by Lord Wolseley not only to disparage the diagram of effects of shell fire shown, but to prove that "the effect of artillery is more *moral* than *actual*." He says in his "Pocket Book" (p. 389, 8th Edition): "This should be constantly pressed on the minds of you

infantry soldiers;" and he quotes at p. 121 the instance of Gravelotte, where it was said 90 per cent. of killed and wounded were hit by bullets and only 6 per cent. by artillery fire. Supposing this to be correct, it may be pointed out that at this battle the Germans attacked in some instances in columns, that Bazaine held back a fine reserve of artillery, and that the French fired common shell or ineffective shrapnel. The reason for impressing the above so-called truth, on the infantry especially, comes out at p. 121, viz.:—to "put a stop to the cry for more guns which one still hears occasionally." I am afraid this cry for more guns, as well as men and horses, will be heard pretty loudly if we find ourselves at war with a Continental nation.

If we want to form a just estimate of what artillery did as an arm in recent Continental wars, it is better, instead of trusting to doubtful tables of losses, to examine carefully the reports and accounts of those who actually served in those wars, or wrote from sound information at the time. There are plenty of such sources of information respecting the war of 1870-71 in the official accounts, and in those of Hoffbauer, Boguslawski, Rüstow, Frossard, De Wimpffen, Nieman, and others; and fortunately, as far as artillery is concerned, the subject has been exhaustively treated by Prince Kraft zu Hohenlohe Ingelfingen in his "Letters on Artillery," a good translation of which, by Lieut.-Col. Walford, R.A., is to be found in the "Proceedings of the Royal Artillery Institution" of last year.¹ You are all probably aware that Prince Kraft is considered one of the ablest artillery Officers in Europe, as far as field artillery is concerned, having had ample experience in the commands of large numbers of batteries in the wars of 1866-70, and having exerted himself most energetically during peace-time to improve the German field artillery in all its branches,—organization, drill, tactics, and gunnery. The chief results to be gathered from these "Letters on Artillery" were put forward by Colonel Brackenbury in his lecture on the "Use and Abuse of Field Artillery" at Aldershot.

Well, in all these works we may find numerous instances of a way being opened for successful attacks by other arms, of infantry and cavalry attacks being stopped or repulsed, of buildings and other obstacles being broken through or destroyed, of field artillery or machine-guns being annihilated, silenced, or driven off by the fire of artillery, and it should be needless to say that moral effect could hardly have accomplished such things without a considerable amount also of destructive effect. Although the Sepoys in the Indian Mutiny were, as Lord Wolseley said at Aldershot, inspired with confidence by hearing their own guns fire blank cartridge, I confess I don't think French, German, or our own troops would be satisfied or terrified by mere noise. The first time I was under a heavy fire from artillery a round shot came shrieking along, knocked the leader of the team of an ammunition wagon off his legs, rattled through the belly of a wheeler, and dashed on as if it had done nothing; the moral effect was certainly

¹ All quotations from Prince Kraft's letters are from this translation.

very great, and I had difficulty in getting the men to disentangle the team; it was not, however, produced by the noise but by the ghastly damage done. Those who have seen service in warfare where artillery has been employed, will, no doubt, acknowledge the great moral effect produced by its fire; and, as Colonel Brackenbury pointed out at Aldershot—"It is not the number of the enemy killed and wounded which ensures victory, but the moral effect produced on the remainder." I and a good many others think artillery may claim to inflict, beyond mere moral effect, a great deal of actual damage to men, horses, and matériel, if it be properly trained and handled well in action, but the latter is impossible if its power be not acknowledged.

To judge what can be done at the present time by artillery in the field, we must take into account the improvements made during recent years in guns and ammunition, and, what are of equal importance, the pains taken to train and instruct both Officers and men in marching, tactics, and gunnery; so that in future we shall have to deal, if engaged in a Continental war, with more formidable artilleries than that of the Germans which produced such great results in 1870. Colonel Brackenbury exhibited instructive diagrams, showing the number of hits on targets at different ranges made by the shrapnel shell and case shot now used. The latter struck me especially as being far more numerous than I should have expected. These diagrams were said to have produced quite a nightmare at Aldershot, so I have refrained from borrowing them for this afternoon. It is true that the table of losses appeared to reassure some of the speakers, but I think I have shown it is not very trustworthy, and in any case would hardly apply to the future.

In the war of 1866 the German artillery were badly handled and could not shoot, and in 1870, although it was well handled and shot with precision, it fired but very few shrapnel shell, and had, I think, no time-fuzes; while the French fired a good number of shrapnel, but with fuzes only adapted to a few ranges, and could not therefore be effective. I think but scant justice has been done of late to General Boxer, R.A., who made so many improvements in the shell and fuzes, and I do not hesitate to say that had British artillery taken part in these wars, the enemy would have been considerably astonished by our shrapnel fire, and would have suffered much from it. At that time only ourselves and the Austrians put the bursting charge at the base of the shell. I myself fired spherical shrapnel shell with terrible effect over the heads of our assaulting troops, at the left flank of the Redan, 35 years ago, and our field batteries used shrapnel in the Crimean war; and during the Mutiny in India we fired shrapnel at Lucknow with the fuze inwards to act as case, a similar method to that (setting the fuze at zero) recommended by Prince Kraft now, and which has long been understood in our Service.

The rifled guns first introduced, and those used for many years after, were fired with small charges compared to those of the old smooth-bored guns; and even in 1866, many of the German Officers, who were then much behindhand in artillery matters, contended that

there should always be, as they had at that time, a certain proportion of smooth-bored field guns, for shrapnel and case, owing to the low velocity given by the small charge of their rifled guns, which were not effective.

Now, in consequence of the large charges and better adaptation of the powder and dimensions of the bore, very high velocity is given to the shells, and this has immensely increased the power of shrapnel shell fire. These shells can be fired with destructive effect at much longer ranges and at lower angles of elevation, so that more ground is rendered dangerous by the bullets after the shell bursts; and I am told that they can break through shelter-trenches, buildings, and obstacles of small strength, and still be effective inside of them, even with percussion fuzes, which would have been useless with the shrapnel from the older guns. We thus see that there has been, during recent years, the development of a more destructive fire from artillery. There would be a disadvantage in the high velocity if firing from below at troops or guns posted just behind a ridge, and in some other cases, and there might be premature bursting, a serious thing if firing over the heads of our own troops; but I understand that with the steel shrapnel now made it does not occur; on the contrary, the shell does not break on explosion, which is a disadvantage. I stated this objection of premature bursting some years ago in the discussion after an able lecture in this room by Major-General H. Brackenbury. There is also another disadvantage resulting from very high velocities, viz., greater difficulty in regulating fuzes, the intervals of time corresponding with differences in ranges being so much less than with the lower velocities. The bursting charge is placed in the head of this shell, to give room for a few more bullets; but this is against the principle of the shrapnel, and must cause retardation of the bullets.

In an attack on an entrenched position, or in firing at guns or troops posted or moving in ground pretty well sheltered from shrapnel fire, or at artillery either in the open or in gun-pits, common shell will have to be used. Remember that the effect of a common shell on explosion acts all round, while that of a shrapnel lies mainly in a forward direction. The force from the explosion of a common shell is capable of dismounting guns and destroying carriages, while the flame explodes ammunition boxes, and sets fire to combustible objects. And I can assure you from experience that the explosions of shells, dropping over cover and bursting, so as to hit those apparently under secure shelter, have a demoralizing effect not to be despised. This is especially so with vertical fire; I am not going to propose mortars for field service, but I have long thought that a few batteries of rifled howitzers, firing shells with large bursting charges, would be often valuable in the field, especially for attacks on entrenched positions; for being fired with smaller charges and at higher angles than shrapnel shell, they could reach objects quite secure from the latter. I cannot see the object of firing common shell with very high velocities in the field, the effect on men and horses under cover, or on guns, wagons, ordinary buildings, &c., being thereby diminished. I

should think it very doubtful whether tough steel is a good material for common or other shells. Then the effect of shells can be increased by having bursting charges of *mélinite* or other more powerful explosive substances than gunpowder. I am told by the best authority in this country that the application of high explosives in shells is being rapidly and successfully developed; this will be a means of greatly increasing the power of artillery.

It is sometimes objected that common shells are liable to bury themselves harmlessly in the ground, with or without bursting, as many did in the actions during the war of 1866; but that many of the Prussian shells were blind is not very surprising, for Prince Kraft says: "I could also name to you some large bodies of artillery whose shells were blind, simply because, in the projectiles furnished at the renewal of their ammunition from the columns, they had forgotten, as was afterwards discovered, to insert any percussion arrangement." And he adds, "it is difficult to see how the shells could have been expected to burst." Fuzes are sometimes said to be defective when the fault has arisen from irregularity in boring or setting them.

It will be of little use to have powerful guns if Officers and men are not thoroughly trained in gunnery, so as to employ them in the most efficient way. An artillery that goes into the field at the present time, without the requisite gunnery training, will be very soon knocked to pieces by an opponent who has acquired the art of shooting, notwithstanding any superiority in armament the former may possess. Although Prince Kraft may now teach us a great deal, founded on his unrivalled experience in the command of artillery in war, there is little doubt but that he and other Officers of the Prussian artillery, who effected such a transformation in their systems of both gunnery and tactics between the wars of 1866 and 1870, learnt a good deal from us. Long after the establishment of our School of Gunnery at Shoeburyness,¹ the development of the artillery course at the Royal Military Academy, Woolwich (in which I had some share), and the foundation of the Royal Artillery Institution, and of this Institution, for distributing throughout the Service artillery literature of the most valuable kind—the Prussian artillery was in the most benighted condition. Independently of taking their tactics from the war-time of 1815, their School of Gunnery was not formed on an adequate basis till after the war of 1866 had shown such lamentable deficiencies in shooting; and then, as Prince Kraft tells us, "a singular fate was reserved for the scientific arm. It had to accept the principles of the unscientific infantry, the rifled firearm, and the breech-loader, and also their method of theoretical instruction," and "that a number of instructors had first to be taught," and that "the year 1867 was nearly over before a sufficient number of instructors had been provided to teach the troops a rational manner of shooting."

Notwithstanding the valuable results accomplished by our School of Gunnery at Shoeburyness, it has two disadvantages. One, that it

¹ 1859.

is combined with the Experimental Department; this is an advantage itself in some ways, as the courses and batteries trained there can acquire some acquaintance with the new matériel introduced from time to time; but, on the other hand, one department must interfere more or less with the other as regards convenience of practice, and I have often noticed it when there in command of cadets or field batteries. The second disadvantage is that a flat range over sands is a very imperfect one for field artillery practice, as it does not represent the conditions of service. But the Government took the wise step, in 1877, of forming annual practice camps at Hay and Okehampton, where field batteries can be trained on ground such as would be met with in actual warfare; in these they can be taught to fire at dummy troops or guns, on different kinds of ground, at varying levels, in the open, or protected by shelter-trenches, gun-pits, parapets of earthenworks, or behind folds in the surface.

Careful instructions are laid down for the practice of horse and field artillery at these practice camps, and four descriptions of practice are carried on, viz., elementary, competitive, battery service, and brigade service. The two latter are conducted, as far as possible, under service conditions, and as they are at unknown distances, a method of finding the range, called *ranging* a battery or brigade, is adopted, consisting in three processes: (*a*) finding the long bracket, (*b*) finding the short bracket, and (*c*) verifying the range; the bracket being the distance between the ranges of two shells, one under and one over the object. Our batteries are provided with range-finders, and have observing parties which, by signalling, can show the effect of the fire; and to test the supply of ammunition from the wagons, the full number of rounds to be fired is not carried in the limbers.

The Germans lay much stress on practice at moving targets, not merely crossing the front at right angles, but obliquely, and advancing towards the battery, and selecting some point of ground over which the target must pass, and laying the guns on it; as we should do in firing from a coast battery on a vessel in motion attacking or passing it. They do not appear to attach so much importance to ranger-finders in the field as we do, trusting to the burstings of common shells. These methods of firing at targets moving in different directions are laid down in our Field Artillery Drill Book and in the instructions for our practice camps, and are carried out there by the batteries.

Hitherto four horse or field artillery batteries practised annually at Hay, and nine batteries in three divisions at Okehampton; but as Hay is unsuitable for 12-pr. B.L. or 13-pr. M.L. guns, thirteen batteries will go to Okehampton this year.

It only remains to take full advantage of these practice camps. It is said that the shooting season might be lengthened by adding a month at the beginning and another at the end; that more batteries might be sent at one time; and that they might be kept more continuously at work while there. These would involve increased expenditure of ammunition, and the steel shrapnel shell are each costly, but much of the practice can be carried on with the ordinary

cast-iron shells. Elementary practice in loading, laying, and firing a gun at targets at known or unknown distances can be done on any ordinary range like that at Shoeburyness. These machine-guns and magazine rifles should be tried against artillery, and for this purpose some infantry might be sent down to Okehampton. There is said to be little practice at unseen objects, and not a sufficient variety in the works fired at.

We hear a great deal now about quick-firing guns, and they are doubtless formidable weapons in fortresses, coast batteries, and ships, but I cannot see how they could be used to any extent in the field, as they require to be fired continuously from the same position without recoil. I have often thought that our field carriages might be improved by having recoil slides or some arrangement for lessening recoil. If the recoil could be prevented, both accuracy and rapidity of fire would be increased, the labour of running up would be avoided, and guns could be placed, as Captain Stone has pointed out, in positions otherwise impracticable.

The non-recoil carriages now made by Nordenfelt, Armstrong, and other companies are a great advance as far as they go; but although the compressors and breaks stop the running back, they do not prevent motion sufficient to throw out the laying to some extent, and the strain on the carriage puts a limit to the calibre of gun that can be fired from them. A 6-pr. is the gun recommended for horse artillery, but the shells of such a piece would be insignificant compared to those of the 12-pr. service guns. They might, as their advocates say, fire a greater weight of metal in a given time, but I think this is a fallacious comparison; and great care would have to be exercised to prevent quick firing being indulged in too often, or for too long a time, with consequent running out of ammunition. No doubt quick-firing guns are admirably adapted to some purposes for which horse artillery are employed—advanced guards, retreats, surprises, &c.; but horse artillery are often wanted to join the line of a mass of guns, and to oppose powerful field-pieces. Quick-firing guns have the great advantage of requiring so few men to work them, and being free to move in any direction, of giving great facility for following objects in motion.

Then with respect to the Maxim, the latest development of the machine-gun, we heard that Mr. Maxim, in reply to Lord Wolseley's remark, "If you can invent a machine-gun which will pump lead on troops or guns at a distance of 3,000 yards you will create a new departure in all the military tactics in the world," said, "that he had done it;" and, further, "that I will not only pump lead 3,000 yards, but also 4,000 yards, with great facility." It may, however, be suggested, that artillery might be able to return this storm of lead with the addition of a certain amount of iron, explosion of shells, and fragments, that might serve to knock the Maxim machine-guns about, damage their action, and dismount them; also that infantry or cavalry would not be inclined to remain quietly exposed to such a storm as a target for the Maxim gun. I am quite ready to allow that the Maxim gun is a very formidable weapon when used against any troops at

comparatively short ranges, if they are in pretty close formations and in confined situations, but at long ranges the effect cannot be observed, and their fire is of little use against matériel, whereas if struck by shell they are very liable to be disabled.

Of the effect produced by the rifled field artillery of the French in the war of 1859, or of that by the breech-loading small-arms of the Prussians in 1866, there was no doubt; but it can hardly be said that the war of 1870 was much influenced by the French mitrailleuses, although they at times caused a great deal of destruction. In my work on "Modern Artillery, 1873," I gave a number of instances, collected at the time, of the employment of mitrailleuses in action. One was as follows:—At Gravelotte, a mass of German batteries (84 guns) came into action against a somewhat similar number of French guns and a battery of mitrailleuses. "As the batteries galloped up, vast numbers of French shells burst short in the air, or on the ground in rear, but struck nobody; a continuous rain of mitrailleuse bullets also fell into a particular hollow behind them where nothing was; but the German commander of the first three batteries in action directed their whole fire to be given together on the first French mitrailleuse on the right; thereupon, a confused storm of explosions was seen to spring all over where the mitrailleuse had stood, succeeded only by a vacant space with some wreck on the ground; the same treatment was adopted with the second and third mitrailleuses, on which the fourth vanished of its own accord."¹ The rapid destruction of the machine battery was not confirmed by Froissard, but he admits that it lost a great many men and horses, and had to be withdrawn with the aid of the French infantry supporting it, and it is evident that its fire did no harm. On the other hand, some mitrailleuses held their ground against artillery and repulsed infantry, but they were behind epaulments on the heights of Villette.

It may be said that the Maxim gun is a great improvement on the French mitrailleuse then used, but small-arms and field-guns have been also greatly improved since 1870.

In the discussion after Captain Stone's lecture at Aldershot, Major Hutton stated, that although the Nordenfolt gun made excellent practice on a level range, their effect was small at ranges of 1,450 and 1,120 yards when fired on ground under service conditions, the distances being accurately found with a range-finder; this was attributed to the wheels of the carriage not being level, but the firing party thought they had done considerable execution. This ignorance of what you are doing is a great objection. Then Major Mechem stated that the smoke was so dense that the target was hidden, but this difficulty might be obviated by using smokeless powder; he also stated, that at 400 or 500 and 1,100 yards the rifles of infantry made much better practice than the machine-gun.

Major Hutton also gave an instance from the war in Egypt, where the machine-guns had to stop firing, as they dropped their bullets among their own infantry, over whose heads they were firing, although

¹ Taken from "Observations amongst German Armies during 1870," by Colonel H. A. Smyth, R.A.

the ranges could be easily calculated by telegraph poles. I agree with what Mr. Nordenfelt said, that "the rifle calibre gun will not take the place of the shell-firing gun."

A few machine-guns might be useful with the infantry escort for artillery, in keeping down infantry fire upon the guns, and resisting any sudden rush upon them. Some infantry Officers say that machine-guns attached to infantry rather tend to impede them, as infantry can move over ground impracticable to carriages; but organized in small batteries, as suggested by Captain Stone, they might greatly assist infantry or cavalry in close action.

We now come to the ranges at which guns should be fired in the field. In the first edition of my work, "Modern Artillery," published in 1870, I put them at from 1,000 to 2,500 yards, and for position guns some hundreds of yards further, always insisting that the longest *effective* ranges should be chosen when practicable; and, as these agreed with those laid down by Prince Kraft in a pamphlet he wrote shortly after the war of 1870, entitled "The Employment of Field Artillery," I kept to them in the edition of 1873. I added that in some cases when guns were attacked by infantry or cavalry, or if they could be brought suddenly on the flanks of an enemy's troops, very short ranges might have still to be used, but that breech-loading small-arms and machine-guns should render ranges under 1,000 yards very dangerous to artillery. Now that field-guns give such high velocities to their shells, greater *effective* ranges can be employed, and we may, I think, accept with confidence those given by Prince Kraft. He says: "The effect of artillery is noticeable at 5,500 yards. The effect of shrapnel begins at about 3,800 yards, and at from 2,000 to 1,500 yards is decisive, while at from 1,100 to 1,000 yards and under the effect of artillery is absolutely annihilating: always provided that its field of fire be open. Since shrapnel with the time-fuze set to zero have become so murderous in their results, the effect of artillery at very short ranges, which had been diminished by the former inferiority of the case for rifled guns, has now again become annihilating." I don't know whether he means to imply that case shot should be abolished, but I do not think it would be wise to do so. I don't think shrapnel with fuzes set to zero are very effective at ranges under 300 yards. I am no advocate of very long ranges, which are apt to lead to waste of ammunition; and time-fuzes are not adapted to over 3,200 yards range.

We must, however, always remember that the effect of artillery fire, like that of other firearms, is influenced by many circumstances in actual warfare, and not expect the same results as can be obtained on a practice ground. Battles are not generally fought on level plains in fine calm weather with no smoke, dust, or noise, or the issue might be like that of the combat between Kilkenny cats. Battles are often fought in foggy or rainy weather, when field-glasses are of small use, and when objects cannot be seen at long ranges. Both at Inkerman and Sedan the engagement began in a fog. At the former the projectiles of the Russians came crashing into our 2nd Division camp almost as soon as the pickets were engaged, the enemy knowing the

range; and at the latter, the Prussian guns could not at first open fire. Then high wind and heavy rain both tend to disconcert accurate practice. The next hindrances to accurate fire are the clouds of smoke and dust often hanging about, from the firing of guns and small-arms, the bursting of shells, and the movements of troops. Also the horrid noises caused by these, and the frightful gaps made in bodies of men and horses, the destruction of guns and carriages, and the blowing up of limbers and ammunition wagons, are enough to shake the nerves of the bravest troops, and make their shooting more or less unsteady. Besides these, the guns are not, as in sieges, fired from platforms, and must be run up after each round, often on soft or rough ground. Those who think that the effect of artillery fire is chiefly moral should remember that the fire of small-arms in battles is not always what might be expected from practice at a School of Musketry, and I think Lord Wolseley himself remarked on the inferior shooting of the infantry in the Egyptian War.

Lord Wolseley has recently called attention to circumstances that may greatly modify the tactics required in future wars, but I think some of them are scarcely ripe for consideration, at least at present. He says: "One remarkable change will be the absence of nearly all that terrific noise which the discharge of 500 or 600 field-guns and the roar of musketry caused in all great battles. We shall have practically no smoke to mark the position of the enemy's batteries and troops in action. The sound of cannon will be slight, and will no longer indicate to distant troops where their comrades are engaged, or the point upon which they should consequently march. Our sentries and advanced posts can no longer alarm the main body upon the approach of the enemy by the discharge of their rifles." I don't think we have yet reached the time when there will be an absence of smoke in warfare. Powder giving off little smoke is used for sporting purposes, and the French, ourselves, and others are working to perfect a smokeless powder, the explosion of which causes less noise than that of ordinary gunpowder, and if it can be used with success, some modifications in tactics may be necessary; but whether such powder can be made for ordnance is questionable. I wrote to Sir F. Abel on this point, and from his official position he could only send me the following guarded reply, but it is sufficient for my purpose: "Comparatively smokeless powders are likely to come into extensive use for small-arms within a brief period; such powders do produce considerably less noise than black powder. It would at present be premature to hazard an opinion as to the extent to which powders of that description are likely to displace gunpowder of the present types in artillery."

That artillery will certainly not use smokeless powder for shells must be evident, for the smoke from the bursting of the shell is an admirable guide to range and effect, and the noise of the explosion only affects the enemy, and is therefore an advantage, although it is but a moral one. As to other noises in action, there will always be the *pings* of the bullets, and the horrid screamings of the shells as they pass through the air.

With respect to field artillery drills it is pretty generally admitted that they may be simplified with advantage. I had the command of from two to six batteries for some years, and never attempted, nor asked other Officers to attempt, some complicated manœuvres that would not be required in the field. Prince Kraft says on this point: "Judging by my experiences in war, and you will own that in matters connected with artillery they are fairly numerous, the only movements which are of use in the field are, the advance in column of route, deployments, and the advance in line." I think you might add some others, such as change of front and methods of retiring. With what he says of the uselessness of galloping over short distances we should most of us, I think, agree, increases of a few hundred yards range being easily obtained with our present guns without moving. What is chiefly wanted, as he points out, is mobility over long distances in getting to the front on the march. He says: "It is no longer, as it used to be, desirable to gain a few seconds, in order to fire the first shot quickly; on the contrary, a long time is now taken over the first shots, in order to lay and observe them quietly and accurately. It is now a matter of hours, which we must endeavour to gain in coming into action." He writes: "The introduction of rifled guns, and the experience which was obtained in 1866, considerably altered the demands which must be made on the mobility of the artillery. The necessity of employing the great artillery masses early at the beginning of the fight demands quickness of movement, not over distances of 200, or at most 1,500, paces, but over distances measured by miles and days' marching." He mentions an instance when he had to trot 14 English miles in order to come into action, in 1866, but he adds: "Even greater demands than these must be made upon the artillery when it is a question of moving artillery from one flank of the theatre of war to the other, or of sending them quickly to bodies of troops which have been detached to a distance." "For example, the 1st Horse Artillery battery of the Guard marched, on 13th August (1870), 32 English miles from Bermering by Aron to Dieulouard, where it encamped on the same evening."

It is satisfactory to find that the practice of making long marches at a quick pace is not neglected in our Service. In December, 1887, Major Turnbull's battery of horse artillery marched in India 47 miles in 9 hours and 40 minutes, exclusive of two halts of 1 hour and 1½ hours, and three or four short halts. The first 2 miles was across country, the rest over a metalled road up and down hill. In order to make these long marches, horses must be in good hard condition, not merely fat and sleek, as is sometimes thought requisite for our inspections. Lord Wolseley's criticism on the burnishing of "everlasting bright chains" may be just or not, but it is evident that harness must be cleaned properly or it will not last, and may gall the horses.

The importance of coming into action early and quickly cannot be overrated, for batteries in action have a great advantage over those coming into action, and infantry will seldom dare to attack in front a line of batteries in action. The Germans hold strongly that artillery in action cannot be driven back by infantry. Prince Kraft says:

"There were hundreds and thousands of cases in the war of 1870-71 where artillery which refused to retire could not be driven back by infantry fire;" and, "I repeat once more, and I cannot too often repeat, *artillery cannot, speaking generally, ever be driven back by infantry if it refuses to leave its ground.* On the contrary, when infantry fire is really hot, it cannot for the moment fall back, since so many of its horses will then be shot. But, nevertheless, nothing is lost so long as there are a couple of men left with each gun, who can load and lay quietly; it can thus go on doing its work until the last gunner is disabled." He warns us, as Colonel Brackenbury pointed out, against the errors that grow up in a long peace, and the terrible harm which empires do at peace manœuvres by ordering guns back when under the fire of infantry.

The following instance is instructive as showing how artillery fire should be directed against advancing infantry. Prince Kraft says: "Standing behind the Captain of a battery in action, as troops were advancing to attack him, I heard him quietly give the order: 'Against infantry in front, 1,900 paces from the right flank. Ready. Fire one gun.' Then he waited, holding his field-glass to his eye, until the enemy approached the point on which the guns were laid, and gave the order: 'Rapid firing from the right flank.' Then there was a hellish sight, for the advancing enemy disappeared from view in the clouds of smoke which the shells throw up as they burst and tore their way through his ranks. After one or two minutes, the attacking enemy came out on our side of the smoke. It had passed the point on which the guns were laid, and, in spite of terrible loss, approached with undeniable bravery. Then the Captain gave the command: 'Cease firing! 1,600 paces—one gun!—cease firing!' and when the enemy drew near to the new point on which the guns were now laid, he cried: 'At 1,600 paces—from the right flank, rapid firing!' The effect was brilliant, horrible, and overwhelming. No attack could have resisted it."

It seems to me that, although artillery may in most cases be able to defend its front, it does not follow that infantry cannot attack it successfully under various circumstances. Its position may be turned and infantry succeed in getting on its flank at a few hundred yards range; and after the first furious artillery duel many batteries will be more or less disabled, and perhaps out of ammunition, when they might fall a prey to an infantry or cavalry attack well executed; hence the necessity of always providing a strong escort on exposed flanks of a line of guns, and putting horse artillery on such flanks. At first when guns are firing at long ranges there will be no danger from other arms, but battles cannot be decided at several thousand yards distance, troops must come to close quarters, the batteries may have to advance and may get entangled with other troops, or at any rate have their fire impeded by them, and opportunities may arise which may give an enterprising enemy a chance of taking artillery at a disadvantage.

Prince Kraft gives an instance from the Battle of Königsgrätz: "Thanks to the impetuosity and the rapidity with which our infantry

rushed to the front, the numerical superiority of the enemy's artillery could not, for want of time, produce at this phase of the struggle such a tremendous effect as it did at other points and at other moments in the course of the battle. It was, no doubt, on account of the very high corn, and of the smoke produced by the rapid fire which it kept up on our batteries, that the Austrian artillery were not able to follow with the requisite attention the advance of our foremost lines of skirmishers. It was these lines which, suddenly and at almost point blank range, overwhelmed the enemy's guns with a rapid fire, and captured 68 guns of this long artillery line (the 1st Division of the Guard took 55 and the 2nd Battalion of the 50th Regiment 13 guns). The others succeeded in escaping." The Prussian guns were just opening fire, and seeing some Austrian limber boxes explode and their line of guns cease firing, Prince Kraft and others thought their artillery fire had produced this result; but the explosions were due to the explosive bullets of the Prussian infantry. Hoffbauer gives an instance from the Battle of Mars-la-Tour of infantry inflicting considerable damage on artillery at a long range. He says: "From the moment of passing the defile which runs from Flavigny towards the south-west, the 1st Horse Artillery battery suffered severely from hostile infantry behind a hedge 1,500 paces distant." This case of infantry under cover and undisturbed quietly potting at a battery on the move is no indication of the proper range for infantry to engage artillery in action.

If it is of importance to come into action quickly, artillery serving merely as a target while doing so, it is necessary that when in action the fire should be deliberate at first while picking up the range, but when this is found the fire may be rapid, the effect, however, always being carefully noted, and any necessary alterations made in laying the guns and regulating the fuzes. There should be no salvoes except at close quarters, or random shooting of any kind. In firing on artillery several guns should be concentrated on one of the enemy's pieces until it is silenced, when the same fire should be turned on another.

The old rule was to fire common shell to damage or dismount guns and carriages, and to blow up limbers and wagons; and shrapnel shell to kill or wound men and horses, and I see no reason why it should not still apply. Now that shrapnel shell can be fired with percussion fuzes, which was not formerly attempted, they can also damage matériel and might blow up ammunition boxes, but common shell would be more effective for such purposes, and are less costly than shrapnel; and Capt. St. J. Ord, R.A., who has been Staff Officer at Okehampton for three years, tells me he does not consider percussion shrapnel suitable for firing against artillery, the intervals being too great and the bullets not having a very wide dispersion. He says respecting fire at artillery: "(1.) If your enemy's battery is in action in the open but no limbers or wagons visible, i.e., just on the crest of a hill or a little way down the forward slope of it, then the proportion should be $\frac{2}{3}$ common to $\frac{1}{3}$ shrapnel, that is to say, out of every 6 rounds 4 should be common and 2 shrapnel, the great object being to

dismount or damage the enemy's guns. (2.) Supposing the enemy's battery is in action with its limbers and horses visible, then after finding the range¹ I consider the right proportion to be $\frac{1}{3}$ common and $\frac{2}{3}$ shrapnel, i.e., 2 common to 4 shrapnel in each 6 rounds. The shrapnel should do much damage to the horses, always a very large target, and, with the very accurate sights (Scott's) now in the Service, there is great likelihood of the guns being damaged also." When the enemy's artillery is protected by natural or artificial cover, common shell must be used. Shrapnel shell is obviously the best projectile to use against infantry or cavalry when exposed or only protected by slight obstacles; but against troops protected by the nature of the ground or substantial cover common shell should be employed, as also against buildings or obstacles of solid construction.

One of the most important questions affecting the value of artillery in the field is that of the supply and renewal of ammunition, the arrangements for which should not only be thoroughly considered and laid down, but practised when possible in peace-time.

Breech-loading rifled guns can be more quickly fired than the old M.L. smooth-bore pieces, and when masses of artillery are pushed early into action, a very large number of rounds will generally be fired. It is an established principle in the German Service that "the ammunition in the wagons should first be used and that in the limbers kept as a last reserve;" and Prince Kraft tells us that, in 1870,—“so long as the permissible slowness of the fire rendered it possible to do so, every shell was to be taken direct from the wagon, with which object a wagon was posted in rear of No. 2 and another in rear of No. 5.”

Ammunition was allowed to be taken from the gun limbers only in two cases; to fire the first shot in a new position before the wagons had come up, and when a rapid fire was ordered. But as soon as the critical moment had passed, the limbers were as quickly as possible filled up from the wagons." And he says: "I found in the battles of St. Privat and Sedan, when I rode along the line of batteries and looked into the limber boxes they were full. And when at St. Privat we accompanied the infantry to the assault, the batteries reached the heights which had been captured between St. Privat and Amanvillers, and also the closer position near to St. Privat, *with full limber boxes.*"

He appears to advocate posting the wagons in the same line as the guns if there be sufficient space, and contends that they will suffer less if so placed than if they were 300 or 400 paces in rear; for he says: "In these days of rifled guns the space of 300 or 400 paces in rear of the battery is more dangerous than a position near to the battery and in a line with it, owing to the splinters of the shells which spread about it in all directions. The enemy's rifled guns shoot so well that their shells do not go sufficiently wide of the mark to hit the wagons. For the enemy does not lay on the wagons, but on the guns, which are firing at him," and to prove this he points out that—"during the whole of the Battle of St. Privat no wagon was blown up, but only some limbers." I am not quite satisfied on this

¹ Which would be done by means of common shell.

point; I think an enemy would fire at wagons as well as guns, and try to blow them up, as guns are not of much use without ammunition, to say nothing of the moral effect and probable killing or wounding of gunners, drivers, and horses by the explosion.

The supply of ammunition in action being so important, the wagons should follow the guns as closely as practicable, and the 2nd line of wagons should be within reach. Prince Kraft, citing a case from the war of 1866, in which some batteries were separated from their wagons, and the latter did not come up till the action was over, remarks: "But I learnt one lesson by this: *never again to allow the batteries to be separated from all their wagons.*" He goes into detail respecting the renewal of ammunition in the lines of wagons from the columns, and field depôts, but similar arrangements have been laid down for our Service. In peace manœuvres the wagons, under the Captain of the battery, should follow the guns, this Officer selecting good positions for them as regards supply and shelter; unfortunately, at the present time many of our batteries have no wagons.

I pointed out in 1873 that just before the war of 1870 some military critics adopted, from Chalons I think, peculiar ideas as to the employment of field artillery, one of their axioms being—"Concentrate your fire but not your guns," but after the war they appeared to be under the impression that the Prussians had discovered new tactics in massing their guns. Artillery masses had, however, been employed by Napoleon, by the Allies against him at Gross-Beirin and Leipzig, by the Russians at Warsaw and Inkerman, by ourselves at Waterloo, in India, and the Crimea as far as we were able, although one great opportunity was thrown away, by the French in 1859 and by the Austrians in 1866. It is strange that the Prussians, who were then ahead of the other Powers in the weapon and management of their infantry in action, should not have observed these cases and changed their artillery tactics accordingly, but as Prince Kraft says, they still adhered to the traditions of 1813-15 up to 1866.

Napoleon's tactics were to commence an action by sending on light troops and opening a desultory cannonade from various points, to make the enemy compromise his whole force and obtain a knowledge of his position. At the decisive moment an overwhelming fire from a mass of artillery was poured upon a weak point of the enemy's line, and after it appeared to have produced the requisite effect, a large force of infantry, preceded by light troops, advanced to the attack, and accompanied by the light guns up to close shot ranges, cavalry being kept ready to complete any advantage gained. Against breech-loading small-arms and machine-guns artillery could not be sent forward to such ranges without risking annihilation: but there is now no necessity, as rifled guns can shoot as well at 1,200 or 1,500 yards as at 300 or 400 yards. Artillery may have to fire over the heads of their own troops when advancing to the attack, and our shells should, therefore, be made so that they may not be liable to premature bursting.

It is now generally held that artillery should not be kept in reserve, hence the Germans, and others after them, have changed the term

reserve into that of *corps artillery*; and it is pushed on as far forward as practicable on the march, so that by its fire it may conceal the movements of the infantry when coming into action. This might sometimes be hazardous, as pointed out by General Sir E. Hamley in his "Operations of War," 3rd Edition.

It is sometimes said by Officers of other arms that artillery Officers endeavour to make a mystery of their arm, and this complaint has been echoed even by some artillery Officers. I have seen little to justify such a complaint. The details of gun and ammunition are rather complicated in these days, but it is hardly necessary for Generals or other Officers to master these. All they want is to know—what the fire of guns can do under various circumstances, the spaces batteries occupy in different formations, with a general idea of their tactics. To obtain the first it would be wise to give General and Staff, as well as other infantry and cavalry Officers, when practicable, the opportunity of visiting Okehampton, Shoeburyness, and other Gunnery Schools, and observe the practice there; and these Officers might make valuable suggestions respecting the positions of targets representing troops and in other matters.¹ The others can be got from the drill book and the movements of artillery at manœuvres, if they are directed by General Officers and Officers commanding batteries, in an intelligent manner.

The orders issued by H.R.H. the Duke of Cambridge at Aldershot, just before the autumn manœuvres of 1871, abolished the old-fashioned notion still held by some Generals and Officers commanding troops—"that field artillery should conform to the movements of the other arms;" and detailed instructions are now laid down in the "Field Artillery Drill Book" as to the position and functions of Officers in action, the Officer commanding the artillery taking his orders as to the object required, from the General or other Officer commanding the troops. They are worded to secure unity of action with necessary control.

One of the great difficulties we have as a nation to contend against is the occurrence of a number of small wars in various parts of the world, against enemies of different kinds, some mere savages, others having firearms of a sort, others organized and possessing rifled small-arms and artillery, and at the same time to be prepared to take a part in a war on the Continent; and to take even a small part in such a war, where such enormous armies are employed, a great strain on our resources must always be placed. No one with any knowledge of the requirements of active warfare will deny that we are very weak in artillery. There is no field artillery for militia or volunteers, and but an inadequate amount for our regular Army, as I think I can show.

¹ I am informed by Captain G. A. K. Wiseley, R.E., that in Belgium every infantry regiment is required to send a Captain to attend for fourteen days the artillery gun practice, and, as there are seven of these courses annually, each regiment has seven Captains instructed every year. Captain Wiseley adds: "I was assured that this instruction is considered most valuable, as enabling the infantry to appreciate the progress in artillery."

It is, I understand, the intention of our authorities to have two Army Corps, organized so that with the help of reserves it may be put on a war footing without delay.

Now each Army Corps will require—

	Field batteries.	Horse batteries.
Divisional artillery	9	..
Corps artillery	2	3
Ammunition columns.....	7	..
	—	—
Total	18	3
Two Army Corps.....	36	6
Cavalry division.....	..	2
Ammunition column	1	..
Lines of communication	2	..
	—	—
Total batteries	39	8

Fifteen field batteries are to be converted into ammunition columns, but as we have only thirty-eight field and nine horse artillery batteries at home, we should be short by one field battery, and have only one battery of horse artillery and the depôts for emergencies and relief.

Now consider the condition of our batteries at home. Until just before I went to Aldershot in 1879, all our field batteries had 6 guns and 6 wagons, with 92 or 84 horses, but some of the wagons were then reduced. Not long after, in some batteries the guns were reduced from 6 to 4, and now there are 4 horse and 16 field batteries with only 4 guns. As a consequence the establishments were reduced, so that they have recently been weaker than they have ever been since the Crimean War.

The home establishments are now—

	Total ranks. Men.	Horses.
Horse artillery.....	{ 167 125	104 72
Field artillery	{ 166 154 115	86 74 50

The war establishments are—

Horse artillery.....	186	193
Field artillery	177	141
Reserve ammuni- { 1 section.....	190	221
tion columns { Other sections	207	258

Where are you going to get *trained* men and horses to make these numbers complete? You have a small reserve of artillerymen, but remember that you will want about one-third more men and horses to make up casualties after a few months' campaigning. The new

plan of registering horses in civil employ may give us numbers, but will they be trained to stand fire? And many of them will probably be much "used;" and, besides artillery, the cavalry, Army Service Corps, and other troops will require large additions.¹ Then you have India to provide for, and in the event of a war with one of the greatest European Powers, we should certainly have to fight there as well as on the Continent. You may get horses in India, but you must send men there in peace-time, and very large drafts during a war. Whether you form more batteries now or hereafter, as you may be forced to do, all batteries of field artillery should have six guns and six wagons, which is a mere peace establishment and which would not entail very great cost. I should like to ask what is meant by the heading in the "Detail of an Army Corps" of "Guns—four or six horsed." The Berlin correspondent of an English newspaper stated the other day that "in order to enable the German artillery to be mobilized as rapidly as the French, it is intended completely to horse it in time of peace, as is already the case in France."

In a paper recently written by Major-General Stothard, late R.E., in Colburn's "United Service Magazine," he gives ninety-six guns to a German Army Corps of 37,179 of all ranks; but some three years after the War of 1870, the artillery of the Guards Corps and first eleven Army Corps was increased to 102 guns, as I stated at the time on the authority of our Topographical Department. The French have a higher proportion than the Germans, but it is said that a Bill involving a very large expenditure is shortly to be introduced in the Reichstag to complete the German artillery. In our Army Corps we have only 84 guns to 34,984 men; 14 machine-guns are added, but they are not artillery, and if considered necessary will doubtless be added by foreign Powers to assist the other arms.

We are all aware of the difficulties to be surmounted, both by the military authorities and by the Government, in their attempts to carry out the recommendations of the former, when these entail the expenditure of money; but no effort should be spared to open the eyes of the British public to the deficiencies in our military and naval establishments. It would be folly to attempt to satisfy the ideal wants of certain soldiers and sailors, and some of these are rather apt to treat what should be a sober matter-of-fact question in a gushing or sensational manner; while the British public, upon whom, by our extraordinary method of politics, is devolved the power of consenting to or rejecting proposed measures, was said by one of our greatest authors to be "composed mostly of fools." Without endorsing such a sweeping assertion, it can hardly be denied that the British public is not very enlightened on military questions. I met a commercial gentleman when quartered at Sheffield a few years ago, who seriously maintained that it was a great mistake to keep up any army, and that

¹ At Aldershot last autumn four guns of a battery of horse artillery were equipped for service with a flying column. To make this reduced battery up to the requisite strength, the draught horses of the remaining two guns, the whole of the draught horses of another battery, and some of the draught horses of a third battery had to be taken.

war could be carried on most cheaply and successfully by entrusting the management of it to a contractor. Then, last year, in order to obtain evidence on the best methods of training Officers for the Army, a Parliamentary Committee called an accountant before them, whose opinions on such a subject were worth nothing, and he was questioned by an old artillery Officer, who should have known something of the matter, the result being, as was doubtless desired, a recommendation to abolish all military colleges and schools as too expensive, and trust to chance training, as was done some century or two ago.

I have no wish to criticize those who are endeavouring to place the Army on a solid footing, but there is a tendency to suppose that everything has to be commenced afresh. Much has been done during the last 30 years, and improvements have been constantly carried forward, although there was one period of stagnation. Many of those who worked hard and did most to improve matters have been got rid of, and their successors are not always grateful for advantages already secured. Our armaments have been immensely developed; both Officers and men are better educated and trained; the science and practice of gunnery, musketry, engineering, mining, &c., have made great strides; short service has been adopted, which has given us a reserve of men; the Volunteer Movement has been established; the transport, supply, and other services have been placed on a recognized footing; autumn manœuvres and minor tactics have been practised; and a number of small wars have kept alive the military spirit, and, to some extent, tested our deficiencies. As for the artillery, which has been re-organized several times since the Crimean War, an important step was taken shortly after, in placing field batteries on a proper footing by making them permanent, and giving them a proportion of drivers, and their mobility was afterwards increased by mounting the gunners on the limbers, axle-tree-seats, and wagons; but few would say that the present incomprehensible organization of the regiment is satisfactory.

I trust that no one will suppose that in what I have said I have made any attack on so distinguished a soldier as Lord Wolseley. I have certainly contended against one of his opinions, which I and many others consider unsound, and my reason for doing so is, that his opinions naturally carry so much weight from his abilities and position. I have, however, confidence that Lord Wolseley is not above modifying his opinion if facts show that change is necessary; and I hope that what I have said, together with remarks made by others in the discussion, will appear to him sufficient to induce him to reconsider his low estimate of the destructive power of artillery. What, however, I particularly wish to point out is, that we should ascertain practically what we can do with our various weapons, and then suit our tactics to their special purposes. Shrapnel shell, common shell with high explosive bursting charges, quick-firing and machine-guns, and magazine rifled muskets all claim to do great things, but practice *under service conditions* can alone decide their relative values and proper positions. Having ascertained these, our Generals and the troops under them may go into action with the confidence of being able to employ them to the best advantage. What

the Germans accomplished in four years, between 1866 and 1870, by the establishment of a school of gunnery, and by changing their obsolete artillery tactics to meet new conditions, shows clearly what can be done in peace-time to prepare for success in war.

There is another thing I wish to say before sitting down. Both before and after the Crimean War, pamphlets were written, one by a Russian General and the other by a British Colonel, to show that artillery had become the *principal arm*. I have had no intention of making any such claim, and repudiate the idea, as Colonel C. Brackenbury did at Aldershot, although some of those who spoke after the lecture thought that he had attempted to show that artillery could always *annihilate* any troops opposed to them. The bulk of the Army must be infantry; no position can be taken or kept without it, and infantry must, therefore, be the *principal arm*; unless, among those high explosives we hear so much about, we can discover the *tril* of the *Coming Race*, when no troops of any kind would be required. All I claim for artillery at the present time is, that if properly equipped, organized, trained, and employed, it can give very great assistance to the other arms; if—even well organized and equipped—it be badly trained and handled in action, these other arms will suffer great losses in endeavouring to accomplish their objects, besides running the risk of defeat and disaster.

Results of Practice at Okehampton in 1888 with the 12-pr. B.L. Gun.

(1.) Target,—A single line of 70 standing dummies, about 1 yard per dummy.

Range varying from 1,500 to 1,750 yards.

4 common shell to find the range, and then a group of shrapnel from each battery.

Battery. ¹	Number of shrapnel.	Number of hits.	Number of men hit.	Remarks.
1	14	131	22	} Fired with percussion fuzes.
2	14	66	16	
3	14	26	20	
4	14	31	22	
5	9	72	39	
6	11	59	25	

(2.) Target,—3 rows of standing dummies, 35 dummies in each row, 10 yards between the rows:—

¹ The numbers in this column are put to distinguish the groups of shell fired from different batteries of horse and field artillery, the letters and numbers of which are purposely omitted.

35 yards.

10
10

Range varied from 1,950 to 2,100 yards with different batteries.

4 common shell to find range, and then a group of 14 shrapnel from each battery.

Battery.	Number of hits.	Number of men hit.	Remarks.
1	83	46	} Fired with percussion fuzes.
2	110	55	
3	116	62	
4	117	53	
5	143	67	
6	111	30	
7	140	34	
8	154	48	
9	61	40	
10	330	63	
11	145	39	
12	90	29	

(3.) Target,—Scattered infantry, retreating across a ravine, represented by 45 standing dummies scattered about in twos and threes.

Range about 1,000 yards.

4 common shell to find range, then 6 shrapnel.

Battery.	Number of hits.	Number of men hit.	Remarks.
1	50	25	
2	23	17	

(4.) Target,—An irregular line of standing dummies, towards which the 3 batteries composing each detachment galloped in line about 300 yards down hill over rough heather, and then came into action at ranges varying from 300 to 450 yards. Each battery fired 15 rounds of case shot. The line of dummies was divided into 3 groups to allow the result of each battery's practice being distinguished.

Battery.	Number of dummies fired at.	Number of hits.	Number of men hit.	Remarks.
1	27	127	25	
2	25	201	25	
3	20	97	20	
4	20	27	15	
5	20	63	19	
6	20	45	18	

(5.) Target,—Battery in action represented by 6 dummy guns, and detachments of 5 dummies to each, making 30 men. The limbers were represented by canvas screens, which did not give trustworthy results, but on service the limbers might often be under cover.

Range about 1,900 yards.

12 rounds of common¹ and 12 of shrapnel shells were fired from each battery.

Battery.	Number of hits.	Number of men hit.	Remarks.
1	34	10	
2	35	14	
3	30	17	
4	13	10	1 gun detachment blown to pieces.
5	50	16	1 gun disabled.
6	56	18	" " and 1 dummy
7	15	10	blown to pieces.
8	20	12	
9	14	10	1 gun disabled.

(6.) Target,—30 standing dummies in line.

Range about 200 yards.

12 shrapnel shell from each battery, with fuzes set to burst at the muzzle.

A good instance of the destructive power of shrapnel practice was the following, the results of a group of 10 shrapnel fired at Okhampton last year.

¹ The steel common shell for the 12-pr. is so tough that it simply tears open, and is practically useless against troops, though its large bursting charge makes it very effective against earthworks, &c.

Battery.	Number of hits.	Number of men hit.	Remarks.
1	29	19	Result not good. ¹
2	13	6	
3	18	8	

Target,—A subdivision. Gun and limber, the latter represented by a canvas 6' x 6' screen; the detachment and horses being represented by 13 dummies, those for the latter not being so large as horses.

Range 2,650 yards.

Results.—147 hits on horses and detachment.

60 „ the gun.

15 „ the limber.

Total. . . . 222 hits.

The instances of practice at various objects given above have been taken from the records of practice carried out at Okehampton by the batteries sent there last year. The practice was arranged and the results collected by Colonel Murdoch, R.H.A., who commanded the camp, with the assistance of his orderly Officer, Lieutenant J. Headlam, R.H.A. The number of shell fired in each group was small, the object was to get as much instruction as possible out of the ammunition allowed for practice. The ranges were never measured, but found by the range-finder and trial shells; the ground is rough, with considerable differences of level between that on which gun and target respectively stand, and the weather was generally bad.

Colonel E. MARKHAM, D.A.G., R.A.: The very interesting paper which has been read by my friend General Owen is what we should have expected would have come from his pen, as we know he has studied the subject for so many years. The heading of it is, "The Value of Artillery in the Field;" but it seems to me it has rather become a historical sketch of the field artillery of this country up to the present day. He has traversed a very great deal of ground; I do not intend to follow him over the whole of it, but there are a few remarks that I wish to make. He has alluded to the mobility of the artillery, which is most important in the field, but he has not mentioned what he considers should be the proper calibre of guns for the horse and field artillery. He has, however, mentioned a 6-pounder as proposed for horse artillery. I presume he alluded to a quick-firing gun, because it follows what he has mentioned regarding quick-firing guns. In that I think he has made a mistake. Mr. Nordenfelt will correct me if I am wrong, but I believe it should be the 8-pounder quick-firing gun which is going to be tried this year at Okehampton. He also, in alluding to shell fire, said he thought there ought to be certain batteries, attached to an army corps, of field howitzers. We have also this year brought forward, and are going to try at Okehampton, some field howitzers,

¹ The unsatisfactory result was due to the shortness of the range, some of the shells bursting only just before reaching the target. Good results would doubtless have been obtained at 300 or 400 yards range.

4-25-inch bore, which will be tested against the 20-pounder guns which we tried last year, both very powerful guns. General Owen was quite right in saying that measures have been taken to try and remedy the immense recoil given to high velocity guns. We are trying a carriage now with recoil buffers: they have been tried already with the 20-pounder, and also on the field howitzer carriage. Alluding to the practice of picking up ranges, it is a very important point, and I think our instruction is keeping pace with the improvement of the gun. We draw up our rules every year, and they are revised from experience gained the year before. I must say I should like to see several Officers of other branches of the Service go down there and see the shooting; I think they would then appreciate the fire of artillery, and they would see that our artillery is not behindhand in the instruction to the Officers and men. General Owen alluded to certain Officers thinking that the artillery made a mystery of their arm, but he thinks that this idea is now exploded. I think it is so. I can assure you of this fact. Last year I went to Okehampton in company with two General Officers of infantry and several others, one a cavalryman. I believe they came away very much impressed with what they had seen of the fire of artillery. I may also mention, although it has nothing to do with this paper, that a General Officer of cavalry, who commands a district in England, attended a course of gunnery at Shoeburyness last year. I think this proves that the artillery service is not kept in the dark at all, but that we as artillerymen are only too glad to see other Officers of different branches of the Service take up the question, and come and see what artillery can do. I rather wish—but perhaps it was a little outside the limits of the lecture—that General Owen had alluded to the selection of positions for guns in action. This is a question which has cropped up lately, and is rather important, and has been under consideration; and with reference to the supply of ammunition, where the limbers should be placed. Of course we have in these cases been obliged to pick our knowledge from experience gained in foreign countries, but it would be a very difficult thing to draw a hard and fast line as to where the position of limbers should be for the supply of ammunition; it depends so much upon circumstances, upon the nature of the ground, upon when you are going into action, whether you are engaging an enemy who already holds the ground, or whether you have the advantage of selecting the position and waiting for him to attack. We have now been drawing up a new Manual of Field Artillery Exercises, in which we have considered all these questions, and also that one of keeping the limbers away when they come into action, and bringing up some of the wagons, so that when an advance is necessary you have your limber full of ammunition and ready for the work. I see, looking at the table before me, that General Owen has talked about the number of our batteries, and how inadequate they are for the defence of the country. I am happy to say that that table shortly will not prove quite correct. He puts fifteen batteries with the ammunition columns. Arrangements are now in preparation to gradually work these out, so that there will not be a necessity to convert field batteries into ammunition columns. With reference to finding men and horses in these large numbers, we find the reserve is sufficient to provide men for the first army corps to fill them up to war strength. When we have our ammunition columns arranged, and have no longer to convert batteries for that purpose, we shall find that we have a reserve of some fourteen batteries to draw upon after providing two army corps complete. No ammunition columns could be kept up in peace-time: I think that will stand to reason to everyone, for what will be their duties? You would have a lot of men and horses, maintained at great expense, practically without employment. After that we come to the militia and volunteers. General Owen says they have no field artillery. No, they have not: but they have a very large force now of guns of position. They have 104 40-pounders, 28 20-pounders, and 132 16-pounders, or 264 guns in all; and 252 of them are actually in the hands of the volunteers. They are horsed in different ways, some with farm horses and harness, and some of them have applied and have received permission to purchase artillery harness, and drive in the same way as the Royal Artillery. I have only mentioned these few points, because I am in a position to inform General Owen how they stand.

Colonel LONSDALE HALE: I rise at this early period of the discussion because I

have to go away immediately and superintend the firing of leaden artillery, and the movements of leaden soldiers elsewhere. I wish to express the hope that either the lecturer or some artillery Officer will give us some information upon one of the most important parts of the duties of artillery in the field—the value of field artillery, as it is at present, against localities, in which I of course include substantially built villages. Nobody has a firmer belief in artillery than I have myself, but what I should like this afternoon would be that some artillery Officer should give us reliable information on the subject, and I trust it will be of a reassuring character. Supposing a battery came into action in Hyde Park, and fired away at houses of the character of those built in Park Lane, what effect would that battery produce upon those houses? My friend Colonel Brackenbury has lately brought this subject of localities before the public, and he is not a more ardent believer than I am in the part that the defence of localities will take in any future war. I differ from Colonel Brackenbury, perhaps, in his view of the shelter trench part of it, but at the same time I firmly believe that the points that will be held on a battle-field will be strongly defended buildings and villages, and garrisons will never be turned out of these unless the artillery can help to do it, and do it effectively. I have been lately studying the details of the defence of the position of Faily-Noisseyville, and, so far as I see, the effect of our artillery at present upon localities and upon garrisons of localities will be very much the same as the effect of the French artillery upon the Prussian garrison at Servigny. The French artillery fired shells, and set fire to the village in a few places, but with regard to the garrison, they did not care two pins about it. What we should like to know is, whether, with the artillery missiles which we possess at present, we can with a small force of artillery render a locality untenable. Supposing that locality is not made of paltry little houses, how far well-built houses can be rendered untenable either by the fire of common shell or shrapnel. I am quite aware that if you get enough guns you can knock any village to pieces if you have time to do it and have enough guns like the seventy-eight which battered Noisseyville on September 1, 1870; but we have no authentic information as to the actual effect of the present shell, not the shell of the future, which is to be invented, with high explosive compounds, and so forth, but merely the shells of to-day. Can artillery Officers here undertake to turn a garrison out by firing common shell and shrapnel, provided the garrison are placed according to common sense and properly under cover? That is the point on which I hope artillery Officers will give us information this evening.

Colonel MATRICE, R.A.: I propose to restrict myself to one particular point of this most valuable and interesting lecture, that is, as to the question of moral effect as connected with the material effect of artillery, and the references which have been made to the mode in which that subject has been dealt with by three friends of my own in the other arms of the Service, the late Colonel Home, R.E., General Clerj, and Lord Wolseley. I, for one, certainly believe most surely both in the material effect which is produced by artillery, and in the enormously enhanced material effect which will be produced by artillery with our improved sights and our improved guns. But for all that, I cannot admit that it is a disparagement to our arm of the Service to say that its great feature is the extraordinary moral effect which it produces. Take any other arm of the Service: take the infantry. We are all agreed that if it were possible for the infantry habitually to fire volleys instead of engaging in individual shooting, it would be most desirable that they should do so, and it is only because volleys cannot as a rule be fired in action, that we are unfortunately obliged to abandon volleys, and to restrict ourselves chiefly to independent firing. Now the enormous difference between volley firing and independent firing is simply a difference in moral effect. The whole of that marvellous story, which has been told again and again by French writers, even better than by our own historians, of the successive victories of our troops in the Peninsula against French troops has been acknowledged again and again to prove the moral effect produced by infantry fire delivered suddenly and at a given moment. Therefore it seems to me it ought not to be looked upon as a disparagement of the efficiency for victory winning purposes of the artillery to say that the moral effect produced by artillery fire is greater in proportion than the material effect which it also produces.

The reason why that great moral effect is produced is, I think, a very simple one: it is precisely that you get out of the destruction which is produced by artillery just that effect which you would try to get, if you could, from the employment of infantry. The blow when it is struck has the sudden taking effect of a volley. The shell when it bursts effectively at all produces an appalling and tremendous effect on one spot and at a given moment. It is a very serious thing, as General Owen has said in his lecture, to see, as I have done, a couple of horses and men struck over by a single shell; it is a thing that produces an immense effect upon the minds of the men who witness it at the time. And, as it seems to me, the whole use of the arm, and its proper tactics, are determined by realizing that it is this moral effect which, if we are to win victory, we must enhance in every way. As far as I have observed myself, and I have found my observation confirmed by people who have seen far more effective artillery fire than I have, what continually happens under the fire of artillery is this: those who are exposed to it for the first time fully realize that a shell carries with it the possibility of that tremendous destructive effect of which I have spoken, and as soon as shells begin to hurtle through the air the first few rounds tend to produce an enormous moral effect. But after a little time men observe that there are a great many shells which produce no material effect, you have plenty of time to watch them, to see them down, and you see that they produce no effect, and this goes on for a long time, before the next destruction is produced by an effective shell. It is almost always soon after the beginning of artillery fire that this loss of moral effect is apt to occur, because artillery usually begins at long ranges, and because the range has not been quite so accurately found as it is later in the action. Not being at that time in danger of infantry attack the troops under artillery fire can then better than afterwards take cover from it. For various reasons of that kind the early period of artillery fire rather tends, unless it is a very concentrated artillery fire, to undo its own moral effect. You have plenty of time to watch every shot with artillery as you have not plenty of time to watch every shot that is fired from the immense mass of unaimed ineffective infantry fire. You cannot count bullets coming through the air, but where you see shells, as you may do, coming and exploding harmlessly, it tends very greatly to discount the moral effect of artillery. For my part I have always believed, and I think I am right in that opinion, and I have generally confirmed myself by comparing notes with other people, that the enormous importance to us of concentrated artillery simply depends on the great moral effect which is produced by the concentration. Because if you have an enormous number of guns operating upon a single point, and the shells bursting in the air all about you, there is no time to make the calculation as to the material effect between one shell that does strike and spread ruin and the next that does so; and, therefore, seeing that there is continually a certain amount of destructive effect, and the shells are continually coming, the shells that don't strike tend to enhance the moral effect instead of reducing it as they do when there are long intervals without effect. Therefore it seems to me of the greatest importance that we should recognize both in the use of artillery and with regard to the power and effect of the arm, that it should be so employed as to produce that which is the object of all war, which is in all cases and in relation to all arms of the Service the grand thing at which we aim, which, as Napoleon said, counts for nine parts in ten in battle, the production of moral effect. I believe, myself, that the very great increase which we are making to the future material effect of the gun will very greatly enhance that moral effect, and that any future successes will be due not merely to the material loss which will be occasioned, but because of the enhanced moral effect which the artillery will on that account produce. I want to turn to another question in connection with that, and that is the relation of artillery Officers towards the other arms of the Service, in the view which they would wish them to take of their arm. I do not for one moment believe that there is the smallest fear that Officers of other arms will underrate the effect which our own particular arm of the Service, the artillery, will produce in the next campaign. But supposing you were in command of a body of cavalry, dealing with a body of infantry, would not you wish to inspire that cavalry with a feeling that you intended so to lead them against the infantry against which they were going to be engaged, that you would never allow them to do anything

else than to go forward to victory, that never should they have to come disastrously under the killing power of infantry, but that, taking advantage of the rapidity of your movements, and the facility of your manœuvring power, with your knowledge of ground and your skill in using it, and your power of striking round the flanks of the enemy, you would always gain the victory no matter what weapon might be in their hands? And, on the other hand, if you were in command of a body of infantry, resisting that very cavalry, would not you wish to inspire that body of infantry with the feeling that if they are only able to keep command of themselves and keep steady with their weapons, they will most assuredly win? When you come to criticize these books which are written for the instruction of cavalry and infantry Officers, it is not for the advantage of the artillery any more than for the advantage of any other arm of the Service that the infantry and cavalry who are going to co-operate with us should fear the guns that are to be used against them by one of the enemies of England. It is not against them that we are going to use our guns, they are going to join us in fighting against the guns of quite another Power, and I am perfectly certain that to take the specific instances of which Colonel Hale has spoken, the feeling which actuated my friend Colonel Home in speaking mainly for cavalry and for the infantry which must be, of course, the most important arm of the Service, he had this object in view, and had no object whatever in disparaging the artillery. As a matter of fact, I may say Colonel Home's unfortunately premature death, which is one of the greatest losses the Service has had in my time, has deprived us of the enormous advantage of the successive revisions which his book would have received had he lived, and I can answer for it from my own personal knowledge that that book as it stands does not in the smallest degree represent his final views or anything that he would now be satisfied with, had he had the means of carrying out the revision which he would have wished to give to it; therefore, I may admit that there are certain things in it which I should well wish out of it, valuable as it is and instinct with his peculiar soldierly genius. In relation to the particular statement made as to General Clerly's book on "Minor Tactics," it is simply a question of fact. There is the book. It is one very familiar to most Officers, and I can only say I have this afternoon carefully gone over the chapter on the relation of the three arms of the Service, which is the one in which all these questions of artillery are mainly or entirely dealt with, and there is not a single illustration, a single instance, taken except out of the war of 1870. Colonel Hale has long since abolished for us all history prior to the war of 1870. I want to know whether all illustrations from the 1870 campaign are also to be abolished? I quite admit that we are going to have an enormous increase in the power of artillery in the future, but, for the purpose of a text-book, it is impossible to deal with other than the experience of war, and I do not think the attack is quite a fair one upon a text-book which is prepared for a certain specific purpose, and which must deal with the actual events of war, and not with the opinions which we naturally form as to the future of our own arm. Lastly, I should like to say one word about what has been said in relation to Lord Wolseley's "Pocket Book." That book was originally written when he was a Colonel of infantry in Canada, and the very passage which is quoted is directed to the particular effect which ought to be produced upon the minds of infantry who may have to face artillery in the field. I confess myself I should be very sorry to do other than inspire our infantry with the utmost confidence, and as I have urged the effect of artillery is unquestionably, from its nature, to produce a moral effect out of all proportion to its material effect, great as that material effect is, therefore, most assuredly, I should like as far as I possibly can, speaking as an artillery Officer, to discount for all our infantry Officers who have to come into action against artillery, the moral effect which the artillery of the enemy will quite sufficiently produce upon them by its material effect. I have no doubt that that was the motive with which that particular passage was introduced. A passage which originally was written by a Colonel of infantry, speaking especially to his own arm of the Service, has through successive editions become the work of the Adjutant-General of the Army, speaking to the whole Army. In that position I still say that the most important duty of a man who wants to carry forward the Army as a whole to victory is to discount as far as possible beforehand the tremendous moral effect which will be assuredly liable to be produced by the striking and

dramatically appalling effect produced by hostile artillery. There is no fear that he will shake the confidence of artillery Officers in their own arm. I can say positively that no man has more confidence in the artillery than Lord Wolsley. If I may venture to say so, in a mixed assembly of Officers like this, not once, but again and again Lord Wolsley has said to me, as he has said to others, "I do not say this because you are an artillery Officer, but because I find it so—the artillery Officers are the best Officers of the Army." Therefore I may assure you that it is not from some special prejudice against the artillery that Lord Wolsley has spoken in the way in which he has done in the "Pocket Book." He has the most complete confidence that nothing that he says will in the smallest degree shake the confidence of the artillery in their arm of the Service. The very best effect that could be produced upon the rest of the Army is to tell them to go forward against the artillery of the enemy with every possible confidence, and to discount as far as possible, by statistics or otherwise, the tremendous moral effect which the immediate and striking material effect of artillery tends to produce.¹

General Sir GERALD GRAHAM, V.C.: Not being an artilleryman I venture to add my testimony to Colonel Hale's as to the value of artillery in the field. I had not the advantage of being present at Colonel Hale's lecture at Aldershot, but I have heard him lecture at this theatre on a similar topic, and I think, on that occasion, he somewhat successfully demolished much of the statistics that are relied on to prove the inefficacy of artillery in the field. I am only sorry that he had to leave us so soon this afternoon, and did not re-enter on that subject. I can state my belief, not only in the value of artillery, but that our artillery is the finest in the world as a service, and I am happy to hear that confirmed by so high an authority as Lord Wolsley, as quoted by Colonel Maurice just now, as regards the artillery Officers. There is one point I should like to refer to, as coming from an Officer of General Owen's great experience and authority, and that is his opinion of quick-

¹ In speaking I omitted to draw attention to an obvious misunderstanding of some importance as to the phrase used on p. 121 of the last edition of the "Soldier's Pocket Book." "In previous editions of this 'Pocket Book' I have laid stress upon the fact that the effect of artillery fire is more moral than actual, and I trust that these figures will make the Army, especially the infantry, fully recognize the truth of that assertion, and put a stop to the cry for more guns which one still hears occasionally." The last phrase has I find been supposed to imply that Lord Wolsley is content with the fact that we have hitherto had no guns for the home Army, volunteers, and militia at all. This is purely a misreading of the text, which simply objects to an increase in the proportion of guns in the field beyond the 3·75 per 1,000 men which Lord Wolsley has elsewhere spoken of as a maximum. As a matter of fact no one has represented our deficiencies in respect of the home Army more strongly than Lord Wolsley. I was, when Colonel Scott came in, on the point of saying that we also owe entirely to Lord Wolsley what all artillery Officers now recognize as at least one of the most important improvements in our time of the artillery arm—Scott's sights. I may add that from the point of view maintained in my speech, no evidence subsequent to the War of 1870, as to the future material effect of artillery in war, affects the argument. If the victory winning effect of artillery due to its moral effect was so great, as we know it to have been at Sedan, where the Emperor declared that he surrendered to the artillery, the whole question is whether *in that war* the material effect was such as with any other arm would have produced that moral effect. If not, for heaven's sake let our infantry and cavalry know and understand that fact. They will need all their knowledge of it, and all their national phlegm to resist the moral effect of the appalling material effect which artillery will produce in the next war. The technical phrase that it is the duty of artillery "to prepare the way for attack" means that it is their duty so to shake the nerves of the defenders that they may succumb to attack. Ought artillery Officers to wish that their own Army should be prepared beforehand to succumb by cramming down their throats all possible evidence as to the reality of the danger, or should they wish rather that the Army should know that, bad as it looks and is, it looks worse than it is.

firing guns. He says: "I cannot see how they could be used to any extent in the field, as they require to be fired continuously from the same position without recoil." I should be glad to hear from General Owen why the fact of their being fired continuously, without recoil, should make them of no use, or of little use in the field. I should have thought, on the contrary, it would have enhanced their value in the field. General Owen says: "I have often thought that our field carriages might be improved by having recoil slides, or some arrangement for lessening recoil. If the recoil could be prevented, both the accuracy and rapidity of firing would be increased, the labour of running up would be avoided," and so on. It appears to me that General Owen there recognizes the value of non-recoil carriages, and, therefore, I cannot quite understand the first part of the paragraph. General Owen also says, "They might, as their advocates say, fire a greater weight of metal in a given time; but I think that is a fallacious comparison." That is with reference to the small calibre of the 6-pounder gun. Colonel Markham has already observed it is an 8-pounder gun, but I wish to inquire why the above should be called a "fallacious comparison." I should have thought that for a light gun to be able to fire a greater weight of metal in a given time than a heavy gun would be an enormous advantage. Referring to the subsequent remark of the lecturer on the great importance of lightness and the long marches performed by artillery quoted from Prince Kraft, the enormous importance is obvious of having light guns, and everyone who has seen any service will recognize that as a most important factor in the gun. Those who were in Egypt will remember that the 13-pounder we had there, though a most valuable gun, was too heavy for the sand of the desert, and could not be brought out and made full use of on account of its weight. A light gun that will throw an equal weight of metal and produce a greater intensity of fire must have an enormous advantage over the heavy gun, even although each individual round may not produce the same effect. The 6-pounder referred to may be fired at the rate of 40 rounds a minute, which is a very great intensity of fire, and it is a very light gun. Reference is made to the Maxim as being merely a machine-gun. Of course General Owen is aware that there is a light shell-firing Maxim, a 37-millimetre gun, that fires 300, and has fired 400 rounds a minute. There you have a light machine-gun where you have the advantage of seeing the range, and, therefore, there would no longer be the same objection made to it that there is to other machine-guns where you could not observe the effect at a long range like 3,000 yards. The reference to the mitrailleuse is, I think, somewhat misleading at the present day. At that time the tactics of machine-guns were not understood, they were employed against artillery at long ranges, and, of course, entirely failed. It is very remarkable that they should have been able to hold their own against artillery on any occasion, as stated by the lecturer, as it is not intended to use machine-guns against artillery at long ranges; in fact, they should replace infantry, as they may replace long-range infantry fire, but can never be intended to replace artillery fire. There is one point on which I quite agree with General Owen, with reference to the quick-firing guns, that great care would have to be exercised to prevent the quick firing being indulged in too often or too long a time, in consequence of the running out of ammunition. That is perfectly true, and the same objection applied to the development of the muzzle-loading rifle into the breech-loader, and replacing the breech-loader by a magazine rifle. It is a question of fire discipline and training. I think with our artillery we have less to fear from lack of fire discipline than we have with our infantry; the training is higher, and there is not the same difficulty in restraining a gun detachment as there is in restraining infantry in action. It is a matter of nerve, and a gun has no nerves. In my humble opinion all these new introductions are an advantage to us who, as a nation, I believe have better nerves than most other nations. Our men want nothing but training, and the better developed weapon put in their hands will be turned to better account by the British soldier than by the soldiers of more excitable nations, since the greater control is required over the nerves for the arms of the present day. So that the objection to quick-firing guns, that they will tend to waste of ammunition, I think does not apply, assuming, as the lecturer does, that they will be used on both sides, which will always be to our advantage. This leads to the question of the supply of ammunition—one of the most im-

portant questions of the day. I do not know that the lecturer has attempted to solve it, but he has mentioned several very important points on which I shall be very glad to hear the opinions of artillery Officers. They have already been referred to to some extent in regard to placing the wagons in line, and to taking nothing out of the limbers before emptying the wagons. I feel very much reassured by the remarks made by the Deputy Adjutant-General of Royal Artillery. It is a great relief to us to know that so much is being done to improve the organization of the Royal Artillery, more especially with reference to what he has said as to the ammunition columns.

Captain F. G. STONZ: I only wish to make a very few remarks, first with regard to what General Owen said with reference to placing the bursting charge of the shrapnel in the head instead of in the base. To the best of my belief the object, or at all events the result, of placing the bursting charge in the head of the shrapnel, is not principally to secure a few additional bullets, but to ensure the quicker ignition of the bursting charge, the result being that it has become possible to use percussion shrapnel with remarkably good effect, in fact with equally good effect as time shrapnel up to ranges of about 2,000 yards on ordinary ground. This, I think, is a most enormous gain in the power of artillery fire, and it is not by any means merely a question of having a few more bullets in the shrapnel. With regard to the bad execution done by the mitrailleuse in the war of 1870, in the first place it was due to the fact of the weapon being extremely clumsy, and secondly, because the Officers and men did not understand technically or tactically the nature of their weapon. With regard to Major Hutton's remark at Aldershot, which General Owen has quoted, referring to the Nordenfolt machine-gun in Egypt, that their firing was very erratic, Major Hutton pointed out the reason for the indifferent practice by saying that they were not firing from a level platform. Of course no gun, whether a 40-pounder gun firing shell or a machine-gun firing bullets, would be expected to fire correctly unless its wheels were on a level platform or a compensating sight was used. I venture to think the objection is not to the gun in that case, but rather to the utter absence of training which appeared in the gun detachment. It is mere A B C to any recruit in the artillery that the wheels must be on the same level in order to shoot accurately, and that if the platform be not level, compensation must be given by means of the sights; unless men are properly trained in the use of their gun you cannot expect the gun to work of itself.

Captain SALTWATER, R.I.A.: General Owen asked me a few days ago to give a few examples of the effect of artillery practice at Okehampton. In 1887, with the two 20-pounders which I commanded there, we fired a quarter of an hour at a range of 2,100 yards at targets to represent a regiment of cavalry in quarter column, and we put 2,000 bullets into the targets. Four guns afterwards, I believe, put from 3,000 to 4,000 bullets into the same targets. With regard to what Colonel Hale said as to the destructive effect of shell, I may mention the effect of firing with a 20-pounder common shell with a percussion fuze on the block-house down there was wonderful. The block-house was constructed of two rows of timber from 6 to 8 inches in diameter with from 6 to 7 feet of earth between. The first shell from the 20-pounder passed through the first row of timber, burst in the earth inside, and completely opened the second stockade behind the timber, making an enormous breach in the block-house. There was something more than moral effect in that, as you can imagine. Then, again, as to what Sir Gerald Graham said about our guns being too heavy. The lighter nature of guns, I think the 13-pounder and the 9-pounder, in 1857 made no effect whatever on this block-house, or nothing to signify. I mention this as showing the great advantage in some circumstances of having heavier field guns. One can imagine what the effect of shell of this kind would be in village fighting, where the church or the factory, obstinately held by the enemy, would be completely demolished by the shells of this new gun. As regards accuracy of practice, I may mention our competitive practice in 1889 with the 12-pounder B.L.R. gun. Two out of ten men struck a 6-foot square target at 1,500 yards twice out of three times, and several other men struck it once. If this can be done we may hope that they would be able to strike a machine-gun at that range before the machine-gun could do them any very great injury. When speaking of the practice of artillery against masonry, Colonel Hale

would like to know what effect it would have. I do not think it would be very hard to have masonry erected at Okchampton; it would be exceedingly interesting to see the effect of the different projectiles thereon, especially as in any European war there is a good deal of fighting done in and about villages which are frequently the turning points of actions. There is one point which has not been noticed, and that is the effect that the use of signalling should have on artillery fire. Commanding Officers frequently train one or two of their men to signal, but we have no authorized signallers in the batteries of our artillery. I think there should be an establishment of two or three signallers in batteries of field artillery; they ought to be paid as such, and their status should be recognized just the same as it is in the cavalry. Last year we trained two signallers in my battery, and I think the practice was decidedly affected by the fact that the observing party and the Commanding Officer could communicate thereby with facility.

Mr. NORDENFELT: The paper is so full of interesting and suggestive matter that we should take up a week were we to discuss it fully. I want just to emphasize the exceeding necessity of the rearrangement of the Shoeburyness Establishment. I have done so once before last year in this room. In France, the Marine Artillery, only for marine purposes, has an establishment of sixteen Officers, who are working from morning till night. We, in England, have for both weapons—Army and Navy—an establishment where, I believe, there are three artillery Officers, exceptionally clever men, altogether overworked, who have not only to carry out these experiments for us but also to test ammunition and do all sorts of things which no one human being can possibly do, and which they do their best to do. Surely, instead of spending 20,000*l.* a-year on experiments and getting a blowing-up in the House of Commons, if you spend 200,000*l.* I believe they would thank you for it. In France, I believe, they spend about 300,000*l.* on the Marine Artillery alone. The question of small calibre guns as against large calibre is exceedingly interesting, and I hope when the 8-pounder quick-firing gun comes to trial we shall have some very interesting results. Prince Kraft von Hohenlohe gives 3,800 yards as the range at which shrapnel commences to have effect, and from 1,500 to 2,000 yards as the period at which shrapnel is decisive. There is not the slightest doubt that quick-firing guns, be they 6- or 8-pounders, are fully effective up to 3,800 yards, when they have a decent initial velocity. I do not mean to say they have the same effect as 12-pounders at the longest range; I do not say that they have the same effect against buildings, but I should like to see the effect of fifteen 8-pounder shots a minute containing mclinite against two per minute of the field-gun. I do not think there will be much difference on the whole. Colonel Maurice spoke of the suddenness of effect. I am working with a range-finder in which, up to 4,000 yards, we have an average fault of about $\frac{1}{4}$ per cent. That means, I can send up a range-finder beforehand, I can take a distance 2,000 or 3,000 yards away; the enemy does not see that process; I can then get up the battery or quick-firing guns, open fire for a minute or so at a range which I know within $\frac{1}{4}$ per cent., say that it is 4,000 yards—the fault would be 20 yards—I can fire a minute fifteen or thirty rounds and gallop off again. I cannot imagine any moral effect and also material effect greater than would be produced by firing five times as many shells per minute, although each shell is only 8 lbs. as against 12 lbs. You cannot look out for these shells, they come over you as a mass of fire. I believe that it was mass-fire that Lord Wolseley meant when he asked Mr. Maxim whether he could make a machine-gun to fire lead bullets at a long range. Mr. Maxim made one $\frac{1}{2}$ -inch calibre. Since the O'303 gives such excellent results for the distance at which shrapnel is supposed to be decisive, personally I do not believe it is necessary to go to any other calibre, but with the range-finder when I can stand here, knowing my range, fire for a minute or two, then gallop to another point from which I also know the range by having taken it at the previous firing point, unlimber, fire another minute again, and then repeat the same somewhere else, each time knowing the distance, I am perfectly certain the result would be worth studying. I would like to say one word in all kindness. One of the remarks General Owen has put forward is that Major Mecham, at Aldershot, does not believe in the fire of machine-guns. Major Mecham forgot in his report to mention the comparative time of fire. The machine-gun fired, I believe, for one and a half minutes, the

infantry fired for twenty minutes. Besides, I am not quite certain that a musketry instructor, clever and intelligent though he be, is altogether absolutely unbiassed as between rifles and other arms. I do not want to say a word against Major Meacham, he is a clever and experienced Officer, but he is a musketry instructor. I want to say one word more about the quick-firing gun and machine-guns, and it is this: the new powders we are getting are absolutely smokeless; that is to say, the man who fires can see through the haze, but the enemy, if they are a mile away, see only the bluish haze and cannot see the man who fires. These powders are also practically noiseless, at 100 yards or 200 yards from the gun you hear a noise, but no noise of any kind is heard 1,000 or 1,500 yards away. That means that if I have found my range and fire for a minute, I am almost satisfied that quick-firing guns or machine-guns will have the required effect before the field gun is actually ready to commence to fire.

Lieutenant-Colonel SCOTT, R.E.: General Owen has given us a very clear and interesting lecture on the value of artillery force in the field, in the hopes of convincing unbelievers in its efficacy; but if he thinks that they will be convinced by words alone he is much more sanguine than I am; I have already tried that game. To be convinced, they must go and witness with their own eyes the terrible effect of modern artillery fire on the practice ranges at Okehampton, which privilege I have myself enjoyed by the courtesy of the Royal Artillery, for several years, and then they will change their opinions as did a very distinguished General Officer who, to the great satisfaction of the Royal Artillery, honoured the camp last summer with his presence. The knowledge to be gained there, of the effect of artillery fire, of the modifying effect of ground upon the effect of that fire, and of the tactical principles to be learnt therefrom, the General above referred to would tell you, is of the highest importance to every Officer in the Army, whether he be a commander or leader of men in the field. Every Officer who has completed his course at the Staff College should be ordered to Okehampton instead of to Aldershot to learn artillery work. No Officer who has a chance of becoming a commander of troops will in these days be fit for such an important post who (as the lecturer has well said) has not thoroughly mastered the technical and tactical value of each arm, whether it be a field-gun, Maxim gun, quick-firing gun, or rifle; for his gauge of the effect of fire of each of these arms creates in his own mind the principles on which he is to base his tactics, and if his ideas are theoretical on this subject, his tactics will also be theoretical, and will result in an unnecessary sacrifice of the lives of his own men. There is only one way of acquiring the above most indispensable knowledge, and that is to go and see these guns fired, and to note their destructive effects. There seems to be present in the minds of some that the field-gun may be supplanted by one of the new arms, such as a Maxim gun or small calibre quick-firing gun. Now I am not one of those who think that either of them can take the place of the other. We want them all, and as many of them as possible. They each have an independent rôle to play, and it is our business to find out by actual practice what that rôle is, so that we may intelligently combine their forces together to the best advantage, under different phases of the fight. If it comes to a comparison between the value of the Maxim machine-gun and the 12-pounder field-gun, as an engine of war, there is no question in my own mind that the field-gun has the palm. The field-gun, with its shrapnel containing 177 bullets; its case containing 216 or more bullets, its common shell and fragments, can create against troops in the open as deadly a danger zone of bullets at 4,000 yards as the Maxim gun can at 1,500 or 2,000, if the effect of its fire can be observed, and it can attack troops behind cover with effect with its shrapnel and common shell which the machine-gun cannot; and at close ranges it can fire its case with 216 bullets with deadly effect up to 300 yards. How often has it happened that the infantry could not penetrate into a village or house till the artillery had come up to their assistance. With a view to convincing any unbelievers in the value of artillery fire; I would remind them that when a shrapnel is burst at the proper distance from troops in the open, the cone of dispersion of shrapnel containing 177 bullets creates a danger zone on level ground of 140 yards long by 26 yards broad at 1,000 yards; of 330 yards long by 20 yards broad at 2,000 yards; and of 160 yards long by 13 yards broad at 4,000 yards, and that, contrary to the machine-gun fire, the fire

of the danger zone is more intense at the longer ranges than at the shorter range, because the 177 bullets of the shrapnel fall into a smaller space. No, gentlemen, artillery fire is no joke in these days. The hole made by a shot is no longer the safest place to put your head into in these days on land. I do not know whether this practice still obtains in the Navy. The 12-pounder shoots like a rifle, and, in fact, shoots where it is laid. You won't believe me, perhaps, when I tell you that you can hit a gun in about three shots at 3,000 yards, and that shots frequently go through the same hole. With the slow-firing howitzer, I have myself seen at Shoeburyness three shots go through the same hole at 2,400 yards, and if that can be done with a howitzer, the slow travelling shot of which is more influenced of course by the air than that of a high velocity 12-pounder gun, then it can easily be done by the high velocity 12-pounder. There is another point which General Owen mentioned with reference to a battery first coming into action, and then finding the range. I think so highly of the effect of artillery fire, that I do not believe a battery could come into action against another battery already in action without being annihilated; and, therefore, I think it is absolutely necessary that the ranges should be found first of all by range-finder, or by a section of guns, and the sights adjusted under cover, the gun loaded and the fuze set, before going into action. Of course there are difficulties at present about having the gun loaded, but I believe that it could easily be got over with a little thought; also you want the fuze to be in the base of the shell which can be altered after the gun has been loaded. There is another point, that is with reference to the lecturer's remarks on the value which Lord Wolseley is said to put on artillery. I venture to think that his lordship's impressions on that point were very similar to those held by a large number of artillery Officers themselves, previous to the important improvements which have recently been introduced into the training of the Officers and men in shooting, and I am sure no one in England would be more pleased than his lordship to learn that the artillery fire had so much improved, and that the artillery intends to maintain the proud position for efficiency which it has always held in the British Army. Perhaps you are not aware that it was entirely due to Lord Wolseley's influence that the sights which General Owen has been good enough to refer to in his lecture were tried by batteries of field artillery, and if they have met with your approval, it is his lordship that you have to thank for their introduction into the Service.

Major HUTTON, King's Royal Rifles: My remarks made at Aldershot, to which General Owen has alluded, were intended to convey the idea, and, I think, they did in the discussion which followed the lecture, that the machine-gun which we have had an opportunity of testing up to the present moment is not a perfect weapon, and not that machine-guns are not extremely valuable adjuncts to an army in the field. The experiments conducted at Aldershot under the superintendence of Major Mechem, to whom Mr. Nordenfelt referred, were conducted with very great care, and, as far as possible, under service conditions, and the result certainly surprised every one. General Owen has alluded in his lecture to the result of the experimental practice which then took place. The reason that the shooting was so bad we considered to arise from the fact that the sights and mechanism of the guns under trial were defective. The question of the principle of the employment of machine-guns with troops did not come into the question at all, but as practical soldiers we considered that the machine-gun submitted for trial was not a perfect one. I do not think there can be any differences of opinion as to the extreme value of the machine-guns in war, firstly, at short ranges, and, secondly, at long ranges. It is simply a question whether at long ranges the machine-gun is a sufficiently perfect and finished weapon for its purpose. I venture to think that at the present moment it is not so. Some very remarkable experiments took place at Aldershot the other day, which illustrated or brought home to us one of the manifest defects of the machine-gun at long ranges. The new magazine rifle was fired at 2,500 yards by a party of ninety infantry soldiers at a vertical and horizontal target with the most extraordinarily successful results. The target was not seen by the men at the firing point, as it was a very foggy day, but they directed their aim at an intermediate point at 1,000 yards distance, but here lies the secret of the successful shooting; the direction of every volley, and the mistakes

made in the aim, were made known accurately at the firing point by means of the telegraph, and therefore the necessary readjustment of sights was made, and thus it was that the shooting was so extremely accurate. Bear in mind that with a machine-gun you have no means of seeing where the bullets strike, and therefore unless you have a very carefully contrived range-finder, your machine-gun may be pumping lead and exhausting the ammunition limbers to no purpose whatever. Again, the laying of the gun and the sighting must be of the most perfect and complete kind if useful practice is to be reckoned upon at long ranges.

Lieutenant-General Sir ROBERT HUME: I wish as an old infantry Officer to say a few words to tell General Owen how exceedingly interested I have been in his lecture, and also because I do not think any infantry Officers have spoken this evening. The subject of the lecture is of the greatest interest to us, more so perhaps than to artillery Officers, who naturally know so much more about the subject than we do, but it is certainly of quite as much as great interest to us as it can be to them. I have never in the course of my service heard so many observations made in, I may say, depreciation of the artillery as I have heard this evening, I mean that the opinion seems to be pretty general that in other branches of the Service the artillery is not appreciated. But that is not at all the fact. There is no branch of the Service that any of us, I think, are more proud of altogether than our artillery, and I am perfectly certain that any of us, either infantrymen or cavalrymen, would be very sorry indeed to have to depend upon ourselves and to be left without artillery. As for the moral effect of artillery, I do not think, so long as the artillery produces the effect that we wish it to do, that it matters whether it is moral or whether it is actual. I do not know whether there are any other Officers in the room who can remember one instance of the very overwhelming effect of artillery that we saw in the Crimea, I mean at the Alma, when we were going up the hill. There were three shells fired from Turner's battery into what seemed to us an enormous mass of Russians who were coming down the hill, but the effect of those three shells dropped into this mass, whether it was moral or whether it was actual I do not know, was that the mass moved up the hill, and the effect on our men was that they went faster up the hill after that mass than they had done before. That happened when I was a young subaltern, and of course a few things of that sort in the way of practice have a very great effect on one's mind. I know that any of us who served out there, and actually saw the effect, and felt the effect of artillery, have never doubted the value of artillery since those days, and we teach, as far as we can, our men of different branches of the Service what they are to expect from the assistance and also from the opposition of artillery. With reference to what the lecturer said as regards Officers as far as possible being instructed or going down to see experiments with artillery at Shoeburyness or wherever they may be, I think that the different branches of the Service should, as far as possible, whenever opportunity offers, be made acquainted with the arms and with the training of the other branches. In India, where I served a long time, we have many of those opportunities which you cannot have in England, because we are able to carry out our own artillery practice, and our rifle practice near our large stations where any man, it does not matter whether he be a General Officer or one of the privates, infantry or cavalry, can go to the range, and many do go to the range, and see the effect of the practice. With regard to another observation made about artillery Officers making a mystery of their guns, and what they have to do, I can only say in my experience, and I have had a good deal, I have never seen it. I have found the greatest anxiety, not only to show everybody what they have to do, but to get men of other branches of the Service to go and see what they are doing, and the greatest pride taken in showing what they can do. I am delighted to hear all that has been said to-day about the progress the artillery is making, because so much depends upon it, and I feel personally very much obliged to the lecturer for the lecture he has given us, and the opportunity of the discussion. To many of us who are not actively employed, this Institution is the only place where we can hear these subjects properly discussed.

Captain F. E. D. ACLAND: I shall not detain the meeting for more than a few moments, but as an old Shoeburyness Officer, and having spent over four years in experimental work, I should like to say a word or two in regard to what General

Owen said. Firstly as to firing guns on what I think he called "perfectly level ground." As an experimentalist, I am convinced that it is the only way to arrive at any true results whatever with machine-guns or other artillery matériel; and to arrive at any reliable conclusion as to the comparative accuracy of any weapon, every outside cause of possible inaccuracy must first be carefully eliminated. After the weapons have passed through the experimental stage they should of course be handed over to the troops to experiment with them in what is technically known as "under service conditions." I know what an experiment under service conditions means, because I have carried out many in that way myself; but I fear that it often means that insufficient care for details is bestowed on it, and, even if the care is given, the Officer who has charge of the experiment does not fully grasp all those points of detail which are matters of ordinary routine to a man with a regular experimental training. For instance, Major Hutton has just fallen into a trap, in which I must catch him. He has told you that with the new rifle and the new ammunition they fired with most wonderful results at 2,500 yards, and that they had the effect of their fire and so on telegraphed down to the firing point, and then immediately, in the next sentence, he says that with the machine-gun you cannot see the result of your fire, and so how can you expect to get effective shooting at these long ranges? The logical conclusion would be to put the machine-gun on a footing similar to the rifle, and establish the telegraph, and then you have a fair comparison between the two. After an enormous amount of trouble in various quarters they have at last arrived at an ammunition for the new rifle, but as far as I know there is no machine-gun built at the present moment which has ever fired that ammunition. If you want to compare your rifle and machine-gun fire, put them on an equal footing in this respect and fire similar ammunition, and so see which is the most accurate. I must also go back to a remark made by Mr. Nordenfellt as to the experimental establishments of this country. Since I have left the Service it has been my privilege to see the experimental departments of two of the larger European countries, Austria and Russia. I had always, as a true Britisher, expected to find Russia a benighted country, but I must own, to my shame, that though I found the Officers less well educated and less well up in what one might call European gunnery, yet their experimental establishment was certainly double if not treble as good as our own at Shoeburyness. Their instruments were perfect, and if money was wanted and the experimental Officers said that they must have certain things they seemed to get them. The experiments were carried out by a staff of sailors and soldiers, not of soldiers only for naval experiments, but of soldiers and sailors, each doing their own proper work, and doing it in a way which was a source of astonishment to me. In Austria it is much the same thing: each have their own experimental ranges and establishments. Now I am perfectly intimate with all the details of Shoeburyness work, and I say it is monstrous that in this country, with all its wealth, we should be left with one questionably complete experimental establishment, inferior, as far as I can judge from a week's visit to one place and a fortnight to the other, in almost every respect to those in Austria and in Russia.¹

General OWEN: I shall trouble you with very few remarks in reply. The object of the lecture was to elicit information from others rather than to attempt to instruct anybody here. I wanted to hear the observations of those interested in the various points raised. Colonel Markham said that my paper dealt rather with the history than the value of field artillery, but I think the discussion we have had will hardly bear out that criticism. I saw Mr. Nordenfellt the other day, and he was good enough to tell me there was an 8-pounder besides the 6-pounder. If it is an 8-pounder so much the better; but I understood Mr. Nordenfellt to recommend the 6-pounder. Colonel Markham said that I had not pointed out the best places for limbers and wagons in action, but it might be inferred

¹ I am perfectly well aware of the experimental establishment connected with the "Excellent," but it must from local disadvantages remain lamentably deficient in all that can make it a satisfactory place for scientific research into general gunnery questions, which is vital to the correct solution of those many problems connected with matériel before it is introduced into the Naval Service.

from what I did say, that these should be in rear of the intervals between the guns, out of sight, and under cover when possible. As to the introduction of field howitzers and taking steps to avoid the necessity of turning fifteen field batteries into ammunition columns, I shall be extremely glad to hear if both can be accomplished; but the 20-pounder lately tried at Okehampton is not a howitzer in any way. The guns supplied for the reserve forces are very useful, but they are mostly position guns, which would in no way be able to take the place of field-guns. It is not necessary for me to answer what Colonel Hale said; Captain Saltmarsh replied very effectively. I do not think there is much doubt that buildings or strong masonry of any kind would be damaged very considerably by our guns. Colonel Maurice put very ably the contention respecting the moral effect of artillery, but I cannot at all agree with him that the moral effect is *out of all proportion* to the actual effect. However, it is not worth while saying anything more about that point, but I may say this: Colonel Home's book on "Facts," although written a long time ago, is still used. Then again with regard to Lord Wolseley's "Pocket Book,"—I did not quote the edition he published twenty years ago, but the eighth edition. Sir Gerald Graham took exception to what I said about continuously—continuously fired from the same position without recoil. What I say is, you cannot fire a gun continuously that you have to lay between the rounds; you cannot fire a hundred rounds continuously if you have to lay your gun between each round. I am not speaking of the Maxim but the quick-firing guns, and I understood, both from the Armstrong firm and from Mr. Nordenfelt, that the firing of each round put out the laying to a certain extent; that although the recoil carriage prevented any running back, and there was only a slight motion, still there was sufficient to put out the laying.

MR. NORDENFELT: The vibration of the weapon is sufficient to disturb the aim at 2,000 or 3,000 yards; therefore they should always be relaid. But the relaying is done by wheels, and we still fire from fifteen to eighteen rounds comfortably per minute by relaying each round.

General OWEN: I am glad to hear that so much can be done.

Captain F. E. D. ACLAND: Twelve aimed rounds per minute is the condition the Government laid down, so that you can lay twelve rounds a minute.

General OWEN: Captain Stone said the reason for having the bursting charge of shrapnel in the head was that it enabled the shell to be fired with a percussion fuze. I am not quite sure I understood him, but if that is the case, it is an advantage, of course; still I cannot think that the shell is altogether satisfactory, and when I wrote to Colonel Harlow, R.A., Superintendent of the Royal Laboratory, to ask the reason, he replied, "Having the bursting charge in the head leaves room for more bullets."

Captain STONE: I said that putting the charge in the head enabled the bursting charge to be ignited with greater rapidity than when it was in the base, and that therefore percussion shrapnel would take effect under the new conditions with great results up to 2,000 yards; whereas in the old condition, that is, when the fuze took so long to ignite the bursting charge, owing to the latter being in the base, the bullets went up in the air instead of travelling forward. This is due to the fact that in the former case, the burst is almost instantaneous upon impact, and actually takes place at the moment when the effect of the ricochet has brought the axis of the shell into a horizontal position, or with its point perhaps just on the rise from that position; the axis of the cone of dispersion is consequently horizontal or slightly inclined upwards, thus giving great effect to the bullets. In the latter case, however, the action of ricochet is completed before the burst has time to take place, the result being that the axis of the cone of dispersion is deflected upwards to such an extent, that there is practically a safety zone of 50 to 100 yards immediately in front of the point of impact, most of the bullets falling harmlessly over the object aimed at.

General OWEN: Mr. Nordenfelt said the powder they used would make very little noise and no smoke, but a kind of haze, which would be rather an obstruction in the way of those aiming from a distance. That of course is an advantage, and I referred to it in my paper. As to my alluding to a fallacious comparison in counting the amount of metal fired from two guns, I say this, if you have a

6-pounder shell fired against a 12-pounder shell, for instance, the smaller shell, I should imagine, would fire too close, and the cone of dispersion would not be of the same extent. You may fire the same weight, but you would not cover the same ground—that is my meaning. I do not think it is necessary to detain you any longer.

The CHAIRMAN (Sir Lintorn Simmons): I think you will all agree with me, in fact all the speakers hitherto have expressed their opinions that they have been much gratified by the lecture we have just heard from General Owen. It has brought sundry subjects under our notice which are of great interest to the Services. They are so numerous that it will not be possible for me to touch upon many of them, but there are one or two as to which I will make a few observations. The lecturer in the first instance began by combating a statement by Lord Wolseley, that the effect of artillery is more moral than actual, and that it kills but few. I have heard a great deal about moral effects as distinguished from actual effects, but my belief is that the moral follows the actual results, and that noise will not frighten properly organized troops, such as an army might be likely to meet in Europe, but that they are effected solely and wholly by the results that are to be seen among them. There is a certain effect of noise which gives confidence to troops, as when their own artillery is heard in their vicinity, because it assures them that they are supported on their flank, where they know that destructive results are being produced upon the enemy. The effect of the noise of artillery in the field is not like that produced upon a household when a burglar is in the house, who may be suspected of having a revolver in his pocket. Individuals are liable to alarms of that sort, but I do not believe that large masses of men, if well trained, well organized, and subject to discipline, can be affected in that way. What really brings crushing effects in war is when troops having been weakened by disease, by heavy marches, by want of food, or by previous disasters, find they are suffering heavy losses; great moral effects are then produced, and when so fatigued and worn out that they are unable to maintain their ground. These, I believe, are the principal causes why troops retire from the field of battle; but I do not believe in the moral effect of noise at all. The question of quick-firing guns is one of the greatest possible interest. I heard Captain Acland remark that the conditions fixed by the Government for quick-firing guns were that they should be able to fire twelve laid rounds in a minute. That is, I presume, for sea service; and I can perfectly understand such to be the case, because at sea guns are fixed upon standards when they do not recoil at all, which is not the condition of guns which must be subject to recoil or shock when fired in the field. I take it the conditions are quite different. Having seen practice on board ship, I have not the slightest doubt that these guns can be fired twelve rounds in a minute, the gun being in a fixed stable position, and the man who lays the gun never removing his shoulder from its butt.

Captain ACLAND: If the field-gun does not recoil, surely the guns are in the same condition as those on board ship?

The CHAIRMAN: But in the field the gun is not fired from a fixed platform.

Captain ACLAND: The gun will not recoil.

The CHAIRMAN: On board ship the gun is absolutely fixed, and the platform to which the gun is attached is fixed; whereas in the field there must be a certain amount of motion from the shock on the ground. I have not seen these guns at work in the field, but I cannot understand that there is no motion whatever on the ground.

Mr. NORDENFELT: We have often fired eighteen rounds from a field carriage—often.

The CHAIRMAN: Laid?

Mr. NORDENFELT: Yes, often.

The CHAIRMAN: I am glad to hear it, but I do not understand it, I must say, that is, if the gun be carefully laid after each round. Then as to the effect of shrapnel in the field. I have not seen any of these new pattern shrapnel with bursting charges in their head, but having been on the Armstrong and Whitworth Committee, which is now perhaps almost too out of date to allude to, I know that shrapnel shells of those days, as fitted by General Boxer, had the charges in the

base of the shell, and that a great number of rounds were fired direct at walls 18 or 20 inches thick, and against earthworks, when we found that the shells with those percussion fuzes exploded immediately behind the obstacle, as they came out of it, within a couple of feet or so. The results, as recorded, show that they would have had the most destructive effect upon men inside the walls. In order to test the action of the fuzes, which was very quick, shells were fired against targets of wood 2 inches thick, after passing through which, they burst about 15 feet behind them, at least that was the conclusion that was arrived at after a number of experiments carefully conducted. That seems a very quick explosion, and certainly the bullets were not impeded by it, which they must be, more or less, by the explosion of the charge in the head of the shell. I have no further observations to make. These have occurred to me within the last few minutes, and I now ask you to pass a vote of thanks to General Owen for his exceedingly interesting lecture.