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Thursday, April 24, 1890.

MAJOR-GENERAL W. H. GOODENOUGH, C.B., R.A., &c., &c.,
Member of Council, in the Chair.

NOTES ON THE DEFENCE OF A MODERN FORTRESS.

By Lieutenant-Colonel WALFORD, R.A.

I. Introduction.

THE extraordinary career of success of the German field armies in 1870 and 1871 has been, to a great extent, the cause that comparatively little attention has been directed to the action of such forces as were, at various times, detached for the purpose of obtaining the surrender of the French fortresses. The investment of Metz was carried out by the field army alone, and did not in its execution progress beyond the very first stage of siege warfare; while the blockade of Paris, though it was eventually supplemented by a partial bombardment, added nothing to our knowledge of the details of the regular attack and defence of a modern fortress. Much information was undoubtedly gained from the sieges of Strassburg and Belfort, but its value was diminished by the fact that the former was a stronghold of an old-fashioned type, while the stubborn resistance offered by the latter was made possible, not by the permanent fortifications, but by works of inferior profile and of a temporary character, which were thrown up after the commencement of hostilities.

It is scarcely too much to say, that the obsolete nature of the French fortresses, and of their armament, as they existed in 1870, has led many of us to depreciate and undervalue the defensive power of well-designed works, placed in carefully selected positions and armed with ordnance of long range or of great shell power, since at that date we saw that the surrender of a fortress, with the consequent loss of the garrison and material contained in it, was in very many cases caused by a mere bombardment, such as would, in a modern siege, be considered as simply a preliminary operation.

In this manner it has come about that the defensive strength of modern fortresses, with regard to the amount of preparation and the expenditure of time which will be required for their reduction, has been very generally underestimated; there is, in addition, a tendency to underrate the necessity for that reduction.

One not unfrequently hears the gigantic chain of fortresses, which guards the eastern frontier of France, spoken of as if it was a mere line of obstacles, a sort of post-and-rails, which could be negotiated at almost any point with a little determination and a certain amount

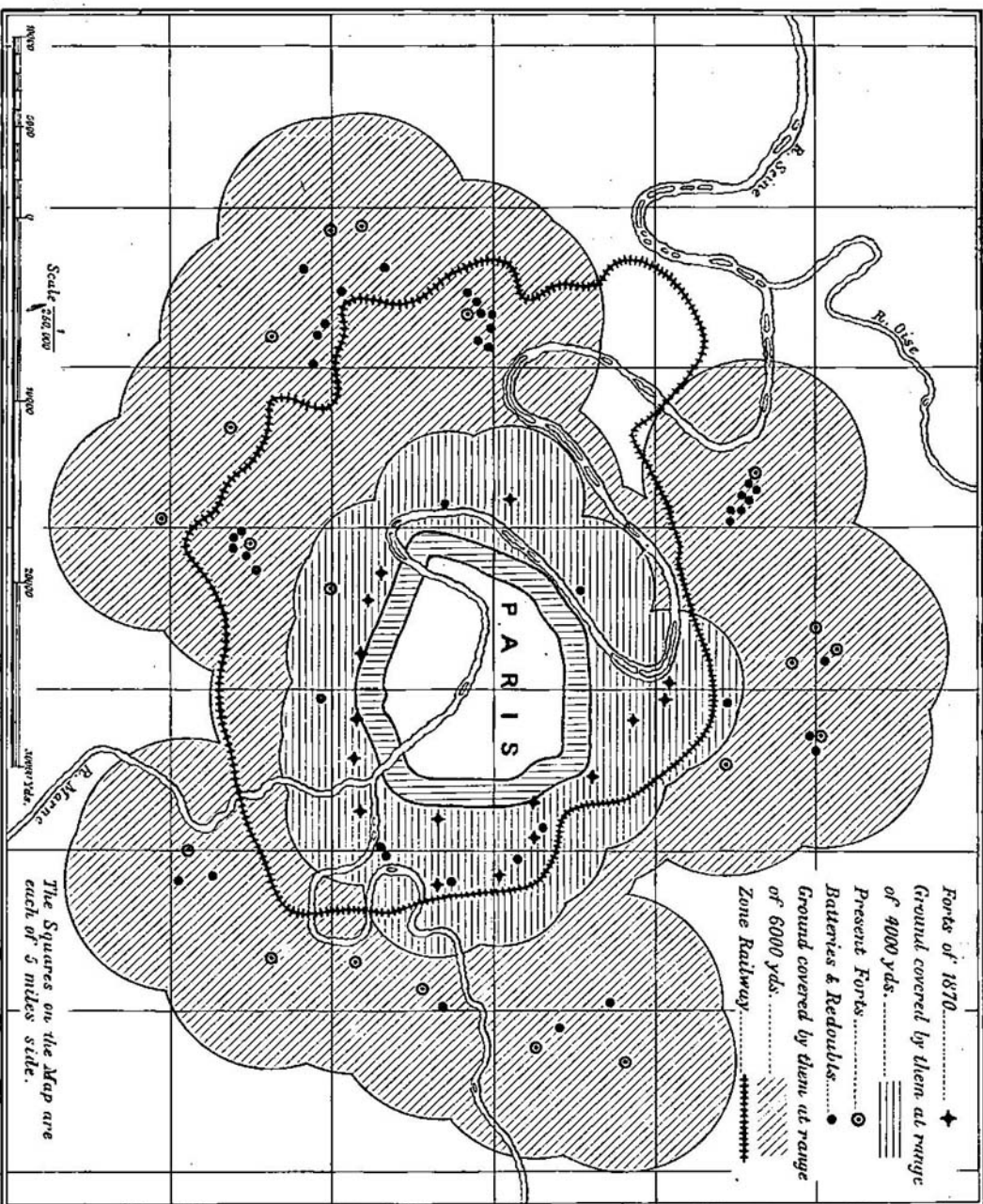
of exertion. Many of us talk airily of masking such and such a fortress by means of a detached corps, and of thus permitting the uninterrupted passage of the main army; while others quote the old maxim—that all fortresses must follow the fate of the field army, and may thus be neglected in the pursuit of the latter. The general truth of these axioms it would be impossible to dispute, but it may be well to consider how far the movements and the action of an army, which may have thus broken through the defensive line and have pushed forward in search of the enemy's field forces, will be limited and hampered by a fortress in its rear, even though that fortress be rendered powerless for active operations by the presence of a sufficient retaining force.

I will not ask you to follow me into a long dissertation upon the vital importance of a secure line of communications, with the consequent necessity for the entire possession of railways, but will mention only the part played by the town of Mézières in the campaign of 1870. This fortress, which is described in the German official account of the war as "incapable of a prolonged resistance," commanded the direct line of rail from Sedan to Rheims, and thence to Paris. After the battle of Sedan a large quantity of engines and of rolling stock was found in the station of that town, and it was desired to use these for the further advance; owing, however, to the fact that Mézières was still in the hands of the French, this material was rendered useless until the repair of the bridge over the Meuse at Bazeilles made it possible to divert it to another line of advance. Again, during the siege of Paris (owing still to the fact that Mézières, which commanded the above-mentioned line, was as yet in the possession of the French), the whole of the trains carrying the supplies for the four German armies then in France were compelled to use the one section (62 miles) of railway between Frouard and Blesme, with the result that though, so long as all went well, sixteen trains could be passed daily over that section, the smallest difficulty or accident led to a serious deficiency of even necessities. Moreover, although, in anticipation of the surrender of Mézières (which took place on the 1st of January, 1871), measures had been taken to repair the remainder of the line, yet, owing to the amount of injury which the rail had received in the vicinity of that town and of Montmédy, it was not until the 21st of January that the 1st Army and the Army of the Meuse could be supplied by the way of Rheims. Can we venture after this to despise even the most insignificant fortress, when its position has been selected on correct strategic principles?

II. *The Modern Fortress.*

I have, with the object of saving time, prepared a diagram (see Plate) showing the enceinte and chain of forts encircling Paris as they existed in 1870, and also the system of fortification employed at the present day for the defence of that capital. The shaded ring round the enceinte shows the extent of ground which, at the period (1840) when the continuous rampart was constructed, would be covered by the fire

SKETCH OF THE DEFENCES OF PARIS.



of the guns of that time at a range of 1,500 yards; the horizontal lines mark the space which was commanded by the forts in 1870 at a range of 4,000 yards; while the diagonal lines show the zone protected by the present forts and batteries, given that the guns may be effective up to a range of 6,000 yards. A merely passing glimpse will show us that the systems of attack and defence must in the future, taking this as a type of a modern fortress, vary much in detail from those which prevailed twenty years ago.

As I have no intention to deal in this paper with matters of history, I will, without entering into the causes of the changes which you may see on the diagram, merely invite your attention to the prevailing characteristics of the present scheme of defence. The most important tactical points around the capital are here occupied by permanent and independent forts, at a long distance from the enceinte and from each other; at a moderate interval from each fort (with a few exceptions) there stands a group of permanent batteries, each of which is designed for the protection of some special area, and is provided with means for independent defence; the fort thus serves as a keep for its nest of batteries. I will further ask you to notice the zone railway, which serves to connect the various portions of the system, and to provide for the distribution of men and material as may be required; the total length of this railway is about 60 miles.

All this is, however, merely the skeleton of the defensive system, for at the commencement of hostilities it is proposed to allot to each fort, and to many of the batteries, a group of "auxiliary batteries," intended to give cover to additional guns and howitzers; while in the spaces between such forts as may form the object of the formal attack, "intermediate batteries" will be erected as occasion may require. Nor is this all; for the intervals between the batteries and all favourable points within a distance of 1,000 yards from the front of the line of defence will be occupied with field entrenchments and other cover for a large force of infantry.

It will thus be seen that a section of the line of defence of a modern fortress is, in truth, a naturally defensible position, further strengthened by the use of permanent forts and batteries, of which, moreover, the fire will be supplemented by that from works of a more temporary character, while the whole system will be covered by an advanced position held by infantry. This last fraction will itself be far stronger than an ordinary defensive position in the field, since by the nature of its plan its flanks are absolutely secure; it may, indeed, be said to have no flanks, since every attack upon it must be frontal.

It will be further observed that, owing to the extent of the position as compared with the width of a front of former fortresses, there will be many more favourable opportunities for counter-attacks than was the case with the sorties of earlier days, since the number of exits has now no limit, while the garrison, acting on interior lines, can concentrate on any point with a rapidity which the besieger may envy, but cannot imitate. Moreover, ample space now exists for the movement of field and other light guns, which may thus take advantage of

any mistake on the part of the enemy with reference to the selection of the site of his batteries.

If we take all these characteristics into account, we shall realize that the facilities for offensive operations on the part of the Defence are now very great, and may thus perhaps assume that, up to a certain period of the struggle, the besieged should, if they be well led, be able to retain the initiative, and to compel the assailant to limit himself to devising counter-strokes to their active efforts.

III. *The Armament of a Modern Fortress.*

The general principle of the distribution of the artillery of a fortress is based on the division of the entire circuit of the defensive ring into sections, each of which forms an independent command.

The ordnance allotted to the fortress will thus be divided into:—

- i. The armament of the permanent forts and batteries.
- ii. The sectional reserve.
- iii. The general reserve.

Of these the first two will be in the hands of the sectional commander, while the third will be at the disposal of the commander of the fortress.¹

i. The armament of the permanent forts and batteries will consist of the long-range guns, which will be stored in the works to which they are attributed, and will on the declaration of hostilities be mounted in the emplacements designed for them; all arrangements for the supply of ammunition, &c., to these guns will be of a permanent character, and all material belonging to them will be invariably kept in the defences to which they belong.

ii. The sectional reserve will be employed in the "auxiliary" and "intermediate" batteries, but will form as distinctly an integral part of the permanent armament as the guns of the forts and batteries. It will consist principally of howitzers, of which some will throw heavy shell, while others will be light enough to admit of some change of position. It was at one time proposed that these howitzers should draw their daily supplies of ammunition from the forts; but this would be a very difficult operation under the weight of fire which will be concentrated on the permanent works, and it will probably be wiser to provide the temporary batteries with special magazines, many in number and small in size. In fact, the works intended to cover these howitzers should partake of the nature of those of the Attack, and the supply of ammunition should follow similar lines.

iii. The general reserve will include all the field guns of the fortress, together with a proportion of light mobile howitzers; there should further be provided a certain percentage of guns belonging to the two other categories, which would be available to replace losses

¹ A similar arrangement will be made with respect to the distribution of the men of the garrison among the defences, as they will be divided into sectional troops and troops of the general reserve, while the former will be further subdivided among the various units of the section.

in action. With the exception of the field guns, which should belong to such field batteries as are told off to aid in the defence, the guns, &c., of the sectional and general reserves will be kept in the arsenal of the fortress until the probability of attack arises. In the earlier part of the siege the guns of the general reserve will be employed as in the Field; this may even be the case at a later period, if advantage be taken of the cover given by the lie of the ground; but it may sometimes be necessary to cover them with a parapet, in which case they must be provided with expense magazines. The supply of ammunition will be carried out by means of the wagons of the batteries.

The general reserve will remain at the disposal of the commander of the fortress throughout the first phases of the siege, but, when, at a later period, any part of it is attached to a section, that part will pass under the orders of the sectional commander.

It will be noticed that the two last portions of the armament of the Defence have been styled "Reserves;" this is solely for want of a better name, for it is not intended to suggest that any part of either of them should be held back from action. The axiom, that the whole of the available artillery should invariably be employed, is nowhere more true than in a siege, and the General Reserve should not, in spite of its name, be allowed to be idle for one moment from the beginning to the end of the struggle.

One other point remains for notice, viz., the absolute necessity for the provision of observing stations in connection with the batteries, and of electrical communication between the former and the latter. Each battery must be supplied with two observing stations, and telephones must be laid down between these and the battery. Such arrangements we should, of course, expect to find in all permanent works, but we must not forget that they are as necessary in the other batteries, since the efficiency of modern artillery fire depends almost altogether upon accuracy of observation and the consequent correction of error.

IV. *The Course of the Siege.*

Since our time is limited, I do not propose to attempt to consider the whole period of a siege, but shall limit my remarks to the phases which lead up to the great artillery combat, and to this combat itself.

The sequence of these phases will be as follows, viz. :—

- i. The reconnaissance of the advancing enemy, and the preparations for defence.
- ii. The action against the enemy's approach, and against investment.
- iii. The struggle for the first artillery position of the attack.
- iv. The artillery combat.

I have been the more willing to limit my paper in this manner, since it seems probable that, when it has been worsted in the great

artillery combat, the Defence will be to a very large extent deprived of such initiative as it possessed during the earlier part of the siege, and that its action will thereafter be limited to opposing and counter-acting the efforts of the assailant. For this reason the later phases of a siege may be best considered under the head of the "Attack."

i. *The Reconnaissance of the Advancing Enemy, and the Preparations for Defence.*—The former of these duties should, of course, be carried out by such mounted troops as the garrison may possess, since infantry cannot be advanced with safety to a sufficient distance from the fortress, and are, moreover, urgently needed for the preparations for defence. It may be best provided for by the use of a line of cavalry outposts, at about a day's march from the main defensive line; from this patrols should be pushed forward by day and night, to a further distance of about 3 miles, while the reserve should be posted at some central point within range of the guns of the forts.

If, however, no cavalry be available, infantry must be used, and should be posted as an outpost line at about the ordinary distance to the front, and under the usual rules. The skilful use of a few mounted patrols will much assist in preventing the possibility of surprise, but it is not advisable to advance the main body of the troops too much to the front, since, should the enemy succeed in cutting off any portion of them he will thus gain, at the very beginning of the siege, a great material as well as moral advantage.

The preparations for defence will consist of—

a. The completion of the arming of the forts and batteries, and the transport of ammunition to them.

b. The construction of the advanced infantry position. The works composing this should be placed about 1,000 yards in front of the batteries and forts, and should consist of field-works—houses and woods, of which the situation is suitable, may also be prepared for defence, but shelter-trenches should rarely be used, as, when abandoned, they serve to facilitate the approach of the besieger. Magazines for small-arm ammunition, and a supply of food and water, must be provided, and certain portions of the posts should be prepared as observing points for the artillery.

c. The removal of all cover from fire and view in front of the artillery and infantry positions; this should be carried out, if possible, to a distance of about 3,000 yards from the defensive line. Under certain circumstances, for example, if houses, woods, &c., occupy positions which would be convenient for the enemy's batteries, it may be advisable to leave portions of cover untouched.

d. The organization for the transport of ammunition, for the provision of telegraphic communication, and for the repair or construction of the zone railway.

It will, moreover, be of advantage to arrange for the enrolment, under military command, of civil artificers of various kinds, and for the systematic use of all available hands for the construction of entrenchments, &c.

e. The collection and storing of all kinds of supplies which can be drawn from the surrounding country.

f. Whenever possible, all persons who are useless to the defence should be removed from the fortress before the arrival of the enemy.

ii. *The Action against the Enemy's Approach and against Investment.*—On the receipt of the news of the approach of the enemy, all available forces, including every gun of the General Reserve that can be horsed, must be made ready to oppose the investment; but the troops should on no account be advanced beyond the range of the heavy guns of the fortress, since the superior numbers of the enemy will probably enable him to cut off any force which may be too rashly engaged.

The flank march, which the besieger must necessarily make in order to carry out the investment, is almost certain to afford the defenders a good opportunity for effective action. It may be possible for them to ambush or surprise the heads of the encircling columns, or to oppose their passage over rivers or through defiles; but care must be taken not to strike at their flanks, for troops which so act will probably be overwhelmed on the arrival of the masses who are following in rear.

The success of any offensive movement of this description depends principally upon the choice of a favourable moment for attack; this can be ensured only by constant and careful reconnaissance.

iii. *The Struggle for the first Artillery Position of the Attack.*—The besieger, after having completed the investment, will probably spend some little time in fortifying defensive points which may cover his parks, camps, &c., from attack, and in collecting guns, ammunition, and stores for the siege; as all such preparations will take place at a considerable distance from the fortress, it will rarely be liable to interruption, except from the fire of the heavy guns, while even this, unless some special object is to be gained, may fail to lead to any result sufficient to justify the expenditure of much ammunition.

When all his preliminary arrangements have been completed, the besieger will push forward in order to seize the position on which he intends to erect his first batteries; this position will, as a rule, be clearly marked out by the lie of the ground, will be well known to the defender, and must be within the range of his guns, since from it the assailant proposes to attack them. This is, therefore, under certain circumstances, a very favourable opportunity for offensive action on the part of the defender, and is especially so when the besieger, being too weak to advance from all sides against the fortress, presses forward at only one or two points.

If, however, the assailant be in sufficient strength to close in simultaneously throughout the entire circuit of the fortress, the defender can do no more than delay his advance by every means in his power. A partial advance of the besieger, whether it be the consequence of weakness or of want of skill, should cause him to suffer severely from a flank attack by the defender, who should energetically assault any portion of the position which the enemy may have seized. When, however, the besieger has secured the whole position, further attacks are not advisable, since they may lead to the surrounding and the capture of the force which makes them, and since also this force has

no decided object to gain, and must eventually retire; such action should be postponed until the commencement of the construction of the batteries of the attack provides a distinct objective for it.

It would at first sight appear as if the occupation of his first artillery position by the besieger must infallibly point out upon which front of the fortress he proposes to make his formal attack, a matter with regard to which the besieged must endeavour to obtain the earliest possible information; but (even omitting the case where his strength allows him to advance from all sides) a skilful antagonist will endeavour to leave this point doubtful, by making one or more false attacks, and may even proceed so far as to throw up batteries against more than one front. Since, however, the bulk and weight of modern siege material is so great that a railway is absolutely necessary for its transport, it is always probable that the besieger will select that side of the fortress of which the attack will be most conveniently served by some existing line; of this, however, the besieged cannot be certain, and he will thus be compelled to delay his last preparations for defence until the further action of the Attack removes all doubt on the subject.

The besieger will next proceed to construct the batteries of his first artillery position; the defender will, on the other hand, use all possible means to prevent or delay this operation, for which purpose he will employ both the fire of his forts and batteries and also a series of counter-attacks or sorties. It will, however, be necessary to first discover the actual locality of such works as it is proposed to assault, for the batteries of the first position of the Attack will, wherever possible, be constructed behind cover, and their parapets will thus rarely be distinguishable from the line of defence.

Failing the possibility of the use of a captive balloon for this purpose, the site which has been selected for a battery must be ascertained by means of a system of night reconnaissances, carried out from the advanced infantry position by numerous small bodies of men, who will push forward from different directions towards the enemy, and who will report (telegraphically if possible) the point where they come in contact with either the working parties of the batteries or with the troops covering those parties. Since it is essential to the success of such reconnaissances that they shall escape observation, they will obviously be neither prepared nor accompanied with the fire of artillery, but it may be well to attract the attention of the enemy in some other direction, either by a heavy fire from the forts, or by making false sorties on a different part of the line of investment.

The information which will be brought back by the reconnoitring parties will enable the fire of the guns to be directed on the spots indicated, and will further make it possible to push forward larger bodies of troops from the advanced infantry position, with the object of driving in the enemy's covering parties and of destroying the batteries. These sorties must be supported by the field batteries of the general reserve.

It has been proposed that the Artillery of the forts and batteries should, even at night, prepare the way for the action of these sorties,

and that, to render this possible, the position of the sallying troops should be shown by means of lights, so arranged as to be visible only from the fortress; but it seems very doubtful whether any such results can be anticipated from the fire of artillery by night as would compensate for the great risk of firing into their own infantry.

iv. *The Artillery Combat*.—The artillery of the Defence, as compared with that of the Attack, will suffer in this struggle from the following disadvantages, viz.:—

a. It will, unless the besieger allows his plans to be discovered, be inferior to it in the number of guns in action, and this for the following reason:

The armament permanently attributed to any one front will certainly be composed of a smaller number of guns than will be devoted by the besieger to its bombardment, while the Commander of a fortress will hesitate, so long as he is uncertain as to where he may expect the formal attack, to reinforce these guns from the armament of other fronts, and may, owing to the same uncertainty, be unwilling to run the risk of serious loss to his general reserve. Even if it be granted that, after a while, he will be able to discover the intentions of his adversary, he must still take into account the amount of time which will be needed for the dismounting, removal, and remounting of the guns which he decides to hand over to the threatened front. It is fair to presume that the sum of these delays will in most cases ensure, at any rate at first, a preponderance of strength to the guns of the Attack.

It is, however, possible that some of the guns of the Defence may be of heavier metal than any of those of the Attack. For example, the forts around Paris were, in 1870, armed with ship's guns of great range and power, while a German author has suggested the use on land fronts of an 8-inch gun weighing 14 tons, and throwing a shell of about 200 lbs.

b. Unless great want of skill be shown in the selection of the sites for, and in the construction of, the besieger's batteries, they will offer a far less visible target than will the large works of the Defence; while, since the latter will have been built in anticipation of war, their position will be accurately known and will be recorded on the maps in the possession of the Attack.

c. The besieger can, in most cases, take advantage of his exterior position, and can bring a converging fire upon the line of works of the Defence: thus individual forts and their neighbourhood can be overwhelmed with the combined fire of several batteries of the Attack, which will themselves, owing to the dispersion of their sites, enjoy comparative immunity from injury.

Under these circumstances it is evident that, if the artillery fire of the permanent forts and batteries alone be employed at this period of the siege, the result must be unfavourable to the Defence, and that it is therefore imperative, in order to obtain any prospect of success, to use all possible means to keep down or silence the artillery of the Attack during this, the most decisive, phase of the struggle.

Strong infantry attacks, supported by such field guns as the fortress

possesses, and by such of the guns of the general reserve as can be transported, must be directed upon the flanks of the besieger's line, while such light howitzers as cannot be horsed should be pushed forward into the advanced infantry position, whence they may be able to produce effect upon such portions of the enemy's batteries as are covered from the fire of the main line of defence. The guns employed in combination with the infantry should act as in an ordinary engagement, and direct their fire, not on the siege batteries, but on the covering masses of the hostile infantry, thus preparing the way for their attack by their own troops.

It must be remembered that at this period the object of the besieger is to so shatter and destroy the artillery power of the defender, that he may be able, with the least possible delay, to construct and occupy his first infantry position at a distance of about 1,000 yards from the main defensive line, and, further, that it is of great advantage to him if he can, without an undue expenditure of time, succeed in so entirely silencing the artillery of the Defence from his present first artillery position, that there may be no need to occupy a second for the purpose of using decisive fire at shorter ranges. Since this is the case, it is evident that any action which will tend to distract the attention of the besieger from his main object of attack, viz., from the guns of the Defence, will be an advantage to the latter, as it will give an opportunity to bring a larger number of the guns of the fortress into action, and will thus tend to prolong the duration of the siege.

The principle of action of the Defence must, in fact, be to refuse to stand on the defensive, and to endeavour, on every possible occasion, to change parts with the besieger (at any rate locally), and to compel him to parry when in the ordinary course of events he would thrust. It is above all things of importance to surprise the enemy, and full advantage must be taken of fog, misty weather and rain, and of any facilities afforded by the character of the ground; it may sometimes be possible for an exceptionally strong garrison to undertake such attacks in open day, but twilight or night is, as a rule, to be preferred. It will rarely be wise to push a temporary success too far, for the enemy is presumably superior in total strength; while the aid of the fire of the guns of the main line of defence will generally be needed to enable the troops to withdraw from the position gained, and to cover the inevitable retirement.

It is obvious, however, that after a time these counter-attacks must become impossible of execution owing to the inferior number of the defenders, to the loss which will be incurred in such struggles, and to the consequent decrease of *morale*; the contest must then assume the character of an artillery duel, assisted on both sides by the long-range fire of infantry. In the meantime, however, the Defence should have discovered with certainty the general intentions of the besieger—and especially the objective of his attack—and should have made use of the time which has been gained to withdraw all unnecessary guns from the fronts not threatened, and to dedicate them to the locality of the main struggle. The same action will also

be adopted with regard to the guns, &c., of the general reserve, and from this moment the whole of the artillery of the Defence, except such guns as are required for the long-range fire of the collateral forts, must be devoted to the attack of the batteries of the besieger, the fire being continued, day and night, until it can be no longer maintained.

It is worthy of remark that it would appear, from the historical accounts of former sieges, that what we may call the "initiative of fire" has almost always been abandoned by the Defence to the Attack; by this I mean that, as a rule, the guns of the defenders have followed the lead, as to action or silence, of those of the assailants. This has been, no doubt, due, in great measure, to the relative moral position of the two forces, but it is the duty of the Commander of a fortress to refuse to give expression to the inferiority of the Defence, however sensible he may be of its existence. It has probably also, to some extent, sprung from a fear, natural to the besieged, of running short of ammunition during the later stages of the contest; but, though it is evident that such action must be regulated in accordance with the supplies available, it is, nevertheless, worthy of note that the majority of fortresses have, at the time of their surrender, been still in possession of an ample store of guns, shell, and powder, which has thus been handed over to the enemy instead of being expended against him. The want of provisions, not the want of arms, has, in siege warfare, been the most frequent cause of defeat.

If the above reasoning be correct, it would seem that the silence of the guns of the Attack (in the absence of unfavourable factors, such as the fatigue or the losses of the garrison, the want of transport for ammunition, &c.) should not imply, as it too often does, the corresponding silence of the Defence. Even though it be granted that the guns of the besiegers, when not in action, will be so withdrawn that they will offer no mark for fire, there will still remain two objects at which practice may be effective, viz.:

a. The batteries, which may be cut through by the steady, well-aimed fire of high velocity guns, with the object of dismounting ordnance, destroying magazines, &c.

b. The covering force of infantry, which will offer a good target for howitzers of all calibres. In the absence of balloon observation by which to obtain information of the position of such infantry, they may be readily induced to expose themselves to artillery fire by threatening, or by actually commencing, an attack from the advanced infantry position of the defence.

It is evident that the defender may thus make the besieger pay a heavy penalty if, having attempted to commence the artillery combat before he has a sufficient number of guns in position, he is even temporarily silenced; similar punishment may be inflicted upon him, should he expose any of his batteries to fire before the whole are ready to begin their action, a condition of affairs which may be the result of unexpected difficulties or delays in the construction of some of these works.

We must, however, consider in addition the case where the assailant,

from the first, gets the upper hand in the artillery combat, and must endeavour to form an opinion how this will affect the several parts of the armament of the fortress.

a. The heavy guns of the forts and batteries.

These guns, being intended for long-range fire and for the direct attack of the enemy's batteries, have, up to the present, been, in most cases, mounted on the commanding parapets of the main forts, and are thus generally exposed to full view. They will, however, under these conditions offer to the enemy a mark so distinct that, allowing for the extreme accuracy of modern artillery, their destruction by the converging fire of the hostile guns must be a mere matter of time (and of a very short time), unless that fire can be kept under or silenced by the action of the secondary batteries of the Defence.

This fact has been, of late years, so completely realized, that it is now proposed to withdraw all guns from the forts, and to place them from the first in auxiliary batteries, where they will be as useful and less conspicuous. If this plan be universally adopted, the character of the forts themselves will be entirely changed, since they will then be used principally as infantry keeps; they will be less prominent as to position, cheaper, and probably both smaller and more numerous. The defensive line of a modern fortress will, under these circumstances, lose its present marked and obtrusive character, and will owe its strength less to material obstacles than to facilities given for the continuance of fire up to the last moment; it will offer a bad target, but afford good cover; what more can we ask from a fortification?

But there are localities in the vicinity of some fortresses which must of necessity be occupied, even though the defence of the surrounding country is impossible from them, except on the condition that the guns be given a certain amount of command. Under such circumstances the guns must be conspicuous from a distance, but may nevertheless be protected in either of the following manners, viz. :—

i. Disappearing mountings.

ii. Armoured turrets or emplacements.

i. The chief failing of the former of these, in addition to some little liability to get out of order, is that it does not give immunity, but only relief, from fire, since, though the gun is under cover while being loaded, it must be exposed when it is fired. It is therefore evident that this description of mounting, though it may delay the destruction of the gun, will not avert it, for the enemy will take advantage of the pause while the loading is taking place to concentrate a number of guns on the spot where the gun will appear, and will, on its becoming visible, overwhelm it with a salvo of shell; the gun may escape again and again, but must eventually be hit, in which case the repair of the mounting will be a tedious process.

Guns mounted in this manner should obviously not be included within the bounds of a fort, which will serve at all times to point out their position, but should be posted in some locality where the observation of fire directed on them would be difficult; this is to a great extent a question of the careful choice of background. Even under such favourable conditions, a single gun of this description would

probably be soon silenced by the heavy converging fire which would be brought to bear on it, and it seems open to argument whether it would not be a better plan to employ a unit of (say) four guns so mounted, of which the emplacements should stand in echelon at varying distances from the enemy.

ii. Armoured turrets or emplacements, whether of chilled cast-iron or of steel, will probably play a very considerable part in the next siege on the Continent. The time at my disposal will not permit me to enter into any description of these defences, but their object is, of course, to render the gun absolutely safe against any but a long-continued fire from heavy ordnance. The chief objections to them are, their cost, which implies that the number of guns so protected will be very limited, and their complicated construction, which renders any repair *in situ* out of the question. It is certain that they must in time yield to the concentrated fire of modern artillery, but this may be said of all other forms of defence, and must be accepted.

b. The howitzers of the sectional reserve.

It has been already mentioned that the most essential condition with regard to the fire of artillery, is that there shall be some facility for the correct observation of that fire; from this it follows that the best protection that can be found against modern artillery is to be found in the concealment of the target from view. This is possible in the case of howitzers since, owing to the high angles of elevation at which they are fired, they can be worked behind cover, either natural or artificial, so high that the pieces themselves are entirely screened from the view of the enemy; even the battery itself in which they stand may be hidden from the target on which the fire is delivered. For this reason the besieger will find it far more difficult to silence a howitzer than a gun battery, to which advantage we may add that a howitzer, as compared with a gun, throws a far larger shell in proportion to its weight, with the disadvantage, however, that the fire is not so accurate.

This quality of comparative invulnerability which howitzers possess is the cause why a very large proportion of both the armament of fortresses and of siege trains will, in future, be composed of this description of ordnance, which are, as compared with guns, easy to move and difficult to silence.

The best calibre for siege howitzers has been a matter of some discussion, and it has been finally decided that pieces of various weights will be necessary, for the reason that, while the heavy howitzer throws a shell which contains a much larger bursting-charge in proportion to its total weight than does the shell of a medium or light piece, the smaller howitzer and its ammunition are more easily transported, and can thus be more readily transferred from one portion of the defences to another. The greater accuracy and higher shell-power of the larger calibre find their use at long ranges and against batteries and other earthworks, while the smaller shell will be principally employed in the later periods of the siege, when a rapid fire of man-killing projectiles at short ranges is the first desideratum.

c. The guns, &c., of the general reserve.

We may pass over without mention that portion of this armament which consists of the reserve of heavy guns and howitzers for use in the batteries and forts, since the duties to be discharged by such weapons have already been considered.

The main armament of the general reserve is composed, as has been stated, of the field and other light guns of the fortress, and should also include a proportion of howitzers of small calibre and great mobility. The activity of this portion of the armament should be incessant; it will be employed throughout the siege, at first against the investment, then in the defence of the country around the fortress, and afterwards, in part, in the advanced infantry position, to assist sorties and to cover them when retiring; as the siege progresses, and the defender's infantry are driven in under the shelter of the forts, the light armament will find employment in fire against the trenches, with the object of delaying their execution and occupation. If it be skilfully used, the light armament will, probably, owing to its mobility, survive long after the heavy guns and howitzers have been silenced, since, though it would have no chance whatever in a direct contest with the far heavier guns of the siege batteries, it can annoy the latter by opening fire from unexpected points, and can escape the consequences of its temerity by shifting its position as soon as the enemy have brought it under an effective fire. The highest and most effectual expression of the artillery tactics of the Defence will be found in the handling of these mobile batteries, in their instantaneous appearance, in their sudden abandonment of the struggle, and in their equally sudden re-appearance in some new position; each fresh attack will compel the enemy to find his range anew, and this operation will in most cases have to be carried out under a heavy fire.

The difficulty which exists in the use of howitzers with Field artillery, namely, the small number of rounds of their large shell which can be carried without injuring the mobility of the battery, is non-existent in the case of siege ordnance, since their ammunition will be transported on a separate carriage to the piece, while it need not be moved at a faster pace than a walk, and should, moreover, be placed in readiness in anticipation of the movement of the howitzer, being packed at suitable points in expense magazines.

It is evident that a considerable portion of the general reserve should be composed of howitzers, if, in addition to what has been already said with regard to such low velocity pieces, it be remembered that they will be able to search out with their fire, at short ranges, folds of the ground and other cover, which a high velocity Field gun could not reach.

There is, however, more yet to be said on this subject; it has been mentioned that the fire of these batteries must cease, and the batteries themselves must move, as soon as the fire of the attack begins to inflict loss; it follows from this that the duration of their action will, as a rule, be but short. It must, therefore, in order to produce good effect, be as rapid as possible; this proviso points to the need for

some quick-firing arrangement for the howitzers which are to be thus employed. The objection to the use of quick-firing guns in the field, namely, the liability to injury of all fixed ammunition except that of which the shell is too small to be of any practical use, will not apply to howitzers under the above conditions, while the advantages of their use will be very great, especially in the later stages of the defence.

I hope that I have yet time to mention two very important matters which concern the defence; of these the first is—

1. *The Conduct of Fire of the Artillery.*—The system of command of the artillery in siege work will to some extent resemble that which obtains in Coast Defence and to some extent that which is employed in the Field. As in Coast Defence, the defensive ring will be divided into sections, while these again will be sub-divided into units, which may be either fixed units, such as combinations of batteries, or the mobile units of the movable armament of the fortress. Whatever the subdivision may be, each unit must preserve its independence of action as completely as all must maintain their unity of purpose.

Fortress artillery, however, has no such aid as is rendered to Coast Defence by the exact information given by the position-finder and the depression range-finder, and the conditions which govern the observation of its fire will thus very closely approximate to those which influence that of Field artillery, with the exception that the observation of the fire of a Siege is far easier than that of a Field battery, since not only are the bursts of the larger shell more plainly visible, but also more favourable points can be selected for the observing parties, who can be pushed forward into the advanced infantry position, and can be placed well on the flanks of the guns.

From this absolute necessity for the exact observation of the fire of the Defence we may deduce the following rules, viz.:—

- i. The guns, &c., in the batteries will be divided into groups, each of which will be, when possible, commanded by an Officer.
- ii. The commander of a battery will correspond, as regards his position and duties, to the commander of a battery in Field artillery; the group Officers will correspond to the commanders of sections, and the commander of a unit, when it consists of more than one battery, to the commander of a brigade division.
- iii. The ranging of a battery and the conduct of fire will proceed on the same lines as those laid down for a Field battery.
- iv. All batteries which are firing at the same target must be under one command, and must be in communication with the commander of the unit.
- v. When the guns of a battery are all firing at one target, they will be ranged by the Officer commanding the battery, as laid down in paragraph iii, but when they are firing at more than one target, they must be ranged by as many Officers as there are targets, with an observation party told off to each target.
- vi. If, in case of emergency, only one Officer is available to range a battery, of which the guns are firing at more than one target, he

must fire through from one flank, and inform the observing party as to the target on which each gun is firing.

vii. When several batteries are in one line, and are therefore, roughly speaking, at the same distance from a common target, it will much facilitate the observation of fire, and quicken the operation of ranging, if the fire, until the range is found, be from one flank to the other of the *line*. When the range is known the independent fire of batteries will commence; this will be carried out from one flank to the other of the *battery*.

viii. The observation of fire must continue after the independent fire of batteries has begun, since, in cases where fire continues for several hours, the conditions of temperature, weather, &c., may probably vary.

ix. Everything must be in constant readiness for an immediate change of target; with this object the ranges of all possible targets should be taken with the range-finder at the earliest opportunity. All orders with regard to change of target will proceed from the commander of the unit.

x. It will be necessary to range the batteries daily, even though the target be not changed.

2. *The Long-Range Infantry Fire of the Defence*.—There are two great drawbacks attending the execution of this most important adjunct to the defence of a modern fortress.

i. The extreme difficulty of the accurate observation of this fire; it is not too much to say that, on ordinary ground, no test of the accuracy of infantry (or of machine-gun) fire can be found, except at such ranges as will allow us to see men actually falling under it; at long ranges this will be impossible, and we must, I fear, accept the fact that under such circumstances the infantry cannot know what is the effect of their fire. Since, however, the range will be correctly known, and the fire will be deliberate, there can be little doubt that a certain proportion of the rounds fired will inflict injury on the enemy; while, on the other hand, the need for economy of ammunition, which is so strong an argument against long-range infantry fire in the field, scarcely exists in the case of a siege.

The Germans propose to get over this difficulty by using either—

- a. Fire with different sights, in which one-third (say) of the company fire with sights 50 yards under, and one-third with sights 50 yards over, the supposed range; or
- b. Pendulum fire; in which the whole company increases or decreases its sights by 50 yards at a time, swinging backwards and forwards over a given area.

ii. The tendency of modern improvements in firearms is to flatten the trajectory, in order to obtain the greatest possible effect at short ranges. This will seriously diminish the effect of long-range fire at a siege, since in order to hit an enemy who is standing in rear of an 8-foot parapet, the bullets must have a slope of descent of at least 1 in 6; this would with a modern rifle be the case only at a range exceeding 3,000 yards.

Two remedies exist for this defect, viz. :—

- a. To permit of the use of a smaller charge under such special circumstances.
- b. To instruct the troops in firing at extreme angles of elevation, and to resort, in fact, to vertical infantry fire.

Each of these plans has its disadvantages, and the latter may perhaps be almost impossible of execution; but the value of long-range infantry fire in a siege is so great, and its material and moral effect, if accurate, would be so tremendous, that we should certainly take steps to render its use possible.

I may here perhaps point out that, at the conclusion of this paper, I have examined the question of Siege warfare as far only as the phase with which former sieges commenced, namely, the construction of the 1st parallel, or, as it is now styled, the 1st infantry position of the Attack; this operation now follows the first bombardment by artillery.

I am afraid that this sketch of a very large subject must contain much which is mere commonplace to many of my audience, but I sincerely hope that in some few of the points which I have suggested there may be found materials for a useful discussion.

Majör RAINSFORD HANNAY, R.A. : Colonel Walford states in his lecture that "it is now proposed to withdraw all guns from the forts, and to place them from the first in auxiliary batteries where they would be as useful and less conspicuous." Now, I admit that the guns would be "less conspicuous," I have been brought up to think that a gun placed in a commanding position in a fort is put there because it is a commanding position, and therefore it ought not to be lightly given up. If you give up the advantage of the commanding position in order that your gun may be less conspicuous, I do not think you can quite say that the gun is at the same time less conspicuous and as useful. There is another point to which Colonel Walford speaks, and that is the fire from the light howitzers. My experience of the light howitzers is limited to the 6·6-inch rifle muzzle-loading howitzers. He says that the light howitzers would be most useful at the later stage of the attack when you want a howitzer or a gun of man-killing power that could be worked with great rapidity. This 6·6 rifle muzzle-loading howitzer is a howitzer that gives most unsatisfactory results, even if it be laid with great accuracy, and taking a long time to lay. I think in the later stage of the defence of the fort, I should be sorry to have to rely upon its accuracy or upon its man-killing power. I admit that we are experimenting with howitzers that are much more powerful, and I suppose they could be more easily worked. But the 6·6-inch is the lightest howitzer at present served out to the Service Batteries for practice, and we must consider that, I think. Even if you had to work with howitzers of greater power, those howitzers want very strong holdfasts, and those holdfasts cannot be put in in a hurry. We have not yet arrived at the quick-firing howitzer that Colonel Walford admits will be a necessity of the future. We must think about what we have got, not what we may get, and I do not think that these howitzers can be quickly worked. My opinion is, that where we want ordnance of a man-killing power that can be worked with accuracy and rapidity, we had better depend upon light field guns than upon any howitzer that we have at present.¹

¹ Good shooting from a howitzer depends upon a very careful combination of charge and elevation, and this appears to me incompatible with quick firing.—B. W. R. H.

Captain MAY, R.A.: I think that we artillery Officers ought to be greatly obliged to Colonel Walford for bringing forward the value of mobility with regard to the artillery power of the defence. Formerly, the artillery of the defence were considerably handicapped, because forts have been designed and armed with more regard to protection than to the development of fire effect. I mean to say that the guns of the defence have been without the mobility, and consequently without the power of concentration, or counter-attack, which those of the attack are able to command. Now with modern improvements, it would seem that it is quite possible for the defence to handle their guns tactically with something of the freedom with which the attack can utilize theirs. The "railway zone," which Colonel Walford has told us of, might be utilized in that way for bringing the guns from the least threatened part of the work towards the front where the attack has become developed. With regard to the reserve of mobile guns, I happen to have read lately in the German periodicals about the German ideas on the subject, and there they certainly seem to think that travelling a mobile gun protected by armour would be of great value. The late Lieut.-Colonel Schumann invented such a gun called the "Fahrbares schnellfeuer Geschütz," and I would like very much to have Colonel Walford's opinion about that, for I have no doubt that he has studied the accounts which have appeared of it, though he has not had sufficient time to mention it in the present lecture. Perhaps, therefore, he can tell us something as to the value of the carriage I have referred to, which is, I may explain, to be a travelling turret protected by armour, in which a gunner can work a quick-firing gun in absolute security. A sufficient supply of ammunition is provided inside and, its service being thus facilitated, the gun is able to be brought into action in any place, however exposed, where its fire may be necessary. I am particularly curious to hear Colonel Walford's views on this invention.

Lieut.-Colonel FRANCIS BARKER, R.A.: There was one point in the interesting lecture which we have just listened to, which Colonel Walford brought forward; namely, that the defence apparently must be of necessity inferior to the attack in consequence of the power of concentration of fire which the attack is able to exert. There is another question with regard to that, which I should like to put before Colonel Walford and the gentlemen present, and that is, how is the attack (at the long ranges which are now a necessity) to concentrate its fire if we suppose that it is not able to see the fire of the enemy when disappearing carriages and smokeless powders have been introduced, or when various expedients which would divert the fire of the attack have been adopted, for instance, flashing large masses of gunpowder to windward of the places where the real gun was put? With these various expedients, smokeless powder for the guns, and large volumes of smoke evolved by other means in different positions from the places in which the guns of the defence are placed, the attack would be completely misled, and it seems to me possible that Colonel Walford could tell us how the superiority would be attained if these expedients were adopted. I should be glad to hear that point discussed.

Colonel WALFORD: Major Hannay spoke first with regard to what I had said as to the probability of moving guns from their conspicuous positions in the forts, and placing them in batteries where they would be less visible. I do not think we shall ever be able to completely hide a gun battery, since the gun will certainly be laid over the sights; but I do think that it is quite possible, and more than probable, that in the future we shall do away with the excessive command which many batteries now have, and which renders them almost as conspicuous in a landscape as a church steeple. I do not mean by this an ordinary, but an excessive amount of command, and I have already said that there are places where a high command would be absolutely necessary. At the same time I think that many of us quite realize that an unnecessary amount of command has frequently been given to guns, thus making the guns dangerously conspicuous, and, though tending perhaps to increase the efficacy of their fire for a time, considerably shortening their lives. With regard to the question of the light howitzers, I certainly did not mean the 6·6-inch howitzer. I referred to a very much lighter weapon, for I hope we may in time come to have a 20-lb. or a 40-lb. howitzer. The same reproach that Major Rainsford Hannay made to me has frequently been made before, namely, that I have not based my paper upon our present equipment. I do not think that this

is altogether desirable. It appears to me that the principal object of a lecture is to look into the future, and not to speak of the past or present equipment. I suppose that the equipments of most nations are at times much out of date, and I think that, in order to adapt our equipment to the requirements of the future, it is necessary to judge what the conditions and exigencies of the future will be; I have therefore always carefully modelled my lectures in this Institution on what seemed the probable future, and have avoided the past as much as possible. Major Hannay further said he would use light field guns against the later stages of an attack in preference to howitzers. I think that he can scarcely have fully realized the meaning that I intended to convey. In the later stage of the attack we may suppose the enemy's shelter trenches to be from 100 to 500 yards from the forts themselves; it would, under these circumstances, be absolutely impossible to use field guns against them, while they might certainly be fired upon with howitzers, since these could throw their shells over the forts, and, being themselves placed in a position in the rear of the latter, would be out of the reach of the enemy's direct fire; whereas, if we employ field guns to fire at 500 yards at shelter trenches held by the enemy's infantry, they would probably not be very long available for action. Captain May spoke of the "*Fahrbares Geschütz*;" I have read a little about it, but not as much as I should wish. I found the other day in a German book an objection made to it that the shield covered only one gun; it was then said that in order to be really useful, the guns should be in pairs in their perambulating emplacement. I do not quite agree with the author, but I have scarcely sufficient knowledge of the subject to enable me to form a really just opinion on the manner of moving the gun. The principle of the mobility of the guns of the defence, as well as of those of the attack, is, however, adopted by every nation, and I hope sincerely that within a short time we shall succeed in having a similar weapon. There does not, however, appear to be very much advantage in possessing a mobile gun that can be travelled on rails, unless we first have a line of railway laid down on the land fronts of all fortresses. Colonel Barker questioned the possibility of the concentration of fire when smokeless powder has been introduced. I must confess that by thus speaking he ventures a little further into the future than even I am prepared to go, but it seems to me that under such circumstances there will certainly be a considerable amount of difficulty in the observation of fire. It is absolutely necessary in order to hit the battery of the enemy to find out its actual position, and the only thing I can suggest is that we should call in the aid of balloons from which to discover the locality of the target. We must know approximately where it is, and must further have some arrangement by which we can see the bursts of our shells; it is not, however, in the least necessary that the target at which we fire shall be actually visible from our batteries, so long as it is visible from some other spot which is in communication with the batteries. I would also point out that what Colonel Barker has said to some extent answers Major Hannay, since the forts which Major Hannay prefers will still be entirely visible, and will point out where the guns are, even though the guns themselves are firing smokeless powder. I do not think there is any other matter to which I have to reply.

The CHAIRMAN (General Goodenough): I think we may congratulate ourselves upon having such a valuable and interesting lecture given upon this subject in the manner in which Colonel Walford has delivered it. The effect of such a lecture is, that it draws attention to the material that we have in use, and I think some of the observations, if I might venture to say so, that have been made, though I should have wished that there had been a much longer discussion, rather point to a want of familiarity with the material and methods which we are employing at the present time in the defence of fortresses and in the cognate siege work. We have a most excellent ground where siege operations are carried on at Lydd, and it is much to be desired that Officers should go down and see the operations which are there conducted in the same way as they have of recent years been encouraged to go to Okehampton to see field practice, and to Shoeburyness to see the practice of heavy guns. Lydd is, as you know, at the extreme of Romney Marsh, and there siege operations with siege guns have been carried on for some years with great effect. Although our lecture has been upon the defence of a fortress, yet, as was alluded to just now, the

fortress guns of the future are very much of the same character as the siege guns; in fact it is an essential feature of the arrangement of the defence, that its character should admit the same initiative, and the same mobility in the direction in which the counter-attack is made, as the besieger enjoys. Colonel Walford chose his lecture admirably, because I am strongly of opinion that a knowledge of fortification leads to clearer ideas of the conduct and methods of field operations generally, as well as of those connected with the defence or attack of a fortress, and he did very well to select the subject of defence, because, as it is certainly the more difficult and perhaps the less attractive branch—less attractive than the attack—it is also the most important; certainly, as long as we have fortresses, one must study their defence. It is not so evident that we may ever be called upon to take part in an attack, but the defence you have always got upon your hands, and you must study it. I think it is particularly valuable that the defence should be studied, because, and I am thinking particularly of a large number of the readers of our Journal who are Officers of the reserve forces, their *role* certainly would be expected to be that of the defence. It is unfortunate, I think, that generally at manœuvres and field days the attack is studied to the exclusion of the defence, and it behoves us therefore to set great value upon the study of defensive operations. There is nothing to be ashamed of in such a study, because, certainly if we consider our own history, we know that, animated by British heads and hands, the defence has many times led most surely to victory. It is very satisfactory to see, as the old adage says, that “what is true is not new, and what is new is not true;” that Colonel Walford insists upon the long-standing principle of the important and essential need of giving the defence an active character. It was that which, under the skilful hands of Todleben, enabled the defence of Sebastopol to be so long maintained, and it is that which should form the essence of all defensive operations. The power to give the defence that active character has been largely contributed to by the armament which we now have in our works. Those works, many of them, unfortunately owing to the exigencies of the present time, are less seen than they used to be, but I can tell you that in the armaments of Portsmouth and Plymouth, our great fortresses, you will find upon the works a large amount of the ordnance mounted upon the self-same carriages that are used in the siege train. I think I shall only be expressing your wishes in proposing a hearty vote of thanks to Colonel Walford for his most interesting lecture.