



Field Howitzers and Mortars

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To cite this article: Lieutenant-Colonel N. L. Walford (h.p.) R.A. (1892) Field Howitzers and Mortars, Royal United Services Institution. Journal, 36:171, 527-544, DOI: [10.1080/03071849209417646](https://doi.org/10.1080/03071849209417646)

To link to this article: <http://dx.doi.org/10.1080/03071849209417646>



Published online: 11 Sep 2009.



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Thursday, April 7, 1892.

MAJOR-GENERAL SIR HENRY J. ALDERSON, K.C.B. (h.p.), R.A.,
President, Ordnance Committee, in the Chair.

FIELD HOWITZERS AND MORTARS.

By Lieutenant-Colonel N. L. WALFORD (h.p.), R.A.

WHEN I accepted the invitation, which the Council of this Institution did me the honour to give, that I should read a paper on "Field Howitzers and Mortars," I did so with very considerable misgivings, since I felt that I was in truth called upon to prophesy publicly with reference to matters on which there is at present scarcely sufficient information to enable an opinion to be formed.

Only two nations, the Russian and the Swiss, have as yet definitely organized batteries answering to the above description; in other armies the question is still in the experimental stage, while in no case has either the armament or the organization of such batteries undergone the stress of war, which must ever be the ultimate test of excellence and efficiency.

It is evident, therefore, that any criticism of the systems adopted by the two Powers mentioned must be limited in its scope by our want of experience, and that the utmost that can be done is to endeavour to reason from the causes which have led to the introduction of high-angle-fire batteries, and to thus deduce the character of their probable armament, organization, and duties in the field.

I propose, therefore, to speak first of—

The Causes which have led to the Introduction of Howitzer and Mortar Field Batteries.

These causes are two in number; they are—

1. The flat trajectory of modern field guns, which, while it has increased the probability of hitting a vertical target in the open, has rendered it impossible, at medium ranges, to reach troops standing behind cover, either natural or artificial, except on the condition that that cover can be pierced or beaten down.

2. The powerlessness of the shell of modern field guns against such cover as is now used, together with the increasing tendency to make use of cover, not only in the defence but in the attack. This powerlessness is due not, as some imagine, to the inefficiency of modern

field shell (which are indeed far more powerful than of old), but rather to the increased strength of such cover as is used in the field, together, as before mentioned, with the tendency to more frequently make use of such cover.

It may be interesting, while considering this point, to study the probable reasons which have influenced Russia and Switzerland, which differ so widely in all respects, as military Powers, in their political situation, and in their geographical position, in the adoption of this equipment, and have made them the pioneers in Europe of an entirely new departure in field artillery.

These reasons were, however, I believe, founded on one event, namely, the defence of Plevna, by Osman Pasha; but that defence has been regarded by the two peoples from a different point of view. Russia, whose very size renders invasion practically impossible, while her position places her beyond the highways of Europe, has regarded the question of high-angle fire in the field from the side of the attack, whereas Switzerland, having learnt a lesson from the events of 1800 and 1814, proposes to forbid the passage of her narrow valley to the great contending Powers, and thus devotes her entire attention to the means which may assist the defence.

It is scarcely necessary that, while discussing this point, I should go into detail with regard to the Russian attack on Plevna, for which, moreover, the time at our disposal would not suffice; but I may, perhaps, be excused if, in order to substantiate my statement that the Russians have introduced the new weapon for reasons connected with the inefficiency of field guns against earth defences, I mention the following facts, drawn from "*La Guerre d'Orient*," published in Paris in 1880.

Previous to the third battle of Plevna, the Russians fired during the three days, the 8th, 9th, and 10th of September, upon the Turkish entrenchments with 400 field guns, of the calibre of 3·4 and 4·2 inches, and with twenty siege guns of the calibre of 6 inches; this fire was principally directed on three works, the Kerim-Tabia, the Grivitza redoubt, and the Central redoubt.

The result is thus described:—

"The effect of the projectiles against the infantry lines and the redoubts of the Turks was *nil*; that against the other works of little importance, either as regards the destruction of the parapets or with respect to the losses caused to the defenders. Whenever, in consequence of a concentrated fire, the parapets had been reduced to shapeless masses of earth, they still continued to afford sufficient shelter to allow of their rapid repair, use being made of earth from the ditches and from the interior, and of gabions kept in reserve for this purpose."

The author further states that this failure was due to the fact that the shells of the field guns were not sufficiently powerful, while those of the siege guns did not burst, owing to defective fuzes. It may also be added that projectiles striking at a low angle have a natural tendency to ricochet, while even in cases where the earth is penetrated, the shell tends always to rise to the surface and may thus, unless the

action of the fuze is instantaneous, leave the parapet before it bursts.

Where, however, the slope of descent is steep, both the probability and amount of penetration are increased, and, especially if a delay-action fuze be used, the utmost value of the bursting-charge may be fully utilized.

The Russians were thus led to the introduction of the new form of field artillery by the conviction that, in order to obtain good effect against cover and on troops in rear of it, it was necessary to use a large shell, falling at a high angle. Both of these conditions pointed to the employment of a mortar or howitzer, since a gun which should fire a large shell with a high velocity would be too heavy for field artillery, while it would further fail to provide a steep slope of descent.

The reasoning of the Swiss we may presume to have been different. Asking only be left in peace, and with no wish for territorial aggrandisement, they desire only to be in a position to refuse the passage through their country to all belligerents; their military system is thus founded on the defensive, since such a passage would be attempted only with a view to gain time, and the certainty of a delay of even only a few weeks, which could be provided by a line of defensive works, if rightly placed, would of itself prevent any attempt being made to force a passage against the will of Switzerland.

In her case, therefore, the field mortar has, we may suppose, been introduced in order to combine, in the defence of a fortified position, the shell power of a siege with the mobility of a field gun, with the object of providing a means by which the stationary guns and howitzers, of which the effect may be neutralized by the unforeseen action of the attacking force, may be supported in their time of need from improvised positions. Moreover, the high trajectory will enable such a piece to search hollow ground, in which the enemy's troops may seek concealment or cover from the low-angle fire of the defence.

In either country the practical object is the same, namely, the destruction of cover and of troops in rear of cover, by means of heavy shell fired from light guns. Howitzers and mortars, when used in the field, have, however, another advantage over guns, of which we may expect that much use will be made. They can themselves, thanks to their high trajectory, fire over cover which is more than sufficient to protect them from the fire of guns, unless the latter are at such a distance that their fire will lose very much in accuracy. For example, a howitzer posted anywhere within 80 yards behind a railway embankment 30 feet high could not be hit by a 12-pr. gun at a range of 2,500 yards, while it could itself fire on the latter.

We may say, therefore, that the introduction of field howitzers and mortars is due to the need which has been felt of the presence with an army of a piece which shall throw a heavy shell (for the destruction of cover) at a high angle (for the evasion of cover), and which shall be sufficiently mobile to admit of its marching with

an army and of its being readily moved from one position to another.

We may pass on to—

The Nature and Tactical Use of Field Howitzers and Mortars.

The use of field howitzers in war is no new thing; not only had we them in our Service in the past, but we have even now in India batteries provided with such pieces. It is, however, necessary to distinguish carefully between what has been and what is now proposed.

Many of us can remember that, not long ago, in the days of smooth-bore guns, every field battery was composed of four guns and two howitzers, which formed the centre division, or, as it is now called, section. In those days the guns fired only round shot, and the presence of the howitzers was due to the need which was felt for some pieces which could fire shell of a sufficient size, while the extremely moderate length of the range of the howitzers was but a small defect, when the musket was useless at ranges exceeding 150 yards; moreover, the larger bore of the howitzers rendered their case shot more valuable both in attack and defence.

These howitzers disappeared as soon as the invention of rifled guns, throwing an elongated projectile, enabled us to fire effective shell from field guns; it is, however, interesting to note that the muzzle velocity of the Armstrong 9-pr., our first rifled horse artillery gun, was 1,055 f.s., only 120 f.s. more than that of the Swiss mortar, which has an initial velocity of 935 f.s., and throws a shell about 40 lbs. in weight.

The field howitzer of former days was, in fact, a field piece of large bore, throwing a shell heavy in proportion to its own weight, but not so heavy but that the piece and its wagon could move with and at the same pace as the lighter equipment of the guns; its adoption implied the voluntary weakening of the long-range power of the battery (as long range was then understood) with the object of providing greater power at very short, but then decisive, distances, while the mobility of the battery was not affected by the substitution of howitzers for guns, though the number of rounds carried for the latter was of course less than that provided for the former.

There was, however, in those days no idea of carrying into the field shells of the weight of 40 lbs., and still less of 60 lbs., which is the weight of the shell of the Russian mortar, since field entrenchments had not then attained the excessive development which they have now reached, nor was the destruction or demoralization of their garrisons previous to an attack of infantry of the same importance in the days when the assaulting party was out of range of musketry at 250 yards, as it is now, when unaimed fire may (at the cost, it is true, of an enormous expenditure of ammunition) be effective at even 3,000 yards.

Thus, the howitzers of those days were, in every sense of the word,

field pieces, whereas now, though we speak of field howitzers, we really mean a weapon which, though fairly mobile, and able at any rate to travel on roads, shall throw a shell of the weight and capacity of a siege projectile, and which thus, since the chief factor of mobility is the weight of the projectile, cannot be placed in the same battery or even in the same tactical unit with a truly mobile field gun.

The closest analogy to the proposed form of howitzer is to be found in our Indian heavy field batteries, which are, in fact, not field batteries at all, but a hybrid between field and siege batteries; but these are still mixed batteries, having four guns and two howitzers. This hybrid organization is a survival, and will probably give way before the opinion which is gradually forming, that shell-power and not gun-power is the most essential quality for the destruction of cover or of troops behind it.

We may say then that the recent introduction of field howitzers is really a new departure, though it has been to some extent foreshadowed, and that its inception is simply a well-marked phase of the constant struggle for supremacy which is always going on between guns and defences, whether the latter be armour-plates or merely earthen parapets. We must own, however, that the increased power of the latter has obliged us, as a type of this last phase, to sacrifice the mobility of the field howitzer to the absolute necessity of using a powerful, and therefore a heavy, projectile. Again, such mobility as is possessed by these pieces is bought at the price of shorter range, since guns to throw shell of the required weight would be incapable of keeping pace with the march of an army, while, moreover, the size and weight of the howitzer shell implies that the number of rounds which can be carried for each piece will be far less than is the case with field gun batteries.

Passing on to consider the tactical use of howitzer and mortar batteries, it will be evident, from what has been already said, that the object of the existence of these batteries is entirely distinct from that of the field gun batteries, and that they will thus be used to supplement and not to replace the latter. The shrapnel shell, the main (and we may hope soon to be the only) projectile of field guns, is most destructive when used against troops in the open, but depends for much of its value on a fairly low trajectory, a fact which, taken in combination with the small bursting charge, which cannot be increased without considerable danger of diminishing the effect, renders it so far useless against troops under cover, that little effect can be produced on them, except at the price of an excessive expenditure of ammunition; while the common shell, if it be allowed to continue to exist, is, even though much or all of its man-killing power be sacrificed for the purpose of obtaining a large burster, still too weak to be effective in the destruction of cover of any thickness. It is, therefore, to supplement this deficiency of power that the field howitzer is to be introduced; this piece may, however, fail in the opposite direction, since, owing to its high trajectory, its shrapnel, except at short ranges, may have little value.

We find, then, that each fraction of the field artillery of the future will be weak in the very point in which the other is strong, and each will thus serve to support, but should not be allowed to compete with, the other.

Following out this line of argument, we see at once that for the ordinary purposes of war, for the daily struggle, and even for the main part of the action in battles fought under normal conditions, the field gun will preserve its supremacy, while the use of the howitzer or mortar will be comparatively exceptional, and will be limited to such actions or to such points in a general action as call for the employment of special means of attack or defence. Another reason exists why the use of field howitzers should be limited, namely, the necessity for economy of their ammunition, since the carriage of large supplies of shell, of which two weigh a hundred weight, will sorely try the transport and load up the ammunition columns.

It follows, from what has been already said, that the rule with regard to the forward position of artillery in the order of march will not apply to field howitzer or mortar batteries, since, in the case of accidental meetings with the enemy, they would rarely be required, as the foe would have no time to construct intrenchments, while in the event of a position fully prepared for defence, it may fairly be assumed that timely knowledge of the existence of such a position would permit of their due arrival on the field of battle. If it be admitted that this theory is correct, it will be seen that there is, in this case, no very great disadvantage in the fact that howitzer batteries will be, for the most part, tied to roads, and that they must further, owing to the great weight and size of their shell, be composed of a number of carriages greater than that which constitutes an ordinary field battery, and must thus occupy a greater length of road.

What has been said above applies mainly to the attack; the defence must always obtain great advantage from the presence of batteries which cannot be silenced by the enemy's guns, provided always that their positions are selected with ordinary care and with some regard to the probable contingencies of the action; it must, however, be borne in mind that positions chosen with a view of affording cover to batteries using high-angle fire will not, as a rule, permit of the defence by the batteries of the ground in their immediate front, and that there is thus some danger of howitzers, if retained in their original position, becoming powerless for action at the critical moment.

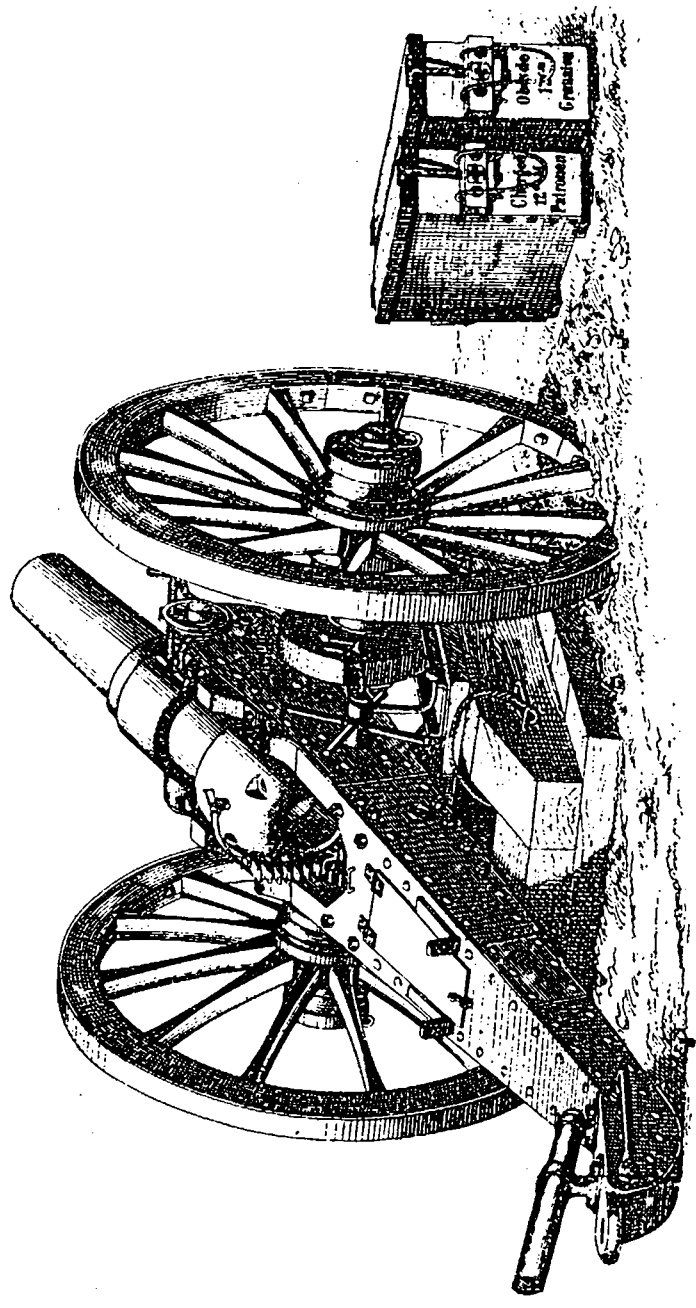
Considering the time which is at our disposal, it may be well to pass on to—

The Armament (including Howitzers, Carriages, and Ammunition) of Field Howitzer or Mortar Batteries.

It will, in the first place, be necessary to discuss the present distinction between a howitzer and a mortar.

In the old days the difference was very clear; not only were the

Switzerland. 4-7-inch Mortar in action.



(From Schubert's "Feld und Gebirgs Artillerien" Vienna, 1890.)

Hombou & Co., Lith. & Martinus Lowy & Co.

two pieces entirely unlike in appearance, but they differed essentially, owing to the fact that the howitzer, which was, in fact, a weak gun, varied its range, like a gun, by means of a change of elevation, but kept, also like a gun, invariably the same charge; on the other hand, the mortar, while used almost always at one elevation, varied its range by means of a change of charge.

This difference has entirely disappeared; the charge and the elevation are now varied both in the case of the howitzer and of the mortar, while the outward appearance of the two pieces, except in some instances as regards their length, is similar. Speaking generally, we may, however, say that a piece is called a howitzer when it is capable of firing at any elevation up to 35° , while it is called a mortar when its range of elevation extends over that amount.

Since the amount of elevation which can be given to any piece depends entirely upon the mounting, it is obvious that a weapon may thus be a howitzer or a mortar according to how it is mounted; as far as the piece itself is concerned, the distinction, has, indeed, ceased to exist, and all light guns throwing heavy shell at high angles with a low velocity are both howitzers and mortars; the former, when they are on a travelling carriage, giving elevation up to 35° , and the latter, when on a standing mounting, admitting of a higher angle of elevation. If we further take the case where one piece has both descriptions of mountings, all difference disappears. On these grounds I propose to speak of the above description of weapon by only one name, that of howitzer, the French *obusier* or shell gun, a generic term.

With regard to armament of field howitzer batteries as proposed by the principal European Powers, I am sorry to say that I have little to add to the statement which I made in my lecture of last year, to the effect that France, Spain, and Russia preferred a 6-inch calibre, while Austria, Sweden, and Switzerland were inclined to adopt one of 4.7 inches, Germany being doubtful between the two calibres, while the United States have adopted a calibre of 3.6 inches, and a 20-lb. shell. These facts testify to the struggle which is going on in the minds of those responsible for the choice of calibre between shell power and mobility, or between shell power and range.

Of Russia and Switzerland, which alone have accepted a complete equipment, the former has assumed shell power as the more important of the two considerations, while the latter, influenced also partly, no doubt, by economy (since the new howitzer is an old gun bored-up), has chosen gun power, as shown by the longer range. The main differences between the two armaments are shown in the accompanying table.

The time at our disposal will not allow of a detailed description of these armaments, but a few words as to their general character may be desirable.

The Howitzer.—The piece itself will, in all probability, as a rule be constructed of steel, as is the case with the Russian mortar; Austria may, however, offer an exception to this rule, since she still holds to steel-bronze as the material for her field guns; while Switzerland, making use, as has been mentioned, of old guns, has

used both steel and bronze for her new howitzers. We may assume that, whatever the material, the weight of such a howitzer will not exceed 9 or 10 cwt.; this will imply a length not exceeding 9 or 10 calibres.

The Carriage.—The howitzer carriage, as compared with the gun carriage, has to resist a lesser shock, but receives it in a direction tending to exercise a greater strain, which, at high angles of elevation, will be but little relieved by the recoil. It must thus be made exceptionally strong, unless, indeed, other means be taken to assist the axle and wheels against the vertical component of the blow.

In the Russian carriage, the bolts which connect the body with the axle are provided with indiarubber buffers, which, when the howitzer is in action, are inclined at an angle of about 45° to the horizontal; these, by their elasticity, tend to diminish the shock of the discharge upon the axle, which is further supported by two props, also bedded on indiarubber buffers. The plate on which these props rest is held fast to the axle by a chain of which the length can be adjusted, and the whole system thus recoils with the gun. In this manner the shock of the discharge, attenuated by the top buffers, is transferred through the axle and the lower buffers to the ground, the wheels being saved from the blow by making the props of such a height that they are lifted off the ground.

When the Swiss mortar is brought into action, small trenches are dug for the wheels, and the weight of the piece and carriage is allowed to rest on a portable bed, which is inserted between the wheels, and has two grooves on the upper surface; in these grooves run two cast-iron rollers, acting as trucks to carry the weight of the whole system. In this case also the wheels are relieved from the shock of the discharge; but, since the charge is smaller and the shell is lighter than in the Russian equipment, we do not find any buffer arrangement introduced with a view of sparing the axle. The bed is carried on the carriage, and weighs 3 cwt. 1 qr. 20 lbs.

The Charge.—The charges used by the Russians and Swiss are given in the table; they are, of course, small in proportion to the shell, and give comparatively low pressures. The division of the charge by the two nations is worthy of notice, and, in this respect, the Swiss system appears to be the better, since the Russian division into $\frac{1}{2}$ and $\frac{1}{3}$ gives only four charges, viz., $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and whole, whereas the Swiss, using $\frac{1}{2}$ and $\frac{1}{3}$, have five, viz., $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$, and whole charge.

The Projectiles. Common Shell.—The Russians use a common shell, weighing about 60 lbs., with a bursting charge of 10 lbs.; while the Swiss have a ring shell, of 40 lbs., with a bursting charge of 2 lbs. 2 ozs.

In the absence of actual experience it is difficult to decide which of these weights is the better, but it seems probable that the Russian shell is heavier than is necessary, and the Swiss lighter than is desirable.

Every pound added to the weight of a shell beyond what is absolutely necessary to enable it to do its work is a distinct disadvantage,

since an exaggerated weight brings with it one or more of three consequences, viz. :—

1. Either the number of rounds carried must be small; or
2. The weight behind the team must be large, *i.e.*, the mobility of the battery must be diminished; or
3. The number of wagons with the battery must be increased, and thus the length of the column on the line of march be augmented.

The Russians, in order to avoid the first two disadvantages, have accepted the third; their mortar battery, at war strength, consists of thirty-six carriages, and would occupy about 600 yards of road. The Swiss, on the other hand, have held to six wagons, and thus, though their shell weighs about 40 lbs. to the Russian 60 lbs., their wagon teams have to draw 46 cwt., and their gun-teams an average of 42·5 cwt. to the Russian 38 cwt. and 28 cwt., and they have, nevertheless, only 70 rounds per mortar with the battery, in place of the 92 rounds of the Russians.

The problem is hard to solve, but one thing is certain, that the common shell must at all costs be equal to its work, that is to say, it must be of such a weight as to be capable of perforating any cover (including overhead cover), which is likely to be encountered in the field, and must contain a sufficient bursting charge to destroy it after penetration. On the other hand, every inch of size and every pound of weight added after these conditions have been satisfied is a very serious disadvantage.

Shrapnel Shell.—Each of the equipments before us has a shrapnel shell; the Russian weighs 68 lbs. and contains 683 bullets, while the Swiss, with a weight of 39 lbs., has 475 bullets.

The question as to the probable utility of shrapnel for high-angle fire is being discussed with some warmth on the Continent; on the one hand, it is urged that an effective shrapnel of large size will have an enormous effect on troops, even though they be under cover, if its bullets descend at so great an angle that the cover gives but small protection; on the other hand, it is stated that the observation of high-angle shrapnel fire is so difficult, and the effect of even apparently effective shrapnel so small at a high angle of elevation, that it is more than probable that the garrison of an earthwork would be driven from their defences by common shell in less time and with less ammunition, even if with less loss, than would be the case if shrapnel were used. Moreover, it is pointed out that shrapnel is almost useless against overhead cover.

The quarrel is a very pretty one, as it stands, and it may be sufficient to say here that, since these weapons will undoubtedly be sometimes called upon to fire at low angles on troops in the open, we cannot afford to dispense entirely with shrapnel, while the choice of his projectile may be safely (and best) left to the Officer who commands the battery in action.

It will be observed that neither of the equipments before us includes a case shot; this appears to point out that these batteries will not be expected to defend their immediate front; and, moreover, seems to imply that they will fire principally at long ranges beyond the reach

of the enemy's cavalry, unless, indeed, it be intended that they shall always be attended by a special escort. Such limitations appear to be undesirable, and I venture to think that the omission of this projectile is an error.

Other details.—Having decided on the weight and the capacity of the shell, it is next necessary to consider what should be the extreme range of the howitzer; this will govern the muzzle velocity, and, therefore, the charge, and therefore, again, the weight of the howitzer, while the amount of recoil and the necessary strength and weight of the carriage must not be left out of account.

Comparing the equipments now before us, you will see that the Russians, accepting a lower extreme range than the Swiss, have a lower muzzle velocity; thanks to this decision, their mortar, though firing a heavier shell, is lighter than the other, while, their carriage being only 84 lbs. heavier, their total weight behind the team is 3 cwt. less than is that of the lighter of the Swiss equipments.

We thus see that, when considering the details of this or any other field equipment, three main points have to be decided; these are—

1. What is the least size, capacity, and consequent weight of a shell capable of doing the desired work.

2. What is to be the extreme effective range. This decision governs the muzzle velocity, and thus the charge; from the latter, again, we must deduce the weight of the mortar, and indirectly the weight of the carriage, as being dependent upon the amount of shock on discharge and the force of recoil.

3. What is the greatest weight behind the team which will not injuriously affect the mobility of the piece, taking into account the circumstances under which it will be used in war; this condition acts in opposition to the two former, and generally leads to important modifications, resulting in such a compromise as forbids perfection in any one point.

It is not my purpose to say to-day anything with regard to our projected equipment, since the time has not yet come to make public what is being done; but I am desirous to bring before you the considerations on which the designing of an equipment must be based, in order to show that this is no simple matter, nor one which can be decided in a moment.

The Equipment and Organization of Field Howitzer Batteries.

The equipment of a Russian field mortar battery consists of 6 mortars, 18 ammunition wagons, 6 carts (to bring up the ammunition to the guns), 1 spare carriage, and 5 store wagons.

You will notice at once the large proportion of ammunition wagons to mortars, large even for the Russian Army, in which field and horse artillery batteries have 12 ammunition wagons. This proportion shows the immense importance attributed by the nation which has last been engaged in war on a large scale to a sufficient supply of ammunition.

On reference to the table you will see that 92 rounds per mortar

are carried with the battery; of these 12 are carried in each limber, 24 in each wagon, and 8 in each cart.

The distribution of the weight behind the team is thus as follows:—

Mortar, Carriage, and Limber.

| | cwt. | qrs. | lbs. |
|------------------|-------|-------|-------|
| Mortar | 9 | 0 | 6 |
| Carriage..... | 12 | 2 | 6 |
| Limber | 8 | 2 | 22 |
| Ammunition | 7 | 1 | 20 |
| Stores | 0 | 2 | 17 |
| | <hr/> | <hr/> | <hr/> |
| Total | 38 | 1 | 15 |

Wagon and Limber.

| | cwt. | qrs. | lbs. |
|----------------------------|-------|-------|-------|
| Limber and wagon-body | 12 | 0 | 0 |
| Ammunition | 14 | 3 | 12 |
| Stores..... | 1 | 2 | 3 |
| | <hr/> | <hr/> | <hr/> |
| Total | 28 | 1 | 15 |

You will observe here, first, that the total weight, as given in the table, does not include any men carried on the limber or wagon; if three numbers be mounted on the limber and six on the wagon, the weight will be brought up to—

| | cwt. | qrs. | lbs. |
|--|------|------|------|
| Mortar and limber (with six horses) .. | 42 | 3 | 15 |
| Wagon (with four horses) | 37 | 1 | 15 |

I have brought these figures to your notice for two reasons:—

1. I want to point out that the weight behind the teams must be enormously increased, if any large proportion of the detachments be carried on the carriages, while, since these batteries will seldom move faster than a trot, and then only for a short distance, it will rarely be necessary to mount the men on the limbers and wagons.

2. I will ask you to notice the very small weight of stores carried; it is so small that we may suppose that none of the personal equipment of the men is on the carriages. All this, as well as every item of stores which can possibly be dispensed with, is apparently conveyed by the store wagons, which do not form part of the fighting battery.

To the best of my belief this arrangement holds with all batteries on the Continent; the French are especially notable in this respect, since their horse artillery carry only a few pounds of stores with the gun (though it must be acknowledged that their wagon is excessively heavy). Surely this should be the rule with all field artillery, who should carry nothing with them but what they actually need daily in

the field, and not overload themselves with all and everything that they may require at some time or another. It may be remembered also that the personal equipment is piled not only on the carriages but also on the draught horses, with the result that a near horse carries a load, in addition to the weight he is expected to draw, of about 18 stone; can we wonder, then, that horse artillery find it difficult to compete with cavalry, who are not handicapped by any weight behind them, and do not suffer from the checks and strains inseparable from rapid movement over rough ground? But, perhaps, I am wandering a little from the subject of my present paper.

To return, I will ask you to consider the supply of ammunition in a Russian mortar battery, viz., 92 rounds per mortar.

We shall not, of course, expect the same rate of fire from a howitzer as from a gun battery, namely, 3 rounds per minute, but we may fairly ask for 1 round per minute as the ordinary rate of fire. On this point I find it stated that the Russians fired 50 rounds in 45 minutes from a battery of 6 mortars.

Assuming that 1 round per minute will be a fair average, the Russian battery carries sufficient rounds to keep up its fire for 552 minutes, that is, for 9 hours, without drawing on the ammunition column, or, as they call it, the "flying park," which carries additional ammunition sufficient for a further fire of $9\frac{1}{2}$ hours. That is to say, the Russian mortar batteries could fight a general action on two consecutive days, using only so much ammunition as would be carried with the field army.

The Swiss batteries, with the ammunition carried on the carriages of the battery, could fight for more than seven hours, or, including that with the ammunition column, for two days of ten hours each.

But in order to have this supply of ammunition, one nation (the Russians) has 24 carts and wagons with the battery, while the other (the Swiss), though using only a 40-lb. shell, has a weight behind the wagon team of more than 46 cwt.

It is evident that we are here again approaching a very knotty question, which divides itself into two parts, viz.:—

1. What is the smallest amount of ammunition which a howitzer battery *must* carry?

2. Assuming that the wagons should be as mobile as the guns, what is the least number of wagons which can carry this amount of ammunition? This last point is, you will observe, again dependent upon the weight of the shell, assuming even that it is not complicated by a demand that the wagons shall carry some of the detachment.

With regard to the personnel and horses, the Russian battery appears to be organized in a similar manner to the other field batteries; it consists of 5 Officers and 226 men, with 167 horses.

The latter are probably (judging by the heavy field batteries which have approximately the same establishment) divided as follows:—

Riding Horses.

| | |
|--------------------------------------|----|
| Officers' horses | 5 |
| Non-commissioned officers' horses .. | 18 |

Draught Horses.

| | |
|------------------------|-----|
| 6 mortars | 36 |
| 18 wagons | 72 |
| 6 carts | 6 |
| 1 spare carriage | 4 |
| 2 store wagons | 8 |
| 3 store wagons | 6 |
| Spare horses | 12 |
| | — |
| | 144 |
| | 167 |

This branch of the Russian artillery is organized in four regiments, each of four batteries and a flying mortar park; a fifth regiment is shortly to be added. On mobilization, the flying mortar park is expended into a mortar park brigade of 4 parks, in addition to which each regiment has a mobile and a local mortar park. The Swiss organization is by batteries of 6 mortars, which are brigaded with gun batteries to form units of position artillery.

The Place of Field Howitzer Batteries in Army Organization.

The unit of position artillery in the Swiss army is the brigade division, which consists of 12 4·7-inch guns, 12 4·7-inch mortars, and 8 3·14-inch guns.

There are 5 of these brigade divisions, giving a total of 60 mortars, to which may be added 10 spare. The brigade divisions are entirely independent of the present divisional and of the suggested army corps organization of the Army, and can be attached provisionally to any force which may require them. It is probable that they will be told off to assist in the defence of certain specified (and in some cases already prepared) positions, and will be used by the Commander-in-Chief of the Army as circumstances may dictate, constituting thus a distinct force outside of the establishment of field or mountain artillery.

With regard to the Russian mortar batteries, nothing appears to be laid down as to their distribution among the corps of the field army, and it thus seems to be more than probable that they also will be retained, as independent units, at the disposal of the supreme military Commander, to be combined by him in accordance with the need for them, and to be attached, in case they are required, to any corps which may be engaged in operations calling for their assistance.

We have as yet no certain knowledge of the German organization of this description of field artillery, but various signs tend to point out that howitzers will be used, in brigade divisions of three or four batteries, as army artillery, contra-distinguished from corps or divi-

Details of Field Mortar Equipments.

| | Russia. | Switzerland. |
|-----------------------------------|--------------------------------------|--|
| Mortar— | | |
| Length | 4 feet 6 inches. | 4 feet 11 inches. |
| Material | Steel. | Steel and bronze. |
| Weight | 9 cwt. 0 qr. 6 lbs. | Steel, 10 cwt. 2 qrs.; bronze, 12 cwt. 1 qr. 19 lbs. |
| Carriage— | | |
| Weight, unpacked..... | 12 cwt. 2 qrs. 6 lbs. | 11 cwt. 3 qrs. 6 lbs. |
| Weight, packed | 22 cwt. 2 qrs. | 29 cwt. |
| Limber— | | |
| Weight, unpacked..... | 8 cwt. 2 qrs. 22 lbs. | 7 cwt. 0 qrs. 20 lbs. |
| Weight, packed | 15 cwt. 3 qrs. (12 rounds). | 14 cwt. 1 qr. 2½ lbs. (10 rounds). |
| Wagon— | | |
| Weight, unpacked..... | 12 cwt. | 15 cwt. 2 qrs. 7 lbs. |
| Weight, packed..... | 26 cwt. 1 qr. (24 rounds). | 45 cwt. 2 qrs. (60 rounds). |
| Weight behind team— | | |
| Mortar | 38 cwt. 1 qr. 15 lbs. | Steel, 41 cwt. 2 qrs. 8 lbs.; Bronze, 43 cwt. 1 qr. 26 lbs. |
| Wagon | 28 cwt. 1 qr. 15 lbs. | 46 cwt. 1 qr. 27 lbs. |
| Ammunition— | | |
| Weight | Common shell, 59 lbs. | Ring, 39 lbs. 10 ozs. |
| Bursting charge..... | 10 lbs. | 2 lbs. 2 ozs. |
| Fuze | Percussion. | Percussion. |
| Shrapnel— | | |
| Weight | 63 lbs. 9 ozs. | 39 lbs. 10 ozs. |
| Number of bullets..... | 683 | 475. |
| Bursting charge..... | 8·7 ozs. | 5·6 ozs. |
| Fuze | Time and percussion, 28 seconds.. | Time and percussion. |
| Full charge..... | 3 lbs. 13 ozs. | 2 lbs. |
| Divided into..... | ½ and ¼. | ½ and ¼. |
| Muzzle velocity..... | 748 f.s. | 935 f.s. |
| Extreme range..... | 3,500 yards. | 5,000 yards. |
| Rounds carried per mortar— | | |
| With battery | 92 (552). | 70 (420). |
| With ammunition column. | 96 (576). | 130 (780). |
| In park..... | 24 (144). | 100 (600). |
| Total..... | 212 (1,272) | 300 (1,800) |

sional troops. It is a matter of common knowledge that the German Army will in the next war be, in all probability, organized in larger units than army corps; these will, it is understood, be designated "armies," and will consist, in round numbers, of 100,000 men each.

It is believed that one or more brigade divisions of field howitzer batteries will be attributed to each of these armies, and will be considered as a force at the disposition of the Commander of the Army alone.

We may thus conclude that the new field howitzer batteries are, practically, the lineal descendants of the old batteries of position, but differ from them in the substitution of a light howitzer for a heavy gun, and in the increase (in the case of Russia) of the number of ammunition wagons. By these two changes they are made more mobile, and are thus rendered capable of keeping pace with the movements of a field army, and of taking part in the attack, whereas, if I am not mistaken, the functions of position artillery were (as its name implies) limited strictly to the defensive. They form thus an addition to, and still remain outside of, the organization of the corps and divisional artillery, being a special force available for special duties, and, as it were, a sledge-hammer in the hand of the Commander of an army, to be used by him when, in his judgment, a heavy blow is either necessary or desirable.

Appendix.

Practice with the Russian field mortar, extracted from the "Jahrbücher für die Deutsche Armee und Marine" for December, 1891.

1. In comparison with the heavy field gun, which throws a 28-lb. shell :
Target.—Shelter-trenches, occupied by standing and kneeling dummies.

Range.—2,180 yards.

Projectiles.—Field gun, 24 common shell and 100 shrapnel.

Field mortar, 12 common shell and 50 shrapnel.

Hits.—Field gun, 37 out of 96 dummies, or 39 per cent. 176 hits.

Field mortar, 46 out of 88 dummies, or 52 per cent.
199 hits.

Time.—Field gun, 1 hour 15 minutes.

Field mortar, 1 hour 6 minutes.

The trenches were on the reverse slope of the hill, and could not be seen from the batteries.

2. Practice with shrapnel against a field work :

Target.—A field work, 115 yards wide and 27 yards deep on the capital. Parapet, 4.6 feet high, and 13 feet thick. The work contained trenches, traverses, and blindages, and was occupied by 366 sitting dummies.

Range.—2,350 yards.

Projectiles.—12 shrapnel with percussion, and 50 with time fuzes.

Hits.—98 dummies were hit, or 26 per cent., by 322 bullets and 14 splinters.

Time.—1 hour.

3. Practice with half charges :

Target.—The same.

Range.—1,640 yards

Projectiles.—50 shrapnel with time fuzes.

Hits.—100 dummies, or 27 per cent., were hit by 201 bullets.

4. Practice with common shell, with half charges :

Target.—The same.

Range.—1,970 yards.

Projectiles.—100 common shell, with percussion fuzes.

Results.—56 craters, within limits bounded by two lines, one 33 yards in front of the glacis, and the other 22 yards in rear of the gorge ditch. 19 hits on the redoubt.

Time.—1½ hours.

5. Practice against a wire entanglement :

Target.—A wire entanglement, 59 feet long and 26 feet broad, covered by a glacis 5 feet high.

Range.—1,100 yards.

Projectiles.—50 common shell, with full charge.

Hits.—9 craters in front of the obstacle, 5 in it, and 13 in rear. 8 pickets were destroyed, but the entanglement was as efficient after the practice as it was before.

Time.—45 minutes.

The craters of the common shell had diameters of from 5·74 to 9·84 feet, and a depth of from 2·95 feet to 4 feet.

It was concluded from the practice that at least 5 feet of earth would be necessary for all overhead cover.

Lieut.-Gen. W. H. GOODENOUGH, C.B., R.A. : By way of opening the discussion, I would express my opinion that as an earnest of attention being drawn to this subject, and of the possible introduction of, perhaps, a reserve of field artillery in the shape of field howitzers and mortars, we may welcome this lecture in a particular manner. I have for many years thought that we should do right in having a reserve of that kind. The necessity for it, I think, is apparent, whether in India or in countries nearer home, and whether from the examination of our own experience in wars, or from the example of foreign armies. I had not intended to make any remarks by way of criticism, but only wished to welcome the subject and welcome the lecture as an earnest of what may follow.

Major E. S. MAX, R.A. : With reference to what we have heard, I think the experience of all campaigns where intrenchments have been made use of has shown the value of vertical fire. Even before the days of Plevna the value of vertical fire had been recognized. I will read an extract I have taken from an article that appeared in 1885 in the Journal of the Military Service Institute of the United States, by Lieutenant Birkhimer, in which he refers to the experience at the latter end of the American War, where vertical fire had been used. He says : "Our experience in the campaigns of 1864 and 1865 against Lee's army, securely intrenched in a chosen position, well illustrates the effective use that can be made of vertical fire. There were at first a few Coehorn mortars with the General Artillery reserve, which were gradually brought to bear against the enemy thus protected by fieldworks of strong profile. As the campaign progressed the utility of this fire, and the ease with which mortars could be transported from place to place, came more to be appreciated, until Coehorn mortars were everywhere in great demand." Then he goes on to say the Germans had solved the problem by adopting Krupp's 15 c.m. (5·9") rifle-steel mortar. I think I am right in saying that since that time they have introduced a lighter mortar. The Krupp mortar weighed 792 lbs., and fired a shell weighing 70 lbs., with a bursting charge of 4 lbs. 10 ozs., and a range of 3,775 yards, and I think was better adapted to a siege than for use in the field. At Plevna the noticeable point was the absolute indifference with which the Turks came to regard the Russian fire ; they quietly waited under cover

while the bombardment was going on, and, when it ceased, coolly went out, met the columns of assault with a heavy musketry fire, and drove them back. Lieutenant Birkhimmer, from the experience of the American Civil War, comes to just the conclusion Colonel Walford has done, namely, that a sufficient reserve of field howitzers held in the hands of the Commander of the whole forces for use as occasion might demand, would be of great use. I dare say many present will remember the way in which the German General Von Sauer has lately written about vertical fire: he is a very strong believer in it, and he goes so far as to wish to see every brigade of infantry accompanied by a battery of howitzers. Indeed, he said howitzers would probably be able to successfully engage ordinary field guns in the preliminary artillery duel. His opponents, while they combated such extreme opinions, all seem to have admitted the necessity for howitzers and vertical fire in the future, and they all agree that the best way would be to have a reserve of mortars or howitzers for use when occasion arose, in the manner foreshadowed by the lecturer. As regards shrapnel I can see there is a good deal of difficulty connected with its use, but I trust we may hope it will be overcome in due time. No doubt heavy shells falling at a very steep angle would make such deep craters that their splinters would mostly fly up in the air, and not do much damage, in a man-killing direction, whatever advantage they might be against earthworks.

Colonel W. R. BARLOW, R.A.: I should like just to ask one question. I do not see anything in those tables as to the weight of bullets which the Russians employ. It is rather an important thing. Is the weight known of the bullets?

Colonel WALFORD: I could not say from memory, but I could find it out.

Colonel BARLOW: I have no doubt whatever in future wars, shrapnel fire from howitzers will be the most effectual at moderate ranges that you can get. At a high angle of descent it is the only shell which will search out cover. Cover must be taken more every day under the tremendous infantry fire, and a velocity of, say, 1,800 f.s. from field guns for shrapnel seems to me to be of very doubtful value. I believe, by reducing the velocity very much you will reduce not only the strain on your gun and carriage, but you will also reduce the very heavy work which you have thrown on your gunners, as you reduce the effect of recoil. Even looking at that very heavy Russian howitzer, 38 cwt., behind the team, I do not see why it should not be taken over heavy ground. I have seen the old-fashioned guns at Aldershot taken over very heavy ground, and over ditches, so that I cannot see why we should limit the use of howitzers to roads. I think it would be crippling their use very much if we did. There is another point as to howitzers. Colonel Walford has given an instance where field guns were of no effect whatever against fieldworks, though howitzers were effective. Now it seems to me that if other nations are going in for howitzers which are thoroughly effective against field works, it would be a very serious condition indeed if we have not got howitzers which will meet them. I believe in having a small charge in your howitzer, and having a very large charge in the shrapnel shell; you will then always have sufficient terminal velocity, as you do not want more than 500 feet velocity to kill a man. If for the sake of gaining accuracy you dispense with a heavy charge in the shrapnel shell, you will fall into error; your bullets will not have sufficient penetration to injure men. I think that a shrapnel shell should have a heavy charge, and that of itself alone will give nearly 200 feet per second to the bullets in the shrapnel shell, thus bringing the striking velocity up to 400 or 500 feet. Personally I am deeply obliged to the lecturer who has brought this most important subject to our notice. I think that the solution of arming our horse artillery will also be found by using guns approximating to a howitzer. The lecturer pointed out that there is very little difference between the mortar and the howitzer. I go a step further, and say there is very little difference between the howitzer and the guns. I believe the howitzer with a very moderate velocity, 1,000 or 1,200 feet a second, would be most effective for shrapnel shell.

Colonel WALFORD (in reply): I have not very much to answer. There is, however, one thing that I should like to point out. As far as my experience goes at present, there is one very considerable disadvantage in the use of high-angle shrapnel, and that is, that at practice it is exceedingly difficult to judge from the

firing point the distance of burst. The rule for field guns, which, of course, is comparatively simple, since in that case the height of burst is not very great, and any errors which may be made will probably be inconsiderable, is of very little use when applied to high-angle fire. Since the shell may fall at an angle of something like 40 degrees, it is extremely difficult, looking from the firing point, to judge the distance of burst, while I do not myself feel certain (not having as yet arrived at a state of knowledge which would enable me to say) at what distance from the target such a shell ought to burst. In the course of some practice during last year, we obtained some very satisfactory results with shell which burst something like 200 yards short, and 120 feet above the ground. Of course, when you have to deal with distances and intervals like these, it will be almost impossible to estimate from the firing point the exact position of burst. Another difficulty in high-angle shrapnel practice will be to judge the "line" of the shell. If a shell bursts 120 feet up in the air, it must be very hard to decide whether it explodes in line with a small target. Supposing that you are firing at a fieldwork three times the length of this theatre, it would be very difficult, at a range of 2,000 or 3,000 yards, to know whether your bullets were falling into it or not. In the present state of our knowledge, it is almost impossible to be certain on this point; there is, however, no reason why we should not eventually work up to some degree of certainty, and I hope that we shall try to do so, and to get some good effect out of high-angle shrapnel. But I believe that, as has been already said, we should in practice get more real advantage out of common shell than from high-angle shrapnel. There is, again, one great objection to increasing the bursting charge of shrapnel beyond certain limits; and I am, moreover, afraid that I, personally, rather doubt whether we should ever get an increase of velocity of the bullets of 200 feet per second by means of the bursting charge of a shrapnel shell. We have found in practice that an increase of the bursting charge beyond what the walls of the shell will stand has the following result, viz., that instead of, as it were, simply vomiting forth its bullets, the shell itself opens and becomes a species of inferior common shell, covering a very large space of ground with a number of widely dispersed fragments. I am inclined to think that Continental nations will take the bull by the horns, and decide that, instead of using shrapnel, which is difficult to observe, and the effect of which is doubtful, they will employ common shell filled with some high explosive. The advantage of such a bursting charge is, that whereas the ordinary common shell filled with powder, falling at a high angle, may very possibly, and does frequently, bury itself in the ground before bursting, the splinters being consequently thrown straight up into the air (in which case they hurt nobody), the high explosive shell will probably burst before it has penetrated much below the surface of the ground, and the explosion may, therefore, do very much local damage. High explosives break up the shell into exceedingly small pieces, so that, probably, a shell so filled would, if you could arrange for the burst to take place at the right moment, be extremely destructive. There is no other point, I believe, to which I have to reply.

The CHAIRMAN (Sir H. J. Alderson): We have had a most instructive lecture from Colonel Walford, on the subject of field howitzers and mortars. It is a subject to which my colleagues on the Committee are giving their very closest attention at the present moment: but it is one which, in working out, requires a great deal of experiment and practice. On the Continent, nobody except these two, the Russian and Swiss, is yet agreed as to what is the best form to use. I think the great question of high explosives has complicated the matter; but I do not believe any nation yet really has determined to carry them into the field. Nearly every day we hear of accidents occurring with high explosives. We ourselves have been very free so far, and we hope we have got something that will answer; but at present it is premature to say anything definite about it. No doubt if we can take high explosives into the field, and use them with these mortars or howitzers, it will be of immense importance to us. I am sure you will authorize me to offer our warmest thanks to Colonel Walford for the great pains and labour he has been at in preparing his lecture, which has given us a large amount of most instructive information, and will be of the greatest possible use to those of us who are engaged in working out this question for our own Service.