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THE TACTICAL EMPLOYMENT OF ENGINEER FIELD COMPANIES IN COMBINATION WITH OTHER ARMS.

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IN "The Tactical Retrospect of the Campaign of 1866" the author observes: "The next campaign will show us this fourth arm acting in rivalry with the others in the battle." By "this fourth arm" is meant the field engineers or sappers or pioneers of an army. The prediction above quoted was fully borne out in subsequent European wars. In 1870 the work of the German engineers, not only at sieges and on the line of communication but in actual combat, contributed freely to the German successes; and in the 1877 campaigns, both in Bulgaria and Armenia, the work carried out by the engineers in action on both sides forms one of the most conspicuous features of the campaigns.

The more recent development of tactics consequent on improved firearms has not tended to decrease the importance of this tactical question, and consequently we find that in most European armies the matter is now carefully considered. It may therefore be worth while for us to devote some little attention to the subject.

A British division is composed of the following fighting troops:— 7 battalions of infantry, 4 squadrons of cavalry, 3 batteries of field artillery, and 1 field company of engineers. The tactical relation of the three arms first mentioned is a subject carefully considered and constantly practised in our Service; it is a matter of the highest importance, also, that every officer who is entrusted with a mixed command should know something about the organization, not only of his own arm, but of the other two. The object of this paper is to endeavour to prove that the engineers of a division, or an army, are not a body requiring to be dealt with differently from other troops, but a fighting weapon possessing certain definite value as a weapon, and requiring to be used on the same broad principles as other arms.

To realize the value of this weapon it will be necessary first to state briefly what the organization of the engineer field companies is, then to detail their duties, and then to show how those duties should in combat be combined with the work of the other arms.

In considering the question of British organization, and for present purposes, we may set aside the fact that in the Indian Army there are six battalions of pioneers, organized on the battalion system. Many distinguished officers have expressed their admiration of these pioneer battalions. I may be permitted to add my testimony to their worth, as I was at one time Staff Officer of a brigade of three battalions of them; and I regret that they are not affiliated in any way to the Royal Engineers, inasmuch as they are certainly "technical troops." In time of war they are used as infantry, armed as infantry, and their organization is that of the infantry battalion. So that they do not come under the consideration, properly speaking, of the present paper.

In time of war the strength of each field company is 1 Major, 1 Captain, 4 Subalterns, 210 non-commissioned officers and men, and 69 horses, including officers' chargers. The interior economy is similar to that of a battery of field artillery, the officer commanding the company exercising a very independent command, and being absolutely responsible for drills, technical instruction, and discipline, as well as for pay, clothing, and equipment of all kinds. The men are divided into the sappers and the drivers; the former are by far the larger proportion. They are enlisted all over the United Kingdom. Each man must have a specified trade (connected with building work for the most part) and be good at that trade. Each man must be 5 ft. 6 in. at least in height, and have a chest girth of 34 in. These conditions, coupled with the fact that, before being drafted into the field companies, each man goes through a year's training at Chatham, keep out of the ranks the immature lads complained of in the infantry. It is not possible for an artisan to be proficient at his trade while still a young lad; consequently the average age in the engineers is higher than in other branches. A company of sappers is therefore composed of better raw material than a company of infantry, both in physique and intelligence. The sappers are armed, equipped, and drilled as infantry.

The drivers, or mounted portion, are smaller and lighter men than the sappers. They need not have any particular trade, and they are not instructed in the technical duties of engineers. Their business is to look after the horses and mules of the company transport.

The extra pay which all ranks receive attracts to the ranks of the engineers a very good sort of recruit, capable of being highly trained and of using his brains well. This has an important bearing on the question of military efficiency.

The companies are equipped with every sort of implement that can be of use either in the constructive or destructive work of the military engineer. This matter has received the greatest attention in our army.

To carry the equipment, wheeled transport is the most economical and convenient form of carriage; but, as wheeled vehicles cannot travel in all situations, pack animals are largely, and in some campaigns have been exclusively, employed. Our present system is to employ a few pack animals, but to carry the bulk of the equipment

on wheels. Of the 69 horses in a field company, 12 are officers', 5 are riding (non-commissioned officers'), 6 are pack, and the remainder are for draught.

The vehicles are as follows:—2 pontoon wagons, 5 forage carts, 1 forgo wagon, and 4 tool carts. The latter are peculiar to the engineers. In appearance each cart resembles an artillery ammunition wagon. They are intended for carrying out all the necessary tools for the work which the sappers may have to carry out in the field of battle. For this purpose the carts are so designed as to be capable of going over rough ground, and of transporting at a rapid pace a limited number of men, sitting on the carts, to carry out any operation, such as the blowing up of a bridge, where time is of importance. These tool carts are the only vehicles brought on parade in ordinary circumstances. They are drawn by four-horse teams, but are so arranged that each double cart may be divided into single carts (each like an artillery limber), drawn by a pair of horses.

All the officers of field companies are mounted, not for parade purposes, but because in most operations where their men are employed they have to go on ahead, examine the ground, make rough estimates of the men and tools required, and generally make all arrangements of such a nature that when the men arrive on the scene of action there may be no unnecessary delay, where time is often of paramount importance. It is evident, therefore, that the officers must be active horsemen and well mounted.

Before leaving the subject of organization, it is not irrelevant to mention that in time of peace both officers, men, and horses are largely employed, for the benefit of the British taxpayer, on the public works. For four days a week on an average the men are employed building, repairing, or supervising the construction of barracks and other military buildings. This is a public economy, it is an advantage to the individual men, and inasmuch as they are employed, generally, under their own officers, there is the great military advantage of constantly associating together on the works of peace those who must work together in war. From this work officers get to know the capabilities of their men, and the men know their officers. It is when thus employed that other branches of the army are most frequently brought into contact with the engineers, and there is, perhaps, not unnaturally, a prevalent idea that the duty of repairing barracks, &c., is the first and only duty of the sapper. This is, of course, quite erroneous.

Every week the men are drilled once or twice under their own officers. The total amount of drill in a year, considering the British climate, is not great, but there is no doubt that it is sufficient to keep the companies at a high level of smartness. No amount of smartness on parade, however, can make up for negligence in technical training, and for this most essential duty thirty working days each year are allotted. The course of instruction includes all the technical work demanded of engineers in modern warfare (except telegraphy, which is the work of a special branch). To the officers of the company this annual course is as important as it is to the men, as they

have to plan, arrange, and calculate the work to be done, as well as supervise its execution.

Thus briefly we have considered the organization and training of this tactical unit in the British service; let us now consider its duties.

The duties of engineers generally in war are of three classes:—

1st. *Duties in Camp.*—The construction of huts and other shelters for troops, the arrangements for water supply, and for sanitation generally.

2nd. *Duties on the March or Line of Communication.*—The making and repair of roads and of bridges, the removal of obstacles, construction of railways and telegraphs, of piers and landing stages, or the destruction of any of the above; also the surveying of the country.

3rd. *Duties on the Battle-field.*—The preparation of positions for defence and the strengthening of natural or artificial posts (such as buildings, villages, woods, &c.,) which may occur in the theatre of operations; whether for attack or defence. Also in the attack, securing any advantage gained, constructing entrenchments and removing obstacles in the field. In sieges the engineers' duty is to direct and execute all works of attack or defence.

Now it is evident that the first and second classes of the above duties are not dependent on the operation of other troops for their proper performance. The sinking of wells or the building of bridges may be quite well practised by the engineers by themselves; they may be even carried out by civil labour. In some campaigns the construction of railways, telegraphs, and similar work has entirely been done by civilians. These duties, therefore, are not strictly speaking tactical operations, though they may be under certain circumstances closely allied with tactics.

But when we come to the third class of duties, we must have them carried out in co-operation with other arms if there is to be any advantage in them, and the labour spent is not to be entirely wasted. It has been the besetting sin of the engineers of all armies that, from the fact that many of their duties may be carried out independently of other troops, the idea becomes established that all their duties are equally independent. They thus come to play at soldiers in a little corner by themselves, to the great disadvantage of their power when the day of battle comes.

With regard to siege works, it must be remembered that the tendency of modern warfare is to carry out operations swiftly, and thus the protracted methods of attack by means of trenches, saps, and mining are too slow. It is probable that in the future large fortresses will be invested and blockaded, as Metz and Paris were in the Franco-German War, and not attacked in regular fashion. The increased power of garrison artillery will make the circle of investment wider than formerly, but nevertheless it seems to be generally accepted by the best authorities that the efforts of engineers will be in future directed towards the prevention of the enemy getting out of, rather than towards their own side getting into, a fortress.

When we come to consider *localities*, such as villages, farms, buildings, woods, quarries, &c., the case is different. These have formed

most important points in battles in the past, and are likely to prove of equal, if not greater, importance in future. Such localities, of some sort or another, will occur in every battle-field; their attack and defence therefore form an important feature in the tactics of all arms, and it is our purpose to consider what part the engineers of an army should take in such combined tactics.

An army operating in the field against an enemy may be acting either on the purely defensive, or on the partially defensive, or on the offensive. In each of these three methods of operation the engineers have their distinct duties.

To act on the purely defensive is of course open to many disadvantages. The power of the initiative is abandoned, and the moral disadvantage is great; but, nevertheless, circumstances may arise when it is necessary, and therefore the duties of all troops in connection therewith must be carefully considered. History, of course, teems with instances of the purely passive defence, instances, too, where such action was the turning point of a campaign, and where nothing else would have been the right thing to do. Again, it does not always follow that because a force is acting on the defensive it has lost moral power; for instance, the German armies before Metz and Paris were, strictly speaking, acting on the purely defensive during the investment of those places, and yet there can be no doubt that they had the moral ascendancy over their opponents.

The tactics of the engineers in the purely defensive may perhaps be best illustrated by reference to the valuable instruction which took place at the Curragh in 1890. Here a brigade of infantry, with a small force of cavalry, engineers, and two guns, was ordered to occupy and defend a position covering a village, executing fully the various works required. The general plan of defence was prepared by the General Commanding the division of which the infantry brigade was a part, and was as follows:—The outer line of defence was a line of breastworks resting on a small redoubt at one end and an epaulment at the other, the second line was a powerful redoubt with two strong block-houses, and there was a third line to be made use of only in the last extremity to cover a retreat. The block-houses had already been built by the engineers, but this circumstance was accidental; had there been any necessity they might have been erected concurrently with the other defences. The organization of the brigade, and the details of how the work was to be carried out, were left entirely to the Brigadier.

The various arms were then distributed as follows:—The cavalry was pushed out to reconnoitre, to discover the enemy and his dispositions. The infantry furnished a covering party of about one-third its total strength, which, with the artillery, occupied a favourable position to guard the approaches to the work and hinder any molestation. The remainder of the infantry and all the engineers did the work of entrenchment. The outer line was divided into two parts, each of which was placed under a battalion Commander, while the work on the second line was placed under the Commander of the 3rd battalion. These infantry officers were entirely responsible for the laying

out and execution of the trenches, for the distribution of their men, and for the quantity of work done. They were, however, supplied with tools from the engineer dépôt, which was in rear of the position, and the senior engineer officer, who was, naturally, in consultation with the Brigadier as to the general defensive arrangements, visited the whole of the works from time to time to assist infantry officers with his advice in matters of technical detail. The men of the engineers were employed in the laying out of the second redoubt (assisting therein the Commander of the 3rd battalion), erecting profiles, constructing revetments, constructing field casemates, placing obstacles in front of the position, and especially laying out land-mines to be fired electrically from the main position. These operations were carried out on several successive days, the programme being varied to suit alterations in the general idea.

It is worth noticing that in these operations the engineers made all arrangements for the supply of tools. Circumstances might arise in which this would be advisable, but as a rule entrenching tools should be supplied by the corps using them.

The Divisional General, in order to test the capabilities, relatively, of men accustomed to work with entrenching tools as against others, gave orders on one of the days that a squad of sappers, not picked men, should be given the same tasks as the infantry, working in the centre of the line between two infantry companies. For various reasons, which need not be detailed here, all the troops working that day were doing their very utmost. The test was therefore a very fair one. The section of sappers, working under an energetic young Subaltern, turned out in one relief (four hours) work which bore to the infantry work the proportion of 10 to 7, or about 30 per cent. more.

Broadly speaking, therefore, the rôle of the engineer soldier in the passive defence is the construction of such works of defence as are of an elaborate nature, and which do not come within the curriculum of the infantry soldier's training, and also he has control over all mines and demolitions.

In the case of the *partially defensive*, it is evident that, unless there is a great deal of time to spare, infantry soldiers cannot be largely employed on the work of entrenchments. Their physical and moral energies are required for other work, and it must be the aim of the Commander to conserve those energies as much as possible. With the engineers the case is different. Their superior power of rapid work may here be very legitimately utilized on the simplest forms of earth-works, and thus they may become a most valuable auxiliary to infantry or artillery by reason of the protection they can afford at the points where they work. It is needless to say that such points must be ordered and settled by the Commander of the force himself. "It does not do for an engineer Subaltern, however gifted, to settle the position of an entrenchment for an army," was the remark of a distinguished General to a young engineer officer who was actually charged with the duty of selecting a position for the rallying of a force. This is a matter which must be evident to every military student.

In our peace manœuvres the positions of shelter trenches are

marked by canvas screens or lines of tape. Of course if these are to be of any value, the troops who are supposed to have made them must be in proportion to the length of line entrenched, and must have been extended on the spot for a sufficient length of time to enable the proposed work to be executed. These very necessary conditions are not always insisted on.

It is in this form of action—the partially defensive—that the mobile power of the field companies is most conspicuously useful. We have many instances in warfare of mounted troops seizing an important point in a battle, but being unable to hold it because there were no tools up in time. A dozen sappers with their tools would have made all the difference. Here, then, is the place for the tool carts being sent as fast as the horses can travel, carrying on them a sufficient number of sappers to commence operations. It must be remembered, too, that in such cases engineers, unlike artillery, can travel without escort. Every man is armed and trained in the use of the infantry weapon. They have nothing to fear from hostile cavalry.

The rôle of the engineer, generally, in the partially defensive combat is to strengthen certain points artificially, in such a way that they may be held by a small force, and thus enable the greater numbers to be free for offensive movements in the counter-attack. These points become pivots, frequently, round which the combat turns. Or they may, by creating obstacles on certain lines of approach, force the enemy to abandon those lines and confine his attack to other lines more favourable to the defence and consequent counter-attack.

Another valuable use of the engineers in this form of operation is in connection with rear-guard actions. In the cases of Münchengrätz in 1866, and at El Bodon in 1811, usually taken as types, it does not appear that technical troops were used at all, and yet no one who knows the tactical value of such troops can fail to recognize the immense assistance they would have given to the retreating forces, admirably as those forces were handled in other respects.

The following instance of a rear-guard action, which occurred at the summer manœuvres a short time ago, is a good illustration of the case:—A small force of a squadron of cavalry, two guns, a battalion, and a field company, the whole under the command of one of the most experienced officers in the English cavalry, was ordered to protect the entrance to a defile, in which, or, rather, beyond which, the main body of an army was retreating. The enemy was reported to be in considerable numbers. The ground towards the enemy was fairly open, with clumps of bushes, and, on the whole, rather favourable to the attack.

The Commander of the rear guard pushed his cavalry out, which, after forcing the enemy to deploy and checking his advance slowly, fell back, reporting the enemy's strength to be about three battalions, with a proportion of cavalry and artillery. Meantime, the other arms of the defence were disposed as follows:—The infantry and artillery were pushed as far forward as was deemed prudent, with orders to fall back slowly when heavily pressed. The engineers had been set to work on a line which rested on natural obstacles on either flank. By the time the infantry of the defence had been pushed back

to this point, closely pressed by the attacking battalions, sufficient time had elapsed for the construction of a useful entrenchment. The case demanded a frontal attack, and the Umpires judged that it presented an obstacle to the advance of the attack of so formidable a nature that, with the proportion of numbers, it was hopeless to attempt it. The rear guard had thus achieved its object.

A somewhat interesting feature in this case was that, owing to a mistake in orders, the engineers were, at the time of commencing operations, some $2\frac{1}{2}$ miles away. When the Officer Commanding heard that the presence of his company was urgently required, he put all the men into the general service wagons (which were at that time authorized for tool transport), and went off as fast as the horses could trot. In about twenty minutes they were in their proper place with the rear guard; the roads were muddy and heavy, and the horses covered with sweat and foam, but they arrived in time to save the day. Such a case might well occur in war.

A French authority has written on this subject as follows: "The retreats of Napoleon would not have been so disastrous if he had made use of field fortification for holding those positions whence he intended to take the offensive, or to cover his retreat. At Leipsic, for instance, it is almost inconceivable why he did not make use of them to cover the bridge of the Elster, his only line of retreat" ("Études sur l'Art de la Guerre," by General Burnod).

We come, finally, to the consideration of the tactical employment of engineers in the *attack*. Here we may again quote from a French author: "The essential principle in a battle, as in a campaign, is to be stronger at any given point at any given time; hence arrangements should be made to hold fast defensive points with few troops, so as to accumulate the greater number at the point where the supreme effort (of attack) is intended" (General Lewal, "Études de Guerre," quoted by De Lambre). This is evidently one of the uses of engineers in the attack, the principle of which we have already touched upon, viz., the strengthening of other parts of the field, so as to liberate as many troops as possible for "the supreme effort."

No doubt it is true that field fortification is less frequently used in the attack than in the defence, and yet, if the lessons of recent wars count for anything, they certainly teach us that, in the attacking columns themselves, there is a distinct place for the work of the engineers as for other arms.

It need hardly be said that an attack should always be preceded by the most careful reconnaissance. The dispositions of the enemy, his numbers, nature of his defensive works, and the nature of the obstacles in front of his position must be ascertained if any success is to be hoped for. In Skobelev's famous attack on the Green Hills at Plevna, on September 11, 1877, the reconnaissance was so imperfect that the existence of the great Krishin redoubt was unknown to the attack. An attack under such circumstances was doomed to failure.

Engineers would necessarily take part in such a reconnaissance, in order to ascertain what were the obstacles against which their energies must be directed.

Then, assuming that by means of cavalry, balloons, field observatories, &c., full information has been obtained, the next point is to decide the exact place where the "supreme effort" is to be made, and so prepare the rest of the field as to make counter- or flank-attack on the part of the enemy impossible. Then comes the artillery preparation. All the guns should be brought to bear upon the place where the assault is to be delivered, some time before the assault is made. If the guns are harassed by the enemy's sharpshooters, these must be driven back by skirmishers. Then comes the time for the assaulting columns of infantry and engineers.

The following is the method of attack proposed by the Russian General Dragomirov against fortified positions. First to push forward a chain of skirmishers to the best position it can find within short range of the enemy, and there to fire away as much as possible, attracting all the attention they can. With them may well be some proportion of engineers to enable them to get some sort of cover. "It is odd if there be not some remains of hedge, bank, or wall between 100 and 300 yards of the enemy" (Major-General C. B. Brackenbury). It would be the business of the sapper to utilize this.

Next comes the main body of the first line, "partly shielded from aimed fire by the chain," and therefore not subjected to severe losses. These must pass through the chain, and get to close quarters as fast as they can. "Engineers . . . should be among the first to be pushed forward" (General Brackenbury) to fight like infantry till they get to the enemy's obstacles, and then to ply axe, crowbar, gun-cotton, or whatever may be specially ordered.

For the further conduct of the attacking columns we must refer to General Brackenbury's book on "Field Works," a book which has a peculiar importance from the immense experience of the writer in European warfare. What we are at present concerned with is the tactical employment of a field company under the circumstances described.

Of course it is obvious that it would be impossible to take the tool carts with their teams into the zone of aimed infantry fire. The sappers must be supplied with tools from their pack animals as much as possible, but long before they reach their object the men must carry their tools themselves, and be ready to use either rifle or tool as the need arises. All superfluous accoutrements should be left behind.

In some foreign armies every sapper, as a matter of course, carries a tool of some sort. This is open to objection. The man who carries a saw might be found in a place where no saw could be used. In our army we carry all our tools for the men, but we never practise the rapid advance of men themselves carrying tools and also rifles. It is a matter for consideration whether the sling of the rifle should not be adapted to be strapped to a tool if the need arise. I may also remark that I have never seen any practice worth speaking of at the important work of overcoming and destroying ordinary military obstacles.

In the case of a division being ordered to carry out the attack as

above described, the following would be a probable distribution of the field company. The Officer Commanding would take three sections out of four to work with the main body. The Captain would command the line of tool carts, and endeavour to push them forward as far as he could. The senior Subaltern would command the one section, which would advance with "the chain," carrying such tools as he might consider necessary to establish their position close to the enemy.

On the very rare occasions when something like this manœuvre has been attempted in our mimic peace warfare, the engineers with the main body have conformed to the orders for the infantry of that body, and have been placed under the command of the senior officer of infantry on the spot. It might happen that the senior engineer officer would be himself the responsible commander of the whole party.

This is the brief outline of the work of the engineers in the attack. It must be obvious to every military student that there are other uses of the engineer in the attack, *e.g.*, the strengthening of decisive points, the holding on to ground already won, the covering of a possible retreat, all of which are operations of the greatest importance, and call for the proper use of the engineers. To dilate upon the importance of these operations would be unnecessary. The subject is not studied much in this country, but it is very carefully considered abroad.

One difficulty in practising these operations in peace is the objection to breaking up the ground in trenches. This difficulty is not removed by the make-believe screens, or by throwing up a small sample of the work required. It is a matter for consideration whether certain portions of our manœuvre land should not be allotted as ground where entrenchments may be made, and Commanding Officers made aware of the fact, so that they might arrange their defensive or offensive operations on field days in such a manner as to enable these selected portions to come within the limits of their operations.

One or two examples from the mass of instances in military history are here briefly given.

On the 31st August, 1870, a French division wrested from the Germans the village of Sevigny, near Metz. From want of tools and engineers the French were not able to take advantage of their success. At 10 o'clock the same evening, the Germans, who had held on to a few loopholed houses and yards, were able to make a vigorous counter-attack, and drove the French back.

At the battle of Mars-la-Tour, the Prussians seized early in the day the village of Vionville. Sappers were pushed into it at once. Some of their tool carts were lost by a charge of French cavalry, but they had enough to strengthen the village, so as to form a useful *point d'appui*, and that village was never retaken. It formed the apex of the Prussian position.

At Königgrätz, the Austrian engineers made a number of entrenchments, yet the corps' leaders knew nothing about them, nor were

they placed where the attack came. When the Prussians did come to various decisive points, such as the village of Maslowed, Ohlum, and Nedelitz, there appear to have been neither the brains to direct, nor the tools to execute, the hasty works which would have made these points of the greatest value.

Königgrätz is an admirable instance of "how not to do it" in the defence.

Plevna, on the 11th and 12th September, 1877, is an equally good instance of "how not to do it" in the attack.

The object of this paper is not to minimize the importance of the combined tactics of infantry, cavalry, and artillery, nor to ignore the very useful rôle which is carried out by the engineers in other duties than in combat: but to insist on their importance as a fighting weapon. The object of all branches of the army should be to co-operate together towards success. This may be done by the engineer in sinking wells or building bridges; only, such duties may be classified with those of the Medical Officer, who by skilful sanitary precautions increases the health of the troops, or the Commissariat Officer, who makes good arrangements for their provisions. The duties in camp and communications have always been recognized as part of the engineers' work, but tactical duties have been but little taught, or, at least, very little practised, by our engineers in combination with the other arms in our army. The literature on the subject in English is very meagre.

Napoleon says, "They who neglect the support which the art of the engineer can give in the field gratuitously deprive themselves of a power and an auxiliary, never hurtful, always useful, and often indispensable."

In our small army we cannot afford to disregard this advice.

The CHAIRMAN: As I have had some little experience in peace manœuvres, and as I have seen the growth of field companies, having been at Aldershot with a company of engineers before there was any field equipment supplied to it at all, also having had command of the troop in which all the field equipment for three field companies and a dépôt field park was massed together; and, subsequently, having had some experience of the handling of field companies in peace manœuvres, I should like to make one or two remarks. First, I would point out that the great difficulty the engineers suffer from in peace manœuvres in England is a want of reality. They cannot carry out in peace the duties which would be required from field engineers in war. Houses and villages cannot be put into states of defence; nor can trees, bush, and other things which would interfere with the field of fire be cleared, a most important matter, which the lecturer has not referred to specially; for the best way of getting cover from the enemy's fire and protecting yourself, is to bring such an overwhelming fire upon him that he is afraid to shoot at you, or, at all events, fires with very great want of precision. Another matter that I think affects our engineer duties in peace manœuvres is the element of time. There is usually a hurry to bring the troops into collision, and after the troops once get into collision, the battle very rapidly comes to an end; whereas all experience shows, especially in cases where a position has been properly placed in a state of defence, that a long time may elapse before troops are driven out of it. There may be a great deal of fighting, extending over hours, without much advance being made; places are taken and re-taken, and everything is not quite so rapidly finished as in our peace manœuvres. In my own experience, I remember seeing a force at Aldershot with its right resting on a strong position at the top of Beacon Hill,

where houses were supposed to be placed in a state of defence, and entrenchments formed. This force was attacked by another coming from Frensham. To the astonishment of the defending force, who thought their right would hold out some time, the enemy came on rapidly, and in ten minutes the troops were turned out of their strong position. Another case I can remember, where there were troops occupying a position near Hartford Bridge Flats. A company of engineers, with all tools and appliances, was sent down near Blackwater Station with orders to fortify it: they had plenty of time and tools, and miles of telegraph wire. They were ordered to cut down the telegraph posts (of course in imagination), to take the wire and make an entanglement. The enemy's cavalry came on through all the supposed wire entanglements in spite of notices saying, "This is impassable!" "This is stopped, &c.!" The defenders thus lost the advantage they had expected to get from the action of their engineers. Officers commanding mixed forces of other arms, together with this new arm (the engineer field company with all its equipment), have sometimes shown a tendency to use the dismounted part of the engineers, without their tools, as if they were infantry, and to send the carts away, not knowing how they could usefully be employed. This shows that it is necessary, as has been so well pointed out, that officers should carefully consider, when they have this equipment put under their command, how it may be used to the best advantage. With these preliminary remarks I will ask any officers, who have had experience, to give us some useful ideas or information on this subject. If there are any junior officers here who would like to make any remarks, I hope that they will not in any way feel, on account of their being junior in rank, that they are not to make those remarks. Only last night I was told, "It is no use going to the United Service Institution; if I am a junior I dare not speak, I shall be shut up at once." At the Council meetings here reference has been made to such ideas being prevalent, and I have heard the members of the Council say that, on the contrary, they are only too delighted if in any discussion here young officers will fully ventilate their opinions. Some of the opinions expressed may possibly be crude, but others may be very good. I will, therefore, ask you to join us in the discussion.

Major S. HARRISON: I should like, although not a junior, to say a few words on this subject. When I say that I have served thirty-one years in the same regiment, perhaps I may come into the list of those who have had some experience, not on the field of battle, but upon those fields where we do the best we can to see what the battle is like. The lecture is peculiarly gratifying to me, because it affords evidence that the condition of mind of the lecturer is the precise condition of mind that I was in some twenty-seven years ago. I am the officer who urged upon the Government at that period, immediately upon the introduction of breech-loading rifles, the absolute necessity of converting the infantry soldier into an engineer. The extreme rapidity of fire made it absolutely necessary, in this country at least, where we should always have to defend, to provide the soldier with the advantage of cover, and in this Institution there lies somewhere a weapon which I submitted to Sir John Fox-Burgoyne, which combines a large number of uses for the infantry soldier. It has the blade for moving the ground; it has the pick for softening the ground, and for loop-holing walls; it has what is a matter of considerable importance, a hole perforated through the spade, behind which the soldier can feel something of safety; for I remember a sergeant-major, who had served in the Chinese War, who said that, when they first went under fire, they really felt that if they could get behind a sheet of brown paper they would have been comforted. Now I respectfully suggest that if it were possible, and you would send for that weapon, wherever it may happen to be,¹ and put it upon the table, you would see at once how extremely gratified I must be to find that that which I wanted twenty-seven years ago, that which I had persistently urged upon every Secretary of State for War at every change of Government, at last has come to the front, and I find an engineer officer of large experience advocating precisely what I advocated, that is, that the infantry soldiers should be furnished with the

¹ During the discussion, the specimen of this implement which was presented to the Museum of the Institution in 1870 was placed upon the table, and, although constructed of the highest polished steel, was found to be in perfect order.—S. H.

means which will make them practically a field company of engineers. In fact the lecturer himself particularly noted that after a time the use of the wagons must cease; the implements must be distributed. The only fault of the engineer field equipment is this, that the number of spades and tools is so extremely limited that, for a country like this, where all sorts of obstacles have to be dealt with by the infantry, at the moment preceding the attack the number is wholly insufficient for the purpose; and I would venture to suggest to the lecturer that he should tell us presently whether, *if it were possible to combine the various uses of axe, spade, pick, and crowbar in one weapon*, it would not be very desirable, for although you might sacrifice some of the perfection and simplicity of the original weapon, it might be of an immense advantage in a country like this, so enclosed by hedges, ditches, and divided into fields and the like, to have a weapon which combines part of the qualities of all these.

Lieut.-General Sir R. HUME, K.C.B.: I do not propose to discuss the lecture, because it is so admirable in itself that I entirely agree with all that the lecturer has advanced; but, having been much thrown during my active service and during peace manoeuvres also with the engineers, I should not like this opportunity to pass without bearing my testimony to the admirable manner in which we in the infantry especially have always been supported by the engineers, and the manner in which they have taught our men to do necessary work under their guidance. In this matter my experience goes back as far as the Sebastopol trenches, and the admirable manner in which the engineers carried out their own work, and showed us how to do any under their guidance, I have never forgotten. And during the rest of my service, wherever I have been thrown with the engineers, I have found their teaching most admirable; they have not only shown us how to do the things necessary, but most cordially co-operated with us always. I observe that the lecturer alludes especially to the pioneer regiments of the Indian army. I have had a great deal of experience with them, and I entirely agree with all that the lecturer has said in praise of their excellence, both as soldiers, and, I will not say as working engineers exactly, but as pioneers, in which capacity they are altogether admirable. I think the lecturer is entirely correct in what he says as to the manner in which field companies of engineers should be employed; but of course, to carry out works of any extent, they must depend a good deal on the co-operation of the other branches of the army, they being themselves too few in number to be able to execute extended works. I have always thought, and think so still, that the rôle of the engineers on active service is to do what they can themselves in the way of entrenchments and works, and, where they cannot do the whole, to instruct as far as possible the bulk of the army, who are sufficiently numerous to carry out the works that they themselves cannot execute. I have always found the Royal Engineers work in every way as an officer thrown with them would wish them to do, and most anxious to carry out any orders that I have ever had to give them.

Colonel E. WOOD, C.B.: I might, perhaps, make one or two remarks. I fully agree with what the lecturer has so admirably said, and I would especially draw attention to the point as to the preparation of the ground in front, the clearing of the ground; for that, as has been said, is really after all the most important matter. There is one little point to which I might take exception, but I fancy that is rather a slip of the pen. I fancy that the engineers, when moving across country by themselves, cannot be said to have "nothing to fear from cavalry." Of course they have just as much to fear from cavalry as the infantry have, but, inasmuch as the engineer is a well trained soldier, he has no more to fear from cavalry than the infantry. You may, therefore, trust your engineers to take care of themselves, being assured that they can always render a very good account of themselves if necessity should arise. With regard to carrying the tools, unquestionably it is all-important that any work that you have to do with the tools should be done quickly, otherwise the opportunity for using your tools may have passed. It follows that the stronger and better winded a man is when he comes up to use the tool the better the results will be. I therefore think that our system of carrying the tools on carts as long as possible, and only issuing them to the men when you cannot carry them any farther, is better than the system which obtains in almost every European army, by which the sapper has always to carry a tool.

Lieut.-Colonel C. A. BARKER: I came in here just by accident, but there is one little point that has struck me during the lecture, and which has often forced itself upon my attention during my service, and that is that engineer officers do not always get the co-operation that they deserve from officers of the infantry. I suppose there is hardly an engineer officer who has been much in charge of a working party who has not occasionally had reason to complain of the apathy of the infantry officers in charge with him. I think it is so important that there should be a better feeling and more co-operation between them, and that something ought to be done to remedy it. When a fatigue party is sent to work, whatever may be its size, it is usually placed under the charge of some young officer and thus gets to be looked upon as a disagreeable fatigue. I think that when large working parties are sent out they should have a senior officer with them, and that when a company is sent out all the officers of that company should go with it. In that way the infantry would begin to feel that the duty on which they are sent is really of importance, and so you would get that willing co-operation from them which they would always give if they only knew how important these duties were in the field.

Lieut.-General Sir R. HUME: With reference to what the last officer has said, my experience, which, I am sorry to say, is not of to-day or yesterday, but of some years past, has been quite different from that related by Colonel Barker; but I am evidently not speaking of the same times.

Colonel JONES-VATGHAN: I should like to repudiate to a certain extent the remarks made with reference to officers of infantry not giving their support to the engineers. I have had some experience of engineer work, both in the field and in peace manœuvres, and I do not consider the remarks made are borne out. I think that infantry officers feel that in an engineer officer and in the engineer corps they have a most important adjunct for field operations, and I think that if in the case referred to, when working parties are sent out, only a subaltern is sent with them instead of the Captain of the company, it is the fault of the regiment, and I hope it is not the experience in every other regiment. I think the general idea is to support the engineers and to do the work that is done as efficiently as possible, and with the greatest support. I quite agree with General Hume's remarks.

The CHAIRMAN: I think that we have got away from the subject, which was "The Tactical Employment of Field Companies of Engineers in combination with the other Arms." I am glad that the remarks that were made by Colonel Barker are not generally agreed with.

Lieut.-Colonel BARKER: I might perhaps qualify them a little in view of what has been said; I simply mean that officers as a rule do not take that personal interest in the work that they ought to do. They very often think that the whole thing is to be done by the engineer officer, and they do not exert themselves to get the men to do their best.

Lieut.-General C. B. EWART, C.B.: I have been waiting, hoping to hear more from the junior officers, and that we seniors should rather come up later on. My own experience may be classed mainly as ancient history. I think we owe a debt to the lecturer for the very interesting *résumé* he has given us as regards the organization and duties of the field companies of engineers, and I wish in anything that I say to hold myself to the subject of the lecture. I entirely concur with what has fallen from Colonel Wood. It is, I am sure, of the greatest importance, if you are getting your men into action and under fire, not to weight them, and not to hurry them if you can possibly help it—to get your tools carried as far as you possibly can, and not to put them into the men's hands till it comes to be absolutely necessary. There is one thing which I think should be very much impressed upon young officers, which is this, that in our Service, and in the various countries in which we have to carry on war where we must carry our own tools, we are very often called upon to take part in operations where it is quite impossible to work with the ordinary wheeled carriages. Going back to the old wars, in 1815 the army of occupation in France was well supplied with the engineer element, and of course they were then equipped so as to always depend upon having made roads to work upon. After 1815 there was a considerable reduction in all arms, and the engineers really were deprived of anything like field equipment practically till 1853. There was no advance; on the contrary, what had been in use was lost. It was

only when we were called upon to take part in the operations at Chobham Camp that we were obliged to cast about and see what we could do to take something of an equipment with us, and we went down with the best that we could turn out from Chatham, which, I am sorry to say, was very poor indeed. The following year we had to go to the Crimea, and then it was lamentable how utterly deficient we were in what we wanted for field service in the engineers. They sent out to us a quantity of artillery wagons from Woolwich, which were to carry our tools, and they did not send us any horses. I went with the Commanding Engineer, and I was acting as Adjutant, and also Brigade-Major (for a short time). I was with him when he urged the want of horses upon Lord Raglan, and begged that he might be allowed even to go and endeavour to purchase them. Unfortunately there was a great scarcity of horses, and we were met by the Commissary-General with the complaint that there was great scarcity of forage. However, before we started for the Crimea we did what we could, and the utmost we were able to organize was that each company of engineers attached to a division should have with it a small mule detachment. We had about six mules fitted with pack saddles, which we prepared in the arsenal at Varna. We did the best we could, and we got all the hints we could from the French who had come from Algeria. We took these with us, but we could not take the field with any wheeled carriages. What we had with us, besides these pack mules, were tools carried in the Crimean Tartar *arabas*. It was only at the end of the war that there came out an organized field company of engineers, who brought with them what we had been longing for all the time. From that time onwards we have not looked back, but the engineer equipment has gone on improving, and now the engineers are able to turn out with troops in the field with a real practical equipment, and that, I, as an old officer, am extremely glad to see. I cannot say how much I think it is of importance that the engineers attached to a division should have with them a proper equipment of tools, and should be able to perform all those duties which have been alluded to, and among the most important of these I certainly would class the repairs of bridges. That was a duty which in the Peninsular War, under the Duke of Wellington, was very much required, and at that time was performed by the old Staff Corps, whose duties have fallen, since the Staff Corps ceased to exist, upon the engineers. But at that time, as we know, and as we can see by looking at the models in the Model Room at Chatham, the Staff Corps had a vast deal to do in this way, and always, I believe, did it well. There are many of those duties which I might allude to, but it is not for me to take up the time of this meeting further than by saying that I fully appreciate the excellence of the lecture which we have heard this afternoon.

Colonel W. SALMOND, R.E.: I think the army has reason to be grateful to the lecturer for his lecture. He has shown in very few words and very clearly what the duties of field companies of engineers in the field are. He has also shown by instances quoted from actual warfare, and the Chairman has shown by instances quoted from peace manœuvres, that it is very necessary that the Commander of the portion of the army with which those engineers may happen to be should be fully acquainted with the value of the weapon that he has to handle in the field company. It was through not understanding the use to which the weapon might have been applied that in certain cases which the lecturer instanced Napoleon's disastrous retreat was not minimized as it might have been, and in other ways, by not utilizing this force to the best advantage, opportunities were neglected. Anything that brings out, as this lecture has done, which will now go forth to the army through the medium of the Journal of this Institution, how this force can be utilized for the good of the army, must be of great service to officers who may be in those positions of command where everything will depend on utilizing every arm of the Service that may be under them to the fullest extent. It is only by doing that that success can result, and I hope that that will follow from the better understanding of all those duties which will be brought about by means of this lecture. There is one further point I wish to mention. I have not had very much experience on active service with regard to infantry working parties, but I had a little in Egypt in 1882, and I can only say that neither on that occasion nor in peace manœuvres—of which I have seen a good deal—have I ever at any time failed to find the greatest interest taken by every officer of infantry who might happen to be told off to supervise or

take part in what are called "digging parties," and so far as my experience goes I cannot agree in the smallest way with the officer who spoke as to any want of interest having been shown by infantry officers on such occasions.

Captain SCOTT-MONCRIEFF: With reference to the various remarks that have been made, I beg first to thank you for the very kind way in which you have received my lecture, and for the very complimentary remarks that have been made about it. Major Stuart Harrison was the first officer who urged the necessity of converting the infantry soldier into the engineer. It is extremely gratifying to learn that he is among the audience to-day, but I must say I do not quite agree with him in all his suggestions. I do not think that it would be possible to make an infantry soldier into an engineer under the present conditions of the Service. We certainly may train an infantry soldier, and I have often had that duty entrusted to me, in the elementary branches of field fortification, and I have found, just as Colonel Jones-Vaughan has stated, that there are some regiments who take keen interest in it, and others who do not. I may mention, with regard to this, that the regiment at the summer manœuvres in the Curragh, in 1890, which distinguished itself most in the operations, was one in which the Commanding Officer had insisted upon every Captain and every Subaltern in the battalion going through a course of instruction at the School of Military Engineering. The result was, the whole regiment was very much better than any of the others. Everybody seemed to take keen interest in the work, they carried out the work with hardly any direction on the part of the engineers, and the quantity of the work they turned out was most satisfactory. With regard to another suggestion of Major Harrison's about the combined tool, it is very interesting to see it. I cannot say that I have had much experience with these combined tools, and, for my own part, I am rather shy of them. I do not think the men take very kindly to them, and, after all, we have, to a certain extent, to accommodate ourselves to the likes and dislikes of those whom we command. Colonel Wood has criticized one little point about engineers having nothing to fear from hostile cavalry. I ought to have said that it was not necessary that there should be an escort of infantry to travel with engineer field companies. We are aware that the safety of artillery depends very often upon the escort that travels with it, and for that reason I have found that sometimes in peace manœuvres the Commanding Officer of a mixed force has suggested that an infantry escort should accompany the engineers. That is not necessary. With regard to the system of carrying the tools, of course, it varies. As officers have remarked, the countries where we have to carry out our operations vary so much, that it is almost impossible for us to lay down any hard-and-fast rule as to the way in which the tool should be carried. I merely wished to throw out one suggestion, that was, that in some way or other the sling of the rifle might be adapted for the carrying of the tool if necessary. It might be sometimes necessary for a man to carry this tool and to use his rifle, and, of course, it is very desirable not to burden the men with unnecessary straps. I think it would be possible so to utilize the sling that it might carry some such tool as that which we see on the table. I thank you once more for so kindly receiving this paper.

The CHAIRMAN: It now only remains for me to thank Captain Scott-Moncrieff and all those officers who have taken part in the discussion. As I happen at the present time to have the honour of holding a command at a little corner where Royal Engineers play at soldiering by themselves, called Chatham, which seems to be referred to in the lecture, I must observe that at that little corner we have a large number of officers of cavalry and infantry who come to be instructed in military engineering, and I find that they take a great deal of interest in the subjects taught. One or two remarks have fallen from speakers which rather show that there is an idea prevalent that the engineers are the only people who carry tools, and, therefore, that all digging work is necessarily to be done by them. But the list of tools that are to be supplied to different branches of the Service provides for a certain amount of picks and shovels to be supplied to regiments of infantry and cavalry; and in addition to that there is a tool called an entrenching implement, of which 422, or about 50 per cent. are to be issued to each battalion on service. Possibly it is because these tools are not supplied to the infantry in time of peace and are not taken on peace manœuvres that the erroneous idea is afloat that all tools for digging must necessarily be supplied by the Royal Engineers.