# THE ROYAL ENGINEERS JOURNAL.



Vol. Vill. No. 1.

JULY, 1908.

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**BRIDGE ACROSS THE MEDWAY** 

AN interesting piece of pontoon, barrel pier, and trestle bridging was carried out recently across the Medway at Chatham, under the direction of Bt. Lieut.-Colonel G. H. Fowke, R.E., the Instructor of Fortification. As no such work has been accomplished on so large a scale of recent years, the following details are published :--

1. Site of Bridge.—The site of the bridge (shown in Fig. 1 of the Litho Plate) was selected on account of the difficulties presented by the high river wall and mud on the Dockyard side.

The strong current (4 miles an hour), its rise and fall (14 feet), and the large amount of traffic afford useful instruction.

2. General Design of Bridge.—The bridge was designed to carry infantry in fours, weighing 5 cwt. per lineal foot of roadway, or 8,400 lbs. on each 15-foot bay. This allowance is sufficient for cattle, 18-pr. and 13-pr. guns, and 5-inch howitzers, but for the 60-pr. gun (owing to the concentrated nature of the load) double chessing would have to be adopted and the bays shortened to 10 feet, and an extra pontoon section introduced into each pier.

The width of the roadway was 9 feet in the clear.

The length of the bays was 15 feet, with the exception of the 2-pier barrel rafts, where it was 10 feet.

The width of the river at high water is 1,190 feet; an additional allowance of 14 feet has to be made for the difference in length at high and low water (adjustment by sliding baulks), which, together with a distance of 4 feet from the Dockyard wall, necessitates 1,208 feet of equipment.

3. Detail of Bridge.—The bridge was a composite one, consisting of a tidal ramp at each end, with a floating portion in between made up of pontoons and barrel piers, having a central cut of 180 feet.—"Y" to "U"—to allow traffic to pass through.

Tidal Ramp, Dockyard Side.—"A" to "C" (Fig. 6).—Six composite trestles, 33 feet high, sunk 3 feet to 4 feet in mud—made specially for the purpose—having an adjustable road transom sliding between the two frames of the trestle, supported, raised, and lowered by chains and differential blocks (Fig. 2); length, 90 feet.

"C" to "D."—Three 4-legged trestles, resting at low water on the mud, and raised by four pontoons as the tide rises (*Fig.* 3); length, 60 feet.

"D" to "Z."—A ramp raft of three pontoons, the ramping being effected by building up chesses on to saddle beams; length, 30 feet.

Floating Portion—"Z" to "Y" (Fig. 6).—Eleven 2-boat rafts (22 pontoons); length, 315 feet.

There were cut baulks at "Z" to allow the bridge to swing at this point when opening at the centre cut.

Between Nos. I. and II. rafts there were sliding baulks to compensate for difference in length of bridge at high and low water.

Central Cut—"Y" to "U."—Two 4-boat rafts and two 3-boat rafts (14 pontoons); length, 180 feet. "U" to "T."—Six 2-boat rafts (12 pontoons); length, 165 feet. Between Nos. XV. and XVI. rafts there were sliding baulks, and at "T," for swinging clear of barrel piers, cut baulks were provided.

"T" to "S."—Six 2-pier barrel rafts (Fig. 9), 84 108-gallon casks; length, 110 feet.

There was a cut at "S," allowing the whole of the barrel portion of the bridge to be disconnected.

Tidal Ramp, Upnor Side.—"S" to "E."—Three composite piers, ramp raft (Fig. 8), 30 108-gallon casks; length, 30 feet.

"E" to "F."—Five composite piers, ramp raft, 50 108-gallon casks, supporting four Service pontoon trestles; length, 75 feet.

"F" to "B."—Nine Service pontoon trestles, length 135 feet, transoms raised and lowered by chains and differential tackles.

4. Construction.—The two tidal ramps, "A" to "Z" and "B" to "S," involving the heavier work were constructed between the 27th of May and the 6th of June. The floating portions were made between the 4th and 6th of June. On the 9th of June the two floating portions, "Z" to "Y" and "U" to "S," were made into bridge and warped alongside the Dockyard wall and Upnor Hard respectively. Commencing at 5.30 a.m. on the 10th of June, these portions were warped out on the stream side as far as "Z" and "S," and then swung into position. The cut rafts cast their own anchors and manœuvred into position.

The bridge was then broken up into rafts.

5. Personnel.—For instructional purposes, 25 officers, 31 N.C.O.'s, and 245 men were employed in making and working the bridge. These numbers could be reduced to 4 officers, 29 N.C.O.'s, and 220 men. The proper complement of a 2-boat raft is 1 commander and 7 men. Six N.C.O.'s and 36 men are required in addition for manning boats.

6. Stores used .---

Pontoons	•••	 •••		•••	•••	55
Casks, 108-gallor	n	 •••		•••	•••	164
Service pontoon	trestles	 	•••	•••		13
Composite trestle	es	 •••	•••	•••		6
Four-legged tres	tles	 		•••		3
			-		-	÷

7. Buoyancy.—The following gives the buoyancy and strength of the various points of support in the bridge :—

Weight bridge will

carry per bay of 15 feet (in lbs.).

Pontoons.—When immersed within 15 inches of gunwale 4632

	·· - J ····		~ 8 "		° 4°3°
	12	"		;;	6050
	9	"		"	7658
	б	"		,,	9088
<b>A</b> 12	opelize	680	1150	nor	how of

Barrel Piers of seven 108-gallon casks, 6,804 lbs. per bay of 10 feet.

Barrel Piers of ten 108-gallon casks, 9,720 lbs. per bay of 15 feet.

Strength of Pontoon Trestle.—Has been tested up to 12 tons. Strength of Transom Composite Trestles.—10-inch fir spars per bay of 15 feet.

Total weight of material used in the bridge =  $117\frac{1}{2}$  tons.

The following is the detail of personnel :--

Position on Bridge.	Officers.	N.C.O.'s.	Men.
	(Capt. Sankey, R.	Е.,}	)
Tidal Ramp "A" to "Z"	A.I.F.	} 2	12
0	(1 Subaltern, R.E.	)	_117
Cut at "Z"	O.C. E Co., R.E.	—	4 Party,
Nos. I. and II. Katts, including	i Subaltern, R.E.	2	14 R.E.
Sliding Baulks,	• C & N		
Nos. III. to VII. Raits	2 Subatterns, K.P.	5	35)
Nos VIII to XI Rafts	OC THE CARE		~~)
Cut at "V"	L Subaltern R F	4	20
4-Boat Cut Raft "V" to "X"	I Officer 7th Co. R.		4 701 8 1 E MAN
Cut at "X"	r Onder, Jur Oo., R	, L, 1	
3-Boat Cut Raft "X" to "W"	I Officer 7th Co. R	л. <u>—</u> Т Я	4 CO.,
Cut at "W"			a R.15.
			4)
3-Boat Cut Raft "W" to "V"	1 Officer, oth Co., R.	E. 1	8)
·Čut at "V"	• • • • •		4 oth
4-Boat Cut Raft "V" to "U"	I Officer, 9th Co., R.	Е. г	8 (Field)
Cut at "U" and	100 at Co PF	)	Co'
Nos. XII., XIII., XIV., and	JU.C. 9th Co., K.E.	··· } 4	28 R.É.
XV. Rafts	1 Suballern, K.E.	···} ·	
			)
Nos. XV, and XVI, Rafts and	1 Subaltern, R.E.	2	14] 119
Sliding Baulks.			Party,
Cut at "T"	1 Subaltern, R.E.	—	4) R.E.
6 Barrel-Pier Rafts "T" to "S"	2 Subalterns, R.E.	6	42)
Cut at "S"	O.C. F Co., R.E.	···· ···	4-
	(Lieut, Du Boulay, R.)	E., }	Party
Tidal Ramp "S" to "B"	A.I.F.	2	12 RE
•	2 Subalterns, R.E.		
		,	
3 Cutters	3 Subalterns, R.E.	3	24 119
3 Wherries		3	12 Party,
		5	K.E.

In connection with the reports in the newspapers of the construction and working of the above bridge, Lieut. G. F. Brown, C.B., R.E., sends an amusing extract of orders issued in 1779 by Lieut. C. Shipley, Corps of Engineers, as showing how the authorities in those days avoided making a "cut" in a pontoon bridge. The bridge in question was one devised by Colonel Debbieg, Chief Engineer, and thrown across the Thames, near Gravesend, for the purpose of transferring an army from Kent to Essex and *vice versâ*, at a time when there was great fear of invasion. The extract reads as follows :--

#### GRAVESEND, August 25th, 1779.

#### INSTRUCTIONS for Mr. Green relative to the stopping of Shipping etc. whilst the Barges are Manoeuvring this day.

You will take care to be well above or below the Communications according to the different Times of Tide, if the Barges work on the Ebbtide, you will cruise off Mr. Webbers, or in the Northfleet Hope. If on the Flood in the Hope.

You will speak to all Vessels, and require them immediately to come to an Anchor, acquainting them with the Hawsers being stretched across the River.

You will have a Serjeant and Twenty Men with their Arms and Ammunition in the Sailing Boat with you, who will have Orders to follow your directions. Therefore should Vessels persist in making their way after you have hailed them, you must immediately order half of the people to Fire with Ball amongst the Rigging etc. Should they not immediately attend to that, the Rear Rank will also Fire amongst their Sails and Rigging. Should not this still have the desired Effect, You will directly man the Eight Oard Boat, and take in as many of the Party as it will hold, go on Board and cut the Anchor from the Bow and let it go with all her Sails Standing.

The Sloop will at the same time run up as close as possible and the remainder of the Party remain on the Deck, ready to give you every assistance in their Power. You may further acquaint the Masters and Pilots, that should they by their rashness be the Means of the Hawsers being cut, and thereby obstruct His Majestys Service, they may lay it to the Account of their own Obstinacy.

CHARLES SHIPLEY.

MR. JOSEPH GREEN, Cockswain of the Chief Engineer's Boat.

### SOME NOTES ON THE OPERATIONS OF LEE AND GRANT IN NORTHERN VIRGINIA IN MAY AND JUNE, 1864.

#### By LIEUT.-COLONEL, J. E. EDMONDS, R.E.

THESE notes on the campaign in Northern Virginia in May and June, 1864, which is one of the subjects set for the promotion examination in November next, were originally compiled for the assistance of a friend; it has been thought that they might be of service to other officers who are preparing to submit themselves to the examiners. They may also prove of general interest, as strategically the operations which are included in the above period turn on the successful defence of a capital, by a numerically inferior covering force, against an army led by a general who was "determined to hammer continually against the armed force of the enemy and his resources, until by mere attrition, if in no other way, there should be nothing left to him but submission"; \* while tactically they deal with the attack and defence of entrenched positions improvised on the field of battle.

The effective range of aimed rifle fire in 1864 was, it is true, only 300 yards, but as the campaign was fought mainly in country so thickly wooded and overgrown with trees and scrub that the enemy could rarely be seen even at this short distance, there are, in spite of the improvement in firearms, tactical lessons to be learnt from the battles as regards fighting in enclosed country, while as examples of the general nature of the attack and defence of entrenched positions they have lost little of their value.

The Situation.—At the opening of the campaign the Army of Northern Virginia, under General Robert E. Lee, some 60,000 strong, including 8,000 cavalry and 220 guns, held a fortified position about 20 miles long on the southern bank of the Rapidan River (say, on the Ouse, north of Cambridge<sup>†</sup>), 60 miles north of Richmond (London),

• The up-to-date equivalent of this sentiment is to be found in the German Infantry Training : "Forward on the enemy, cost what it may."

<sup>†</sup> The attempted parallel between Northern Virginia and the south-east corner of England does not include the configuration of the ground; but if the south-east corner of England is imagined to be without the chalk formation and otherwise what it probably was like 800 years ago covered with woods, close thickets, and marshes, with very few clearings and open spaces, except in the southern section, where there was much the Confederal Capital, and facing north; two army corps, those of Lieut.-Generals Ewell and A. P. Hill, occupied the position with their foremost troops, the remainder being in winter quarters in rear, while the army corps of Lieut.-General Longstreet was held in reserve. The cavalry, under Lieut.-General J. E. B. Stuart, was concentrated lower down stream.

For the purposes of the campaign the Rapidan River may be regarded as a sea, of which the South had lost command, for Lee's cavalry was unable to cross it and ascertain what was going on beyond it. The Federals had actually complete command of the sea.

The main Federal force in this theatre at the disposal of Lieut.-General U. S. Grant, who had been recently brought from the west, after his success at Chattanooga, to command all the armies of the United States, consisted of the Army of the Potomac, under Major-General Meade, recently reorganized into three army corps under Major-Generals Hancock, Warren, and Sedgwick, and a cavalry corps, under Major-General Sheridan, together with the army corps of Major-General Burnside (a former and unsuccessful commander of the Army of the Potomac, senior to Major-General Meade), under the direct orders of General Grant. The strength of this force was about 120,000 men, including 13,000 cavalry, and 300 guns. It was in the neighbourhood of Culpeper (say, Peterborough), about 10 miles north of the Confederate position, with its outposts on the Rapidan (Ouse) River.

Besides the main force, the Army of the James, under Major-General Butler, consisting of two army corps (Major-Generals Gillmore and W. F. Smith) and a cavalry division (Brig.-General Kautz)—about 40,000 men, of which 5,000 were cavalry, and 90 guns—was concentrating at the mouth of the James (Thames) River, about 80 miles south-east of Richmond (say, near Margate). In and around Washington (Boston, in Lincolnshire), 100 miles north of Richmond, were 40,000 to 50,000 men, retained for the defence of the Capital. In the Shenandoah (Severn) Valley was Major-General Sigel with 6,500 men, with a part of his force, of the same strength, detached under Major-General Crook in the Kanawha Valley (Central Wales).

Confronting the detachments west and south-east of the capital, General Lee had about 6,000 men defending Richmond and Petersburg, which were reinforced, after Butler had commenced moving, by

Indian corn grown; the bottom lands near the rivers, and especially the sources of the smaller streams, marshy; no roads, only a few tracks—a very fair idea will be had of the theatre of war. The woods were in some places of pine, through which it was difficult for a horseman to force his way, but generally oak predominated; in places the large trees had been cut down, and a jungle of young growth had sprung up, which was more impenetrable than the pine.

19,000 men collected from South Virginia and North Caroline by General Beauregard. In the Shenandoah there were about 5,000 men under Major-General Breckenridge.

While Lee was confronting Grant in the eastern theatre of war during the two months in question, in the western, 450 miles south-west of Richmond, Lieut.-General Joseph E. Johnston, with 60,000 men, was opposing the advance of a numerically superior Federal force (about 109,000 men) under Major-General Sherman. The operations in the two theatres of war at this period were separate, and beyond the fact that Grant and Sherman commenced moving simultaneously at the same hour, had only a general relationship to each other. No attempt was made by the Confederates to utilize interior lines, and to withdraw forces from one theatre to assist in obtaining a victory in the other. The number of men who could have been spared, owing to the large Northern forces in both theatres, was too small to be of decisive effect; nor does it seem likely that the South had sufficient rolling stock available to move a large number of men rapidly; it had taken the Federals, with their enormously greater resources, 111 days to move 23,000 men from Virginia to Tennessee after the defeat at Chattanooga. The operations of Sherman had the effect on the campaign in Virginia that they prevented reinforcements being sent from the west to Richmond; while later on, as he pushed forward and gradually deprived the South of territory whence it had drawn men, supplies, and other resources, he contributed possibly more to the final surrender than the force immediately under Grant's eye in the east; for the Army of Northern Virginia stopped going from inanition rather than defeat. But unless Grant had held Lee fast, Sherman's task would have been far more difficult than it was, and perhaps had been impossible. It was definitely agreed between Grant and his subordinate that, should their opponents try to utilize interior lines, and withdraw forces from one theatre, every endeavour should be made to push on after the retiring force at the highest speed possible.

The Two Armies.—In addition to being numerically superior to its foe, the Northern Army was better equipped, supplied, and provided than any Confederate Army that took the field at any period during the war; nothing was lacking to it which money could purchase. The Southerners, on the other hand, had suffered severely during the winter from insufficient clothing and food; they existed largely on mealies and vegetables, receiving a small meat or bacon ration only twice a week, and in the coming campaign numbers were without shoes or headdresses, and there was constant lack of ammunition.

The Confederate Army, however, enjoyed the advantage of sound military organization; the same units had existed from the commencement of the war, had been filled up by drafts, had maintained their traditions, and established *esprit de corps*; the officers had remained with it, and the senior ones were nearly all graduates of West Point.

In the Northern Army units were raised and allowed to die out, their places being taken by fresh ones under new officers; this vicious system seems to have been in favour with the various State Governments, for the reason that it gave them frequent opportunities of nominating new batches of persons for the rank of officer, for officers were raised with a unit, and disappeared, as a rule, with it. Conscription, though it had been made legal, was rarely enforced, for the reason that large sums were raised by subscription to pay bounties to secure the necessary number of the State contingent, and so to make the application of the law unnecessary. Substitutes also were allowed. Although there was a large percentage of men who had enlisted from patriotic and conscientious motives, yet they did not form a majority, and in the severe fighting of the campaign they suffered a far heavier percentage of loss than the recruits who had enlisted for the sake of a bounty and hoped to earn another by re-enlisting at the end of the period for which they had engaged. What little esprit de corps and tradition did exist in the army corps, divisions, and brigades of the Army of the Potomac had been sorely wounded and broken in March by the arbitrary dissolution of these higher units and the formation of three army corps from the five which had borne with honour the burden of several campaigns, though composed, it is true, of varying regiments. Thus the First and Third Corps disappeared altogether. Finally, many of the generals had received no military training, and had been appointed for political reasons :- Butler, who commanded the Army of the James, was a civilian, who had never shown any proof of military capacity; Sigel, commanding in the Shenandoah Valley, was no better; as Halleck said of him, "He will do nothing but run. Never did anything else." Grant, on taking command, requested the removal of some hundred such generals, but President Lincoln found himself unable to comply with his wishes to any great extent. "Steps of this sort, however, were not to be taken without difficulty, for they intruded on the domain of politics. Nearly every officer of importance who was displaced would become an enemy of the Administration, while his friends would protest against the injustice done him and threaten to oppose the President at the next elections."\*

A notable characteristic of both armies was their fondness for, and skill in, entrenching directly they found themselves in the presence of the enemy.

The Campaign.—The main outlines of the campaign are exceedingly simple, and, taking London to represent Richmond, ran roughly as follows:—Lee is on the Cambridgeshire Ouse (Rapidan), with his

<sup>6</sup> Badeau II., 29. The Presidential election was at the end of 1864.

left flank at Huntingdon. Grant, on account of his overwhelming superiority in numbers and the general situation, having the power of strategic surprise (equivalent, as before mentioned, to command of the sea), commences moving at midnight on the 3/4th May, and crosses the Ouse just below its junction with the Cam with the intention of turning Lee's flank. Lee at once sets his three corps in motion eastward through Cambridge, and the two armies come into collision, as the various divisions arrive on the field, at Fordham, near Newmarket (the Wilderness). During the 5th to 7th May the Federals lose 17,666, the Confederates between 8,000 and 11,400 men.

Unable to make any impression, Grant determines to continue the movement to his left flank, and on the evening of the 8th May starts his force off towards Cockfield, Essex (Spottsylvania), 15 miles to the south-east.

Its advance is delayed by the Southern cavalry, which enables the Southern infantry to reach Cockfield before the Federals. The two armies fight on a line running roughly north-west and south-east during the 9th to the 19th May, Grant gradually edging his force towards its left by the nocturnal transfer of troops. The Federal losses are about 19,000 men, those of the Confederates considerably less.

Before this battle commences Sheridan's cavalry force is sent off on a raid, and is followed by a portion of the Southern cavalry; he does some easily-repaired damage to railway lines, finds London defended by fortifications, and returns to his army by re-crossing the Thames below London.

On the night of the 20th May Grant again begins moving to his left, towards Halsted (Hanover Junction), on the Colne (North Anna), but Lee again is able to interpose. The armies face each other on the Colne the 24th to 26th May. Grant's right and left wings are south of the river, but his centre is on the north bank; being strongly entrenched, he is not attacked, but he also, seeing that there is little chance of attacking with success, moves, preceded by his cavalry, towards Brentford (Cold Harbour); Lee follows suit. In the attacks made on Lee's hastily-constructed entrenchments over comparatively open ground during the 1st to the 3rd June the Federals lose some 12,000 men, the Confederates about 2,000, when General Meade suspends the fighting by Grant's direction.

Meantime Butler's 40,000 men, who had been assembled at Margate, had been conveyed by water to Chatham, and after making a feeble advance are bottled up by Beauregard in the Hundred of Hoo (Bermuda Hundred), between the Thames and the Medway; part of the Southern force is then withdrawn to assist Lee and part of Butler's force (Smith's Corps) is withdrawn by water to join Grant. Sigel's force in the Severn (Shenandoah) Valley is also defeated, and part of Breckinridge's force then called to Lee's Army.

Grant now determines to carry his flanking operations still further,

and commences crossing the Thames (James) at Tilbury, completes the passage by the 15th, and moves on Sevenoaks (Petersburg). A partial attack by two corps on the entrenched lines at this place fails, and Grant sits down to conduct siege operations.

While Grant is making his arrangements for crossing the Thames, a force of 11,000 men under Early is sent to Bath to work northeastwards and threaten the Northern capital, Boston, in Lincolnshire.

During the whole of the above operations Grant's lines of communication, being to the sea on the east coast, are shifted southwards as required, and are always covered by his front.

Grant's Stralegy.—When Grant took the field against Lee for the first time the experiences of the previous Federal commanders in the Virginian theatre of war were available for his guidance. The endeavours of Generals Pope, Burnside, and Hooker to manœuvre against Lee had led to disastrous failure, while remaining inactive and inviting attack as practised by McClellan and the two last-named generals had given Lee opportunities equally calamitous to the Federal cause. The lesson might perhaps have been deduced that Lee was naturally more inclined to undertake bold operations when at a distance from Richmond than when danger to the capital compelled him to remain near it. The lesson should have been deduced that a very large numerical superiority was required to inflict a defeat on the Army of North Virginia.

The essence of Grant's plan of campaign was to stick close to Lee's Army; he wrote to General Meade: "Lee's Army will be your objective point. Wherever Lee goes, there you will go also"; and to this plan he adhered with the utmost persistency. In all previous campaigns of the war there had been pauses between the battles during which both sides refitted and recruited; now from the 5th May, 1864, when the fighting in the Wilderness commenced, until the 9th April, 1865, when Lee surrendered at Appomattox Court House, the armies were in close contact, and scarcely a daypassed without fighting.

This was Grant's so-called policy of "attrition." His initial attempts to expedite it by hurling superior numbers against the Southern forces regardless of losses, content if a not disproportionate number of his foes were placed *hors de combat*, must be accounted a tactical failure. He could certainly replace his losses, while it became increasingly difficult for the South to find men, but no troops could be expected to carry out such a process day after day; and Cold Harbour showed that neither commanders nor men would continue it.\* No troops, except perhaps fanatics, will stand con-

<sup>&</sup>lt;sup>o</sup> When the order to renew the attack was given, Hancock used his discretion and declined to move forward; Smith refused to obey. In the 6th Army Corps the order to advance was given to the men, but they merely re-opened fire without advancing.

tinuous heavy losses. The ordinary soldier expects to have a reasonable chance of returning home to tell the tale. He will not fight for generals who always have a heavy butcher's bill and no visible success in the form of captured trophies and prisoners or conquered territory. Grant's change of methods after he had crossed the James River is indication that he recognized that his men would not respond to his original programme.

That the campaign was strategically a failure is proved by the facts that at the close of the period under consideration Lee was able to detach 11,000 men, under Lieut.-General Early, to threaten Washington, and the Confederate lines of supply were still intact.

Given Grant's three to one superiority in numbers, he was justified in making detachments, but it can hardly be said he made them as small as possible.\* The leaving of the original detachment in the Shenandoah Valley was unavoidable :- There was a Confederate force there, and the valley had been and was again to be the path for threatening Washington. Grant's directions to Sigel to defeat Breckinridge, to combine the detachments in Western Virginia with his own, and advance viâ Lynchburg and Gordonsville towards Richmond (in which neighbourhood Grant hoped to be) were in accordance with sound strategy; they might have been bettered if the advance had been ordered direct via Gordonsville, without the delay of a detour to Lynchburg. The detachment failed because of the incompetency of its commander, as Butler's detachment also failed. The best and most skilled officers must be selected for the command of independent detached forces; but, as already pointed out, Grant was unable to get rid of all "political generals" at once ; later he certainly rendered great service by insisting on the employment of none but the right men.

Butler's detachment of nearly 40,000 was a very large one (Grant eventually withdrew Smith's corps from it, which may perhaps be taken as recognition that it was too large, or at any rate that men were more wanted elsewhere). Grant's hope that the mere threat of its presence south of Richmond would induce Lee to make heavy detachments to defeat it, or cause him to retire nearer to Richmond, was a miscalculation which showed he did not appreciate Lee. A force of this size ran a great risk of being cut up before Grant could help it, if Lee attacked it seriously. If the Army of the James was merely to be a threat, then 10,000 men would have answered the purpose equally as well and could have been more easily withdrawn. Grant's orders to the detached force were by no means explicit, and

<sup>&</sup>lt;sup>o</sup> There were 662,345 Union soldiers present for duty on the 1st May. Of these Grant had in the field in the east about 173,000, Sherman in the west 109,000; the rest were doing garrison duty and were practically of no account except as police. The remarks here apply to the 173,000 men immediately included in Grant's campaign.

the movements expected of it were dependent on the success of his main force, which never developed. It would appear that he expected Butler to invest Richmond from the south while he himself co-operated from the north; that he collected a large siege train would seem to indicate that he anticipated an investment and bombardment in the first campaign. The capture of Petersburg, which would have been easy if attempted by a rapid movement directly the campaign opened, and undoubtedly a decisive step towards the end, was not alluded to in Grant's directions. A commander like Butler, however, who when detached requires detailed orders to compel him to render intelligent co-operation, is of doubtful assistance to a commander-in-chief, and it is better to utilize his services where they can be closely controlled from Headquarters.

If the whole of Butler's force had been brought north of the James River (as one corps of it was later), had been utilized to seize Cold Harbour and Hanover Court House in advance of Grant, and thus to threaten Lee's right flank, it might have produced decisive results, and yet would have been so near to Grant that it could not have been attacked without his being able to succour it. The separation of the forces was unnecessary, and after the Battle of the Wilderness Grant seems to have had misgivings about it, for he sent urgent messages to General Halleck for "all the infantry you can rake and scrape." Generally the division of force in a small theatre of war like Northern Virginia is a mistake, unless for the special purpose of ultimate combination on the battlefield. Both Butler and Sigel were too far off for concerted action with Grant, and liable to defeat, as happened, without Grant being able to render them assistance. It is true they occupied part of the Southern forces, but by no means an equivalent number of them. It was, however, the last exhibition of isolated effort, want of co-operation, and division of forces on the part of a Northern commander ; and it may even be said of Grant's initial movements that they were sufficiently energetic, simultaneous, and well directed to hold the enemy fast and to deprive him of the power of reinforcing the most threatened point to any great extent from elsewhere.

Having decided to take the initiative, Grant had the choice of attacking Lee's position on the Rapidan River or crossing above or below it, so as to turn the left or right flank of his opponent. The first alternative does not seem to have been considered at all by Grant; there was, it is true, an unfordable river in front of the position, and any attempt to force a passage would have been equivalent to making an opposed landing on a beach; but Grant had an enormous superiority in heavy artillery, which might have been made use of to bombard the position and hold the defenders to it. As there would have been an obstacle between the guns and the enemy, a small escort would have sufficed. No diversion seems to have been made to distract attention from the crossing that was made elsewhere. Strategically there were very good reasons for selecting the line of advance by the east; the seacoast, with the very numerous waterways leading inland from it, was always behind Grant, giving him instead of an ever-lengthening line of communication a series of short and secure ones (as the Japanese had in Korea). By the western line he would have had to rely on one single-track railway, little better than a contractor's line, and he must have made detachments to guard it, as its direction was diagonally across the enemy's front. It is said that Grant feared that if he moved west Lee might have advanced towards Washington, but it is doubtful whether he would have abandoned Richmond at this stage, and it is difficult to conceive how he could have kept his troops supplied, except from Federal magazines, as the whole country from the Rapidan to Washington was by this time absolutely bare. There would have been risks by the western line; but it must be remembered that later on, when Grant was south of Richmond, all his endeavours were directed to cutting Lee off from the west, and it was by using Sheridan's cavalry to head Lee off from the west more than a year later that the final surrender was brought about.

Tactically the advance by the eastern flank offered serious disadvantages; the country there was difficult, and therefore in favour of the better-trained troops; it offered no facilities for the employment of artillery and was practically unmapped.

It has been suggested that Grant might have advanced as McClellan did, in 1862, by the Yorktown Peninsula, or that he might have made the Army of the James stronger than the Army of the Potomac. Against the former proposal it is urged that the large amount of time and the large number of vessels required to transport the men would have given Lee warning, and that this movement would have uncovered Washington. Lee could certainly have delayed an advance on this line, for no outflanking movements by Grant would have been possible with a broad river on each side. It does seem, at first sight, that as Grant chose eventually to transfer his whole force to the south of the James River, he might have saved much loss of life and of time had he gone there originally. As he was prepared to make large detachments, he might have given Meade the smaller force to hold Lee, and himself going to Butler have made the principal attack with the Army of the James. Grant's objective, however, was Lee's Army, and such a use of his troops might only have led to the capture of the city of Richmond, and this at the expense of the defeat of the force under Meade, when Lee would have been free to devote his whole attention to the Army of the l'ames.

Generally, Grant's strategy must be considered as eminently safe. and suited to the political exigencies. The detachment of Hancock's Corps after the Battle of the Wilderness, as a lure to Lee, failed, as might have been expected of so ancient a ruse of war. The risk again was not worth the result expected. The corps, if Grant was prepared to hazard it, would have been more usefully employed (in combination with Sheridan's cavalry) in seizing some advanced point, *e.g.*, Spottsylvania cross roads, of strategic value, or in acting against a flank while the frontal attack was in progress.

Grant, on the other hand, allowed his whole force to be diverted from his march and attracted by Ewell's Corps (in the Wilderness) instead of using the advantage of the initiative to press on to ground more favourable to his numbers and artillery.\*

Grant's passage of the Rapidan was a striking success, and that success should have been pushed. His battle in the Wilderness and his processional flank march from the Wilderness to Spottsylvania, and from Spottsylvania to Cold Harbour in contact with Lee, and his continuation of the movement across the James, were of no avail, as Lee had always a shorter distance to march on interior lines to confront him again, and his movements were made so slowly that Lee had time to entrench. If he could have held Lee with part of his force while the remainder (or Butler) enveloped Lee's right flank, the Southern case would have been difficult. As pointed out under night operations, the manœuvring by night, by which Grant sought to gain advantage, wore out his troops and made them less fit to meet the foe when eventually they reached their allotted positions. That the fighting of the Northerners after they crossed the James River was never up to the standard of that done in the Wilderness is probably due to deterioration in quality of the mon ; the best and bravest had fallen in the wholesale slaughter of the earlier battles.

Lee's Strategy.—Lee's strategy must also be characterized as safe; the situation was too serious for him to endeavour to compensate for lack of adequate numbers by the brilliancy and novelty of his movements. The capital of the Confederacy, which was also its greatest arsenal and storehouse, was threatened. Had it been completely defended all round by forts and fortifications so as to make it safe from an assault, except at an enormous expenditure of hife (as von Moltke considered Paris was in 1870), he might have felt himself more free to manœuvre. Basing himself on Lynchburg (the third largest city in Virginia), he could have operated against Grant's flank whenever he tried to extend his line westwards.

Lee's three corps in winter quarters in the neighbourhood of

<sup>\*</sup> The defenders in the Wilderness also had the great advantage that they could lie unseen, while the attackers had to advance, practically as game driven to the hunters, disclosing their presence as they forced their way through the brushwood. Not to get through such unsuitable ground as fast as possible was a most unfortunate mistake.

Orange Court House and Gordonsville were practically in a flank position covering Richmond. On account of his superiority in numbers the initiative lay with Grant, and with it the advantage of strategic surprise. Lee had to be prepared to meet any move that he should make.

Roughly, the three Confederate corps were arranged in a triangle with the base towards the north; this may have been for the convenience of cantonments and supply. It is easy to see that had the apex been towards the north (say one corps occupying the position on the Rapidan with advanced troops, supported by the remainder of the corps, with the two other corps in second line) then one and a-half corps would have been immediately available to uncet any attempt to turn either of his flanks.\*

It is said that Lee had early intelligence of Grant's decision to push south-eastwards; if so, the position of his corps might possibly have been improved, for at midnight, when Grant commenced to move, they were distant from his probable route through the Wilderness: Early's Corps, 18 miles; Hill's, 28; and Longstreet's, 38 (by road 42). If two or all of Longstreet's divisions (actually at Mechanicsburg, south of Gordonsville) had been nearer to Hill they might have intervened on the 5th instead of the 6th, and the Wilderness might have been a Southern victory.

Lee's detachments—that of Breckinridge, in the Shenandoah Valley, and that of Beauregard, near Petersburg—appear to have been calculated with great nicety; they were just strong enough to defeat the more numerous forces, under indifferent generals, which were opposed to them. Directly they had successes Lee withdrew 2,500 men from the Valley (on the 15th May) and Pickett's Division (on the 16th, and later Hoke's) from Beauregard.

Lee was too inferior in numbers to force the fighting; as von ' Clausewitz puts it: "He who has to seek a result by delaying the enemy, and must economize the lives of his men, should not of his own accord increase the intensity with which the war is waged." His chance lay in the enemy's mistakes: "The weaker one is, the more one must live by the faults of others."

It has been suggested that had Lee not been ill after Spottsylvania more advantage might possibly have been taken of the division of the Federal forces when they lay on the North Anna; but they were entrenched and their flanks secure, and therefore they were in little danger from Lee's inferior numbers. The situation in no way resembled that of McClellan on the Chickahominy in 1862.

Early's raid to Washington, like Lee's series of defensive positions, was only a means of gaining time and of taking the pressure off

<sup>9</sup> The formation above suggested is really a square with half a corps at each of the upper corners and a whole corps at each of the lower ones. Such a formation is now much in favour with French strategists.

Richmond; no decisive results could be expected of 11,000 men utilized in this manner.

A somewhat interesting comparison might be drawn between Lee's strategy at this period and Frederick the Great's in the later part of the Seven Years' War. Lee's flank position might be compared to Frederick's at Schmottseifen; but Frederick, after his defeat at Kunersdorf and the disaster at Maxen, did not (as Lee after Gettysburg) abandon the offensive, as is evidenced by the Battles of Lieguitz and Torgau. It must, however, be borne in mind that Frederick was not opposed by a Grant, and that the standard of discipline of the Prussian troops did not fall off as that of the Southerners. In the Prussian Army there was always hope; in the Confederate each action was only one step nearer the end, a proof, perhaps, of the true measure of the defensive.

Moving on shorter lines Lee was always sure of being able to interpose between Richmond and the enemy, and to hold him in the difficult country, but he could do no more.

Lee's Tactics .- Throughout the campaign the force at the disposal of Lee was too weak to take full advantage of the opportunities offered him by Grant ; a defensive position has fulfilled its purpose when it has delayed the enemy, or caused him heavy loss through a too contemptuous attack on it; a general who clings to a position or a series of positions cannot expect to achieve a victory that will have a real effect on the course of the war. Had Lee been able to form an offensive wing as well as a defensive one, and to attack Grant while he was assaulting the entrenchments or immediately after he had failed, such a victory might have been his. Von Werder's excellent defence of the Lisaine position in January, 1871, for instance, merely stopped the French; it was you Manteuffel's force coming down on their flank which drove them out of the theatre of Wellington's army at Waterloo may also be regarded as a war. defensive wing ; it held the French, but without the action of Prince Blücher's offensive wing it could not have brought about decisive results. Had Kuropatkin at Liao-yang used his left wing to attack the Japanese south of the Tai-tzu River while two and a-half of their three armies were detained in front of the Shou-shan-pu position, instead of letting it wait to be attacked, as it eventually was by a far inferior force, the course of the Manchurian War might possibly have been changed. But for reasons very different to those of Lee the Russian commander clung to positions; even his attempts at the strategic offensive at Te-li-ssu and the Sha Ho merely ended in the tactical defensive. That Lee was perfectly aware of the course which offered the best results is proved by his use of Jackson's force at Chancellorsville as an offensive wing while he held the Federals on part of their front with his main force.

The value of a defensive position held by a small force was

exhibited at the Ya-lu; the Japanese spent many days in preparing to attack it, and had General Zasulich evacuated it directly the Japanese showed signs of advancing, it would fully have answered its purpose. The Nan Shan position did good service, but was also held a little too long. The action at Ta-shih-chiao showed signs of better generalship; the defensive position there detained the Japanese and caused them heavy casualties, and was evacuated without loss during the night.

Lee of course had not elbow room for this manœuvre; the foe was so close to Richmond that he was bound to cover it directly and dared not retire. General J. E. Johnston, who was opposed to Sherman, had the necessary space, and utilized it by taking up successive positions.

Under the conditions imposed on him, Lee chose a nearly pure defensive attitude; the few attacks he judged it opportune to make, as for instance that on the 2nd and 6th Federal Corps on the 22nd June, led only to temporary successes; his opponents were able to re-occupy almost immediately the ground they had lost.

Lee, for the same reasons, perhaps, which prevented his taking the strategic offensive, attempted no great counterstrokes. On the morning of the 2nd June at Cold Harbour he sent Rode's division of Early's Corps to attack the Federal right flank, and it was able to roll it up for a considerable distance and even to take it in rear. Most of his counterstrokes, however, were purely local and carried out to the front; they led to heavy losses and small results, as might be expected, for the troops engaged in them had naturally to cease firing to a great extent during the movement, to abandon their cover, and to cross the very obstacles which had been embarrassing their opponents; they were never followed by a line of fresh troops to secure the advantage gained.

The defensive lines of the Confederates were never selected by Lee, although he endeavoured sometimes to rectify them; they were merely the best lines available taken up by the troops themselves; working parties of negroes were brought up to strengthen their profile; in many cases, however, the parapet consisted of nothing more than a log, behind which the firing line lay. In the plans of the battles the lines appear very irregular and haphazard, but the cause of their apparent want of system was the desire of each unit to get to a place where a clearing or high ground would enable it to secure a good field of fire. The extraordinary protuberance to the line at Spottsylvania, known as the "Bloody Angle" or the "Mule Shoe," an inverted U projecting nearly a mile in front of the general line and open to attack on three sides, was occupied because it commanded a good view.

Grant's Tactics.—Grant's methods of attack must be considered faulty; he attempted to take the Confederate entrenchments by

main force, and failing to do so manœuvred to place his army so as to turn the positions, only to find his enemy confronting him again. It would appear that a turning movement is of little use unless the enemy is held in front at the same time by the attack of a sufficient body of troops; the frontal attack of the Second and Fourth Japanese Armies at Mukden while the Third Army endeavoured to turn the line is an instance on a large scale of the necessary procedure, but no more classic example can be found than the operations which were being carried on at this very time by General Sherman to dislodge General Joseph E. Johnston; true he only advanced 100 miles in 100 days, but he did advance and did reach Atlanta.

If the force is too weak to make a determined frontal attack and a turning movement at the same time, and the position is a strong one, a turning attack, if the ground permits of it, may be made in the hope of finding the new position assumed by the enemy less strong than the original one; otherwise recourse must be had to siege works and approaches, or at least an accelerated form of siege warfare. Grant resorted to this procedure after Cold Harbour, but he evidently thought it too slow, for he made one more attempt at assault in his first attack on Petersburg.

The procedure for the attack of a position that cannot be turned, which is advocated on the Continent, is that a series of entrenched infantry positions should be taken up during successive nights, until an "assault position" is reached, that is, one so near to the enemy that an assault in the dark offers reasonable chances of success; from this position parties are sent out to reconnoitre and destroy the obstacles, to select routes, etc. While the infantry and engineers are thus engaged the artillery from concealed positions or epaulments engage the enemy's guns and keep their fire down until the moment of assault.

Against an enemy who is preparing a position instant attack by the shortest line before he has had time to make it formidable is probably the surest and easiest road to success.

Entrenching on the Battlefield.—The failure of the Federals with superior numbers to capture the Southern entrenchments was perhaps due to the nature of their troops; it must not be forgotten, however, that the assaults of the Confederates at Gettysburg had also failed.\* Both sides in this stage of the war were too much given to entrenching themselves directly they had deployed for action, a habit which Stonewall Jackson's men were never permitted to learn,

<sup>\*</sup> It may be noted that the Northerners were not anxious to cross bayonets with the Confederates. At Spottsylvania Robinson's brigade was persuaded to charge home up to a breastwork by being given the false intelligence that it was only held by cavalry (who were known to have no bayonets). In this connexion it is of interest to hear that the German cavalry is about to be supplied with a bayonet.

as his battles from Kernstown to Chancellorsville show. The custom was so engrained that Hancock's Corps on the first day in the Wilderness halted, entrenched, and even made abattis when everything depended on a rapid and resistless advance, regardless of losses, before the Southern right wing grew sufficiently strong to offer any real resistance.\* A genuine attack is not to be expected of troops that adopt this principle, and the lifeless course that the attack so often took in the Civil War is a warning that the spade in the attack may have undesired effects. It has of course its true use when an attack is brought to a standstill by overwhelming fire, and the infantry must be given every assistance in maintaining its position, or when it enables a weak force to hold on to the enemy while the decisive attack is made elsewhere, as the Japanese used it in Manchuria, but the attack in the true sense of the word has nothing in common with the use of the spade.

Artillery Co-operation.—Another cause of the Northern ill-success in assaulting entrenched positions was the failure of the artillery to co-operate; this was of course mainly due to the nature of the battlefields, a tangled wilderness of trees and undergrowth, and marsh, with few clearings. This condition, however, must have been foreseen by Grant when he made his choice of the eastern flank for attack. Without proper artillery preparation it is evident that even in 1864 an attack on an entrenched position had little chance of success. Grant had heavy artillery with him, and no doubt would have used it if it had been possible, as at Spottsylvania he actually did bring up and use some small (Coehorn) mortars. Indirect laying of field guns seems to have been unknown in those days.

It was of no use to send in frontal attacks of heavy masses of infantry† without artillery support, as they were stopped by a single line of men with single loaders. Similar attempts by the Russians at Plevna, our own troops at Colenso, and the Japanese at Ta-shih-chiao, Liao-yang, Sha Ho, and Mukden have all failed.

It is worth recalling that a little earlier in the same year, in March, 1864, the Prussians proceeded very differently to the assault of the Danish position at Düppel. The attack was prepared by the fire of 100 siege guns, and although the position was infinitely stronger than the hasty entrenchments of the Confederates, the assault was successful. Perhaps the Prussians paid the position too much honour by spending 19 days before it, but for certain success in the attack of a position there must be a methodic and almost siegelike procedure. The importance of the result in relation to time will

• The respite thus given to Hill enabled him to rectify his line and to entrench, which he had not previously done.

<sup>†</sup> Hancock's attack at Spottsylvania was made 20 deep; the 6th and 8th Corps attack at Cold Harbour 3 and 6 deep respectively; no attack seems to have been less than 4 deep.

be the ruling factor in the actual course followed; in the case of Plevna, Todleben, when he took charge, decided on an investment; Nogi at Port Arthur, as his army was wanted for service elsewhere, tried to hasten proceedings by assaults at heavy cost of life.\* When a whole frontier like that of France is a fortified position, it must be assaulted somewhere, but in field warfare, if there is room to manœuvre, the procedure adopted by the Japanese at Mukden, as before referred to, would seem the best course -To establish equilibrium by entrenching opposite the position, so that the front can be held by a (comparatively) small number of men, and then to manœuvre round one or both of the flanks (if sufficient numbers are available). Grant was preparing to do this after Spottsylvania (the trenches were to have been held by Warren's Corps), when Lee moved to anticipate him; should assault, however, be absolutely necessary, careful reconnaissance and the commencement of bombardment to find the weak places must be resorted to. It must always be remembered, however, that the longer a field position remains unattacked the stronger it will become, as opportunity is given to the enemy to improve it.

Night Manœuvring .- Night marches and manœuvring by night in the hope of effecting a surprise at daybreak or of anticipating the enemy at some point were a special feature of Grant's operations. He started at midnight on his first campaign against Lee and commenced his moves to all his new positions by night. As a matter of fact, as surprises, his night marches were failures; Spottsylvania and Cold Harbour show that a night march is a poor means of getting out of a difficult situation. It was also repeatedly proved that even when the night march had succeeded, it was difficult to get the troops into attacking formation unobserved, and the advantage gained was quickly lost. The records show that the troops were reported too tired to attack without rest and without a pause for food, and that those who went into action after a night march suffered more than usual from shock when they were wounded. The case is different when, as so often happened in Manchuria, troops already in position are led forward short distances in the darkness, or use the cover of darkness to advance a short distance to a fresh position.

The night time was also much used to shift troops which were in close contact with the enemy. This the Russians also did frequently in Manchuria.

In the attack of the First Japanese Army on the Russian works at Mukden the infantry attacks (or advances) were made entirely by night. The infantry got forward as far as they could and

• Wellington's procedure at Ciudad Rodrigo and Badojoz in 1812 is of interest in this connexion. Time was of importance; he assaulted one after 12 days, the other after 20 days' siege and bombardment.

entrenched, built up sandbags, or got cover from the ground; during the day they lay unable to move or even raise their heads, but the Russians were prevented from attacking and driving them back by continuous artillery fire. This perhaps is the proper use of the night and a good procedure in the attack of an entrenched position.

In this connexion the translation which appeared in the *Journal* of the Royal United Service Institution of last year, of the views on the attack of positions of the chiefs of staff of the divisions of the Second Japanese Army, written after Liao-yang, will be found of interest.

Reconnaissance.—Both sides appear to have failed to reconnoitre adequately the enemy's movements and positions. There was no proper staff system and the reconnaissance work seems to have been left to the sharpshooters who covered the advance on the position. As a result of this want of system both armies stumbled on each other; there were fierce encounters where they came in contact, and other troops in the vicinity converged towards the fighting, without searching for weak points or for the flanks, so as to produce a decisive result.\* In such circumstances a properly combined attack was out of the question and, as in practically all the battles of the Civil War, attacks were not made simultaneously along the whole front.

The uncertainty of the whereabouts of the enemy led, as at Spottsylvania, to tentative measures on the Federal side; the attack was made first with the right wing, then with the centre, then with the left, then with the right again. The experiences thus gained were not, however, altogether lost on the Army of the Potomac, for at Cold Harbour a definite attempt was made to apply all available forces at the decisive point, although from the nature of the ground only three out of the five corps could be brought into action; but in the attacks on Petersburg in June, 1864, the troops were again sent in piecemeal; possibly this was due as on other occasions to the bad work of the insufficiently trained staff officers.

In spite of the increased difficulties of reconnaissance, it is more important than ever to-day to have reliable information before an attack is delivered. It will take a considerable time, and specially trained officers and men must be employed. The Japanese procedure at the Ya-lu, though it seems slow, is no doubt the right one.

Cavalry.—At this period of the war, three years after its commencement, by dint of training and war experience the Northern cavalry, recruited mainly from a population which, if it owned horses at all, preferred driving to riding, was nearly equal in quality to that raised from the sportsmen and hunting men of the South; it was in this

<sup>•</sup> It is recorded as altogether exceptional that Colonel Upton, who was commanding a brigade in Sedgwick's Corps, examined the ground over which he was to attack at Spottsylvania himself, and made his 12 regimental commanders do the same, and explained to each what his task was.

campaign half as numerous again as the Confederate cavalry (about 12,000 to 8,000). It had not, however, produced a capable leader, and Sheridan, who was selected by Grant to command it, was an infantryman by training and had never served with cavalry;\* he had commanded all infantry units up to a division; he was chosen solely on account of his energy and dash.

The cavalry on both sides was in reality mounted infantry; shock action was not sought after; there was hardly a sword in either command (if a regiment did possess one it was used for cutting up sheep); when mounted parties met they used their revolvers; both carried rifles or carbines.<sup>†</sup> Some of the Northern cavalry had the advantage of the Spencer repeating carbine; they had no bayonets nor lances.

Grant (or Sheridan for him) does not seem at this time to have known how to use his numerous cavalry force. During the advance to and at the Battle of the Wilderness it was not used independently, but as advanced guard cavalry, which merely skirmished with the enemy's horsemen, and as guard of the baggage trains. During the advance to Spottsylvania, General Warren complained that his corps was blocked and retarded by the cavalry. This may possibly be a clue to Grant's extraordinary action in sending his 12,000 cavalrymen off on a raid, when he wanted every single man he could lay hands on to fight Lee at Spottsylvania. During the move to Cold Harbour the cavalry was very properly sent on in advance to secure the high ground ; but, again, when the first attack on Petersburg was made the cavalry was away on a raid. No attempt was made to use this large force to attack Lee's flank or rear, or to impede his advance, or to head him off when he moved, as was eventually done in the closing scene of the war. The raids accomplished nothing-they did not even destroy the Confederate lines of supply; the small damage done to the railways was repaired in as short a time as it had taken to carry out. It was only discovered later that to make a railway useless the displacement of a few rails is insufficient; it was eventually found necessary to place whole divisions in single rank along a track, to overturn it by lifting one end of the sleepers by word of command, and then to burn the sleepers and twist the rails.

Far better service was done by the Confederate cavalry. In spite of the presence of a superior force it managed to get in front of Grant's troops whenever they moved, by felling trees to block their progress and by constructing entrenchments to give the appearance of the presence of infantry; during the fighting it watched the flanks and

\* It should, however, be noted that in the four years' course at West Point cadets are taught the duties of all arms.

† In 1870, six years later, the German dragoons and hussars only had carbines; the firearm of the Uhlans and Cuirassiers at the commencement of the war was a pistol. They eventually carried captured rifles. formed a valuable strategic reserve. Its efficiency was largely due to the better knowledge of the country possessed by the men and their good shooting. Few cavalries have rendered their side such valuable assistance. As the ground on which it had to act was quite as unsuited to cavalry work as is the zone of country between London and the coast to the south and east, the factors which contributed to its success against a more numerous body of horsemen are worthy of attention.

Command of the Sea .-- Finally attention must be drawn to the fact that although the North had complete command of the sea and the great waterways, this contributed nothing positive to enable Grant to win a victory or to the final defeat of the Confederate States. It gave the Federals valuable facilities in that it permitted Grant, as McClellan before him, to shift his base, and to transfer troops with certainty and ease, and allowed him the advantage of strategic surprise; it presented serious inconveniences to their opponents in that it prevented them from getting assistance from the Trans-Mississippi States, from receiving warlike stores and supplies from Europe, and from obtaining funds by disposing of their produce abroad; but it was not vital to the termination of a life-and-death struggle; in fact, had the attributes of the two parties been reversed, and had the South been the manufacturing community instead of the agricultural one, it would have been of little importance. Nor is this an isolated case of the inherent incapacity of naval supremacy to count as a decisive factor in the termination of a war; Napoleon's sea power was annihilated at Trafalgar in 1805, but it required many years of desperate fighting on land and a final crushing defeat in a land battle to years later to end his victorious career.

The absolute command of the sea which the Allies held in the Crimean War did not in any appreciable degree hasten the end or contribute to a definite conclusion. In 1866 the Austrians gained a decisive victory in the only naval battle of the war, but it had so little influence on events that it is practically forgotten. In 1870-1 the French had undisputed command of the sea in the theatre of war. It did not, however, save Paris from capitulation nor the loss of two fair provinces; the best use that could be made of the trained sailors was as artillerymen with the land forces. British naval supremacy aided but little in shortening the long struggle in South Africa with two Republics which possessed no navy whatever. Even Tsu-Shima would not have helped the Japanese in the objects of the war—the re-capture of Port Arthur and undisputed supremacy in Korea—had victory favoured the Russians on land.

In bringing a war to an indisputable finish, command of the sea has no more effect than has the successful defence of positions, and, as General Beauregard said of the Southern passive-defensive policy, "It may make a long agony, but can never win a war."

## STUDIES ON THE USE OF FIELD TELEGRAPHS IN SOUTH AFRICA.

By MAJOR E. G. GODFREY-FAUSSETT, R.E.

WE are constantly being told by those to whose opinion respect is due, that "the South African War was exceptional; it cannot be taken as a precedent; we must train for European warfare." No doubt this is so, but, after all, is it not the unexpected that always happens in war? and in order that this inevitable unexpected may not upset the machine, flexibility of organization is required. Such flexibility can only be produced by a careful analysis of the varying conditions met with on active service.

This is my excuse for asking the hospitality of the R.E. Journal for a series of studies on the use of telegraphs in South Africa. I have selected five episodes from many :—

- 1. A section working in rear of an advancing division (Lord Methuen's advance on Kimberley).
- 2. A section maintaining the internal communications of a mixed division (Sir John French's operations before Colesberg).
- 3. A Telegraph Division acting with a force of several divisions across open country (Lord Roberts' march on Bloemfontein).
- 4. Widely dispersed columns concentrating strategically on an objective (the advance on Pretoria).
- 5. Semi-permanent telegraphs in guerilla warfare (the blockhouse system in the Transvaal).

It must be borne in mind that the telegraph organization of 1899 was very different to what it is to-day. The Telegraph Division was taken as the unit, and each Telegraph Division consisted of four independent sections. Each section comprised two air-line detachments, and a more or less experimental cable detachment. This organization was intended for advanced line-of-communication work, and though many experiments at manœuvres had given telegraph officers great faith in the use of cable for tactical purposes (a faith shared also by many who had witnessed the trials), it was not, as now, translated into an organization for the purpose.

# I.-LORD METHUEN'S ADVANCE ON KIMBERLEY.

# A SECTION WORKING IN REAR OF AN ADVANCING DIVISION.

When the 1st Telegraph Division arrived at Cape Town on the 12th November, 1899, it was met by orders to proceed to De Aar, to there obtain its horses and mules, and to send a section as soon as possible to join Lord Methuen's force, then assembling at Orange River for the relief of Kimberley.

By dint of working all night at unloading the ship, the wagons and stores, with an advanced party to draw the animals, were despatched to De Aar on the afternoon of the 13th, the remainder of the Division following on the 14th.

By the evening of the 16th the animals had been obtained, and the whole Division was assembled at De Aar. The sections were No. 1 (Lieut. Jelf), No. 2 (2nd Lieut. Henrici), No. 3 (Lieut. Moir), and No. 4 (2nd Lieut. Mackworth). All efforts were directed to getting Moir's section into order, telling off the mules and oxen, giving the ponies an idea of discipline, and organizing the native drivers. On the afternoon of the 18th Moir's section left by train for Orange River. His marching-out strength was 1 officer, 2 sergeants, 41 rank and file, 1 conductor, 14 boys, 12 horses, 24 oxen, and 40 mules ; with 3 air-line wagons, 1 cable cart, 1 G.S. wagon, and 1 Scotch cart.

Next day the mobility of the section was destroyed at one blow. Moir was informed that water on the line of advance was too scarce for the section to form part of the field force. Nothing remained but to work with the railway companies detailed for the repair of the line, carrying the stores in a truck, and conforming to the movements of the railway breakdown train instead of to those of the Division. The animals and wagons were left at Orange River, and 20 miles of air line were packed in a truck.

As the advance was to be in the Cape Colony, great assistance was rendered by the Cape Telegraphs; wires along the railway were placed at our disposal, and an inspector with a working party was available for permanent repairs.

At the same time it was arranged that the telegraph section should repair two of the railway wires—one for the army, one for the railway.

Lord Methuen's column consisted of  $7\frac{1}{2}$  battalions of infantry, forming the Guards and 9th Brigades, two batteries field artillery, 9th Lancers, some M.I., and a Naval Brigade of about 350 men. His orders were to communicate with the Kimberley garrison, so as to enable men and stores to be sent there.

The column advanced early on the 21st, and located the enemy at Belmont. Their position was reconnoitred on the 22nd, and carried early on the 23rd.

The telegraph section moved forward with the train, repairing two
wires of the railway telegraph line wherever it had been broken by the Boers. This was tedious work, necessitating the straightening and staying of the poles at each end of a gap, and the filling in of the gap itself with two parallel lines of air line. It was made especially arduous, as all poles and stores had to be carried from the railway truck by hand; moreover, the ground was very hard. In spite of these difficulties, 4 miles were run in gaps on the 22nd.



On the 24th the column marched to Swinkpan, and early on the 25th carried the Graspan position, bivouacking for the night at Enslin. The telegraph section worked as before, putting in  $1\frac{1}{4}$  miles of double

line on the 24th, and about  $2\frac{1}{2}$  miles on the 25th. The 26th was a day of rest for the column; but the telegraph section erected some  $2\frac{1}{2}$  miles of double air line.

The march was resumed on the 27th to Witteputt, 14 miles being filled in with air line. On the 28th the column fought the unexpected battle of Modder River—1 mile of air line was erected by each detachment. Next day 3 miles of double line were completed to the left bank of the river. On December 1st the lines were swung across the river, air line run into Modder River station, and the station telegraph office opened.



Thus far all that could be done was to keep up fairly continuous communication with the rear by dint of the greatest physical exertion on the part of the detachments, and this only because the enemy had destroyed the railway telegraph lines in the most perfunctory way. No attempt at any tactical work was possible.

A pause now occurred before the attack on the Magersfontein position on the 10th. This was utilized to organize the lines, Henrici with No. 2 Section taking over the maintenance in rear, and Jelf with No. 1 Section running up a third line. Leave was also obtained to bring up the transport of No. 3, which arrived on the 6th. The Wheatstone sets were got to work between Modder River and De Aar, exercising a magical effect on the tremendous mass of messages constantly arriving by despatch rider from Kimberley.

Considerable trouble was given by Boer raids on the line in rear, in which the wires were cut. The Cape telegraph party, which was repairing the wires permanently in rear, also added inadvertently to the difficulties of good communication.

The section being now complete was able to take a more enterprising part in the advance on the 10th. Lord Methuen's plan was to leave the railway and break through the left flank of the Boer position at Magersfontein, and then turn the left flank of the next position at Spytfontein. A cable cart with 8 miles of cable therefore accompanied the advance of the 10th,  $4\frac{1}{2}$  miles of air line being run at the start to save cable. This air line was run by the combined air line and cable detachments, the wire being run off the cable cart and the jumper parties doubled. By this method it was perfectly possible to keep pace with the infantry advance.

The defeat at Magersfontein completely stopped the advance of the column, and during the next six weeks there is little to record.

The Magersfontein casualty report—a message of some 6,000 words—was despatched in an hour and three-quarters after it was handed in, thanks to the Wheatstone. A circuit of eight vibrators was erected to connect up the Modder River defences; and good work was done on 1st January with a cable cart accompanying a column to the west, which was thus enabled to keep in close touch with another column based on Belmont. This last column advanced along the existing telegraph line to Douglas, and was kept in touch by a small party under Henrici.

The Section worked very hard against most heart-breaking difficulties—no transport, dry and hard ground, and little communication with headquarters. Yet it always managed to open an office at or near the Division, and to get the work off.

The circumstances absolutely precluded any tactical work, and this was little required at Belmont and Graspan, as the front covered by the column was comparatively small.

The working of the railway wire by vibrators was unsatisfactory, and led to the separation of the railway telegraphs from the army telegraphs. Better provision for this work now exists in the shape of railway telegraph sections, which are mobilized with the L. of C. telegraph company. The work requires considerable knowledge of special railway requirements, and it is doubtful whether even yet sufficient attention is being paid to the training of officers and men for this important duty.

A bright spot among all the difficulties which attended the telegraph

service in this episode is the successful use, for the first time in warfare, of the Wheatstone automatic. The provision of the apparatus and of specially trained operators from the Post Office Reserve had been specially arranged on the initiative of Colonel Wrottesley, who commanded the 1st Telegraph Division on mobilization, but was unfortunately drowned on the voyage out. The Wheatstone is a mechanical appliance worked by clockwork, capable of sending up to 500 words a minute on really good lines. It is fed by slip, on which the messages are punched by a number of operators, and at the receiving end the Morse code is automatically printed on a similar slip, which is then written out by another staff of operators. Its effective action has been referred to above—200 words a minute were obtained at Modder River station.

## THE ELECTRICAL SCHOOL AT THE S.M.E.

By LIEUT.-COLONEL B. R. WARD, R.E.

THE first application of electricity to military purposes would appear to have been in connection with lightning conductors and the destruction of wrecks.

A series of regulations of the 4th of August, 1829, laid down the system to be followed for the protection of magazines from lightning. It was not until 1858 that these regulations were reconsidered, and Circular Memo. No. 260, of the 25th May, 1858, was issued by Sir John Burgoyne as Inspector-General of Fortifications. This Circular Memo., prepared "owing to the progress of electrical science during the last 30 years," will be found on page 196 of the *Monthly Army List* for July, 1858.

In February, 1825, Colonel C. W. Pasley, R.E., carried out the first experiment in firing a charge under water. This was ignited through a tube (probably of lead). In 1837 and 1838 Colonel Pasley succeeded in destroying two wrecks—the *William* and *Glamorgan*—which for some years had obstructed the Thames. These also were fired by mechanical means, but the advantages of electrical firing were recognized.

On 10th April, 1838, Colonel Pasley read a Paper at the Institution of Civil Engineers on "Blasting by Galvanism." Daniell's battery, then just invented, was at that time being used as a firing battery, and the first submarine charge to be fired by electricity was exploded on the 17th September, 1839, against the wreck of the *Royal George*. Many other wrecks were similarly dealt with in subsequent years.

Some years afterwards electricity began, tentatively, to find a place in the R.E. Establishment at Chatham. Thus in the Synopsis of the Course of Military Instruction at Chatham, issued by Sir Harry Jones as Director in 1853, we find a reference on the first page to "Telegraphing" and the "Use of the Voltaic Battery" sandwiched in between "Escalading" and "The Use of Diving Helmet."

The science of electricity had, it would seem, obtained a footing as one of the subjects to be taught by the Instructor in Fortification just before the Crimean War broke out in the following year; and the value of telegraphy had been sufficiently established for a singleneedle telegraphic apparatus to be included amongst the earliest stores that were forwarded to the seat of war. Thus in the Official Account of the Engineer Operations, Part I., page 153, Capt. J. W. Gordon, R.E., in reporting the wreck of the screw transport *Prince* in the outer harbour of Balaklava on the 14th November, 1854, states that she had on board one sergeant and three men of the Royal Sappers and Miners, as well as the civil diver—Mr. J. Gordon—and Mr. Orchard, attached to the galvanic apparatus. The latter apparently was intended for clearing the wrecks of the Russian ships in the harbour.

Before the close of the Siege of Sebastopol 21 miles of wire had been laid and eight stations established in the Crimea. As a result of the experience gained in military telegraphy in the campaign, the study of telegraphy, photography, and scientific subjects generally was ordered to be carried out at the R.E. Establishment under a special instructor. This group of subjects came to be designated "Special Schools," or, more shortly, "Schools."

Thus we find from *Jackson's Woolwich Journal* that in 1856 Capt. H. Schaw was "In charge of Schools, Electric, Telegraphic, and Photographic Apparatus." This appointment—which was held by Schaw until 1864—may possibly have been held by him prior to 1858. His successor, Capt. R. M. Parsons, was known as "Superintendent of Schools," an appointment which he held for two years, whilst in 1866 and 1867 it was held by Capt. R. H. Stotherd.

From 1867 to 1883 the holder of the appointment was known as the "Instructor of Telegraphy." From 1883 to the present date the title has been "Instructor in Electricity."

The question of submarine mining, which was prominently brought to the notice of the world during the American Civil War (1861-5), became a practical question in England in 1863. A memorandum of Sir John Burgoyne to the Secretary of State for War in July of that year led to the formation, in the following September, of a committee, appointed jointly by the Admiralty and the War Office. Lieut.-Colonel A. A'C. Fisher, R.E., who was a member of this committee, conducted a series of experiments at Chatham in order to determine the best system of mine defence.

The "Floating Experimental School" at Chatham was established by General Simmons in 1866, and was located in the Medway on an Admiralty mooring-lighter. It was placed in charge of Capt. R. H. Stotherd, the Superintendent of Schools at that time, and in 1868 Sir Francis Head, when visiting the R.E. Establishment, was present at an explosion of a submarine mine, carried out by him from the Floating Electrical School.\*

The Electrical School, as distinct from the Floating Electrical School, was conducted by the same officer, and appears to have been entirely concerned with telegraphy and demolitions. The officers' course in 1868 lasted only a few weeks. The course for N.C.O.'s and sappers, which was intended to turn out skilled manipulators, lasted six months.

The course itself comprised :--\*

(a). The theory and general principles of electricity and its application.

(b). The construction and use of electrical telegraph instruments, batteries, and apparatus.

(c). The transmission and receipt of messages; the construction and erection of permanent telegraph lines; the application of tests; and the detection of faults.

The instruments in use at the R.E. Establishment in 1868 were the single needle, the double needle, the Morse sounder, and the magneto-dial telegraph.

An Assistant Instructor in Telegraphy—Lieut. S. Anderson—was appointed in 1868, and in the same year Major F. Bolton, of the 12th Regiment, was acting as Assistant Instructor in Army Signalling. Sir Francis Head, in the *Royal Engineer*, pages 227 to 245, gives an interesting description of flag and lamp signalling as devised by him.

From this date the science of signalling for military purposes was gradually developed in the Telegraph School, first under Capt. F. A. Le Mesurier, and then under Capt. J. C. L. Campbell, until 1876, when it became a general army qualification. But it continued to be taught to all R.E. officers, and Chatham certificates of signalling were issued till 1884 or 1885.

In 1871 electricity, submarine mining, chemistry, telegraphy, photography, photo-lithography, and signalling were taught by the Instructor of Telegraphy and his assistants.

A drawing of the service telegraphic apparatus, as used in 1873, is given in the *Telegraph Journal* of the 15th March, 1873, Vol. I., page 87. The apparatus was contained in a case  $13'' \times 8'' \times 7''$ , and weighed 25 lbs.

By 1871 submarine mining had become a subject of sufficient importance for an Assistant Instructor to be specially allotted to it. Lieut. R. Y. Armstrong was the first Assistant Instructor for the subject. In the same year the first Torpedo Company was formed, the 4th Company, R.E., being selected for this purpose. From 1873 to 1883 the instruction of N.C.O.'s and men of the Torpedo Companies was carried out on board an old battleship—H.M.S. *Hood* which was moored in the Medway near the left flank of Chatham Lines. In 1875 the officers' course in "Electricity, Telegraphy, and Submarine Mining" lasted 36 days. In 1883 the *Hood* was abandoned, and the companies at Chatham moved into St. Mary's Barracks, the instruction of officers, N.C.O.'s, and men being transferred to new school buildings at Gillingham.

<sup>6</sup> The Royal Engineer, p. 111.

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In 1884 the number of Submarine Mining Companies in the Corps had risen to five, and the companies at Chatham (the 23rd and 27th) were given a battalion organization under the title of the Submarine Mining Battalion. Major R. H. Vetch was the first officer appointed to command this battalion, with Capt. C. V. Wingfield-Stratford as Adjutant. The officer commanding the battalion was made generally responsible for the instruction of officers and men in submarine mining, and the instruction was separated from the Electrical School. In 1886 the first Instructor in Submarine Mining (Capt. A. T. Preston) was appointed, and the number of Assistant Instructors was in the same year increased from one to two, with, in addition, one (so called) temporary Assistant.

The course of instruction in submarine mining for officers lasted 155 days, but it did not form part of the regular S.M.E. course.

The recruits' course for N.C.O.'s and men on being first posted to the Submarine Mining Battalion lasted six months, two months being allowed for further training in rough water at Portsmouth for recruits trained during the summer months.

Special courses were also held for trained submarine miners in "Fitting and Testing" and for "Engine Driving for Submarine Mining Purposes."

The instruction in this course included a general knowledge of steam, engine driving afloat, and engine driving for electric purposes. The last item of this course was carried out by the Instructor in Electricity; the remainder was under the supervision of a retired naval officer, Mr. J. Parry.

From 1892 onwards the requirements of the submarine mining service had outgrown the capacity of the Gillingham School, and new Schools were opened at Portsmouth and Plymouth.

From this time onward the Submarine Mining School at Chatham was considered as being attached only to the S.M.E.

The title of the officer in charge of each School was at the same time changed to that of Chief Instructor. Shortly afterwards the Submining Battalion organization was abolished.

To revert now to the electricity course proper. By 1887 the officers' course had been lengthened from 36 to 54 days.

At this time a certain number of officers were selected for special courses of instruction in electric lighting and firing mines. The course lasted 70 days. Part of the course—15 days—was carried out in conjunction with the Instructor in Field Fortifications, and comprised the use of mines and explosives. Another part of the course— 14 days—was devoted to the use of steam for the electric light. This part of the course was carried out by the Officer in Charge of Workshops. The remaining 41 days were allotted to the Instructor in Electricity. In 1903 the electrical course was reduced to 14 days.

The Electrical School was originally situated in the R.E. Institute,

but in 1885 it was removed to St. Mary's Barracks, where it remained until the end of 1907, when a move was made to the new Electrical School. The new School was constructed at a cost of about £40,000, from designs by Major E. C. S. Moore, who supervised its erection until his death in February, 1904, after which date Colonel A. Hill was appointed to carry out the work until its completion. To Major F. Baylay, at that time Instructor in Electricity, must also be ascribed a very considerable share in the details of the designs.

The necessary funds were originally provided by the Admiralty as part of an agreement with the War Office, which included the surrender of St. Mary's Barracks to the Naval authorities. Changes in Naval policy, however, were responsible for the transfer falling through, and ultimately the cost of equipping the new building with machinery and fittings was provided from Army funds.

The new Electrical School forms a conspicuous pile of buildings facing the Lines, some 200 yards in rear of the R.E. Institute. Its extent, design, and equipment furnish a striking testimony to the increasing importance now attached to electricity in the training of the officers, N.C.O.'s and men of the Corps.

The abolition in 1905 of submarine mining led to the closing of the Submarine Mining School at Gillingham and the concentration of all defence electric light instruction at the Schools at Portsmouth and Plymouth. This left the instructional accommodation in the new building somewhat in excess of the present electrical requirements, and the opportunity was therefore taken of effecting a much needed improvement in the accommodation of the Construction and Fortification Schools, by transferring the latter to the new building.

The important part now taken by electricity in military science has recently been practically recognized by extending the young officers' course from 14 to 74 days. Courses for probationary mechanist electricians and for line telegraphists have also been re-instituted. The instruction in telegraphy and telephoning is continuous throughout the year.

In addition to the usual instructional equipment, the new School comprises a small generating station of approved modern design, from which electrical energy is distributed to the S.M.E. workshops, the R.E. Institute, etc.

It is just 50 years ago that the Circular Memo. No. 260, referred to in the second paragraph of this article, was issued by Sir' John Burgoyne. The same half-century has witnessed numerous and important developments in every branch of scientific activity, but to electricity must undoubtedly be awarded the palm for rapid and uninterrupted progress.

Amongst the various officers who have held the appointment of

Instructor in Electricity, reference may be made to Capt. R. Y. Armstrong and Capt. P. Cardew.

The former officer is probably best known for his work in connection with the submarine mining service at Chatham from 1871 to 1883, and at the War Office from 1886 to 1891, but in addition he was in the first rank of the electricians of his day, and from 1883 to 1885 he was Electrical Adviser to the Board of Trade, where he laid the foundation of the regulations which now govern the supply and distribution of electricity in the United Kingdom.

Capt. P. Cardew specially distinguished himself by his electrical inventions. An account of some of these inventions is given in Major-General Porter's *History of the Corps*, Vol. II., page 195. Amongst others he mentions his vibrator system of telegraphy and the volt meter, for which he was awarded a gold medal at the Inventions Exhibition.

Major Cardew retired from the service in 1894, and is now one of the partners in the well-known electrical firm of Preece & Cardew.

The following officers have occupied the position of Instructors in Electricity and Submarine Mining since the introduction of the subjects into the S.M.E. curriculum 50 years ago :---

# IN CHARGE OF SCHOOLS AND ELECTRIC TELEGRAPH AND PHOTOGRAPHIC APPARATUS.

2nd Capt. H. Schaw ... ... 1858-1864

#### SUPERINTENDENTS OF SCHOOLS.

Capt.	R.	М.	Parsons	 	1864-1866
,,	R.	Н.	Stotherd	 	1866-1867

#### INSTRUCTORS OF TELEGRAPHY.

Capt.	R. I	н.	Stotherd	•••	•••	1867-1871
,,	Е, І	D.	Malcolm		•••	1871-1876
,,	R. 1	Y.	Armstrong		•••	1876-1883

#### INSTRUCTORS IN ELECTRICITY.

Capt. P. Cardew	•••		1883-1889
" R. L. Hippisley	•••	•••	1889-1891
BtMajor A. H. Bagno	ld	•••	1891-1896
Major G. A. Carr	•••		1896-1901
Capt. F. Baylay		• •••	1901-1906
"C. W. Davy	•••		1906-

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## ASSISTANT SUPERINTENDENT OF SCHOOLS,

Lieut. S. Anderson ... ... 1867

## Assistant Instructors in Telegraphy (Afterwards ELECTRICITY).

Lieut, S. Anderson		•••	1867-1871
" W. De W. Abne	У	•••	1871-1875 (title changed to Assist.
			Instr. in Chemistry,
			Dec., 1875)
Capt. R. G. Scott	•••	•••	1875-1877 (temp.).
Lieut. P. Cardew		•••	1878-1883
" G. A. Carr		•••	1883-1886 (lent to S.M. School
			from Jan., 1885)
Capt. R. L. Hippisley	•••		1886-1889
" W. F. Hawkins	•••		1889-
" A. M. Stuart		•••	1889-1894
Lieut, A. H. Dumaresq	•••	• • •	1894-1900
" A. D. Carden		•••	1900-1905
" A. E. Davidson		•••	1905-
"H. E. F. Rathbo	ne		1905-1906 (temp.)

## ASSISTANT INSTRUCTORS IN SIGNALLING.

Capt. A. F. Le l	Mesurier	 1868-1873
" J. C. L. C	ampbell	 1873-1876

## SUBMARINE MINING SCHOOL.

INSTRUCTORS IN SUBMARINE MINING.

Capt.	A. T. Preston		 1886-1891
"	H. B. Roberts	•••	 Acting for six months,

CHIEF INSTRUCTORS, SUBMARINE MINING SCHOOL.

Capt. G. A. Carr		189 <b>2-</b> 1896		
" W. Baker Brown	•••	1896-1901		
" G. P. A. Acworth	•••	1901-1905 (School	closed,	Sept.,
		1905)		• ·

Assistant Instructors in Submarine Mining.

Lieut.	R. Y. Armstrong	•••	1871-1876
"	J. T. Bucknill	•••	1876-1877
,,	G. Barker	•••	1877-1881
22	H. W. Renny-Tailyour	•••	1879-1880 (temp.)
"	R. M. Ruck	•••	1881-1885
**	H. N. Dumbleton	•••	1885-1890
	G. A. Carr	(	1885-1886 (lent from Electl. Sch.)
77	W Baker Brown	3	1886-1888 (temp.)
"	W. DARCI DIOWI	(	(1885-1888)
"	F. R. Reynolds	•••	1888-1891
35	H. B. Roberts	•••	1888-1891 (temp.)
17	E, Seaman	•••	1890-1896 (for Brennan Torpedo)
**	W. G. Lawrie	•••	1890-1892 (transferred to Ply-
			mouth School, 1892)
Capt.	H. B. Roberts	•••	1891-1896
.,,	G. P. A. Acworth	•••	1896-1900
19	C. B. Collins	•••	1897-1900 (for Brennan Torpedo)
Lieut	. G. E. J. Durnford	•••	1900-1905

## HEAD COVER.

## By MAJOR A. L. SCHREIBER, D.S.O., R.E.

THE question of head cover is a very old one, and it may be thought that the subject has been sufficiently thrashed out, and that there is little more to be said in the matter.

My chief object in writing is to express an opinion generally adverse to the loophole for field defences, and as it has struck me that this form of head protection has been very much *en evidence* since the South African War, there may be some advantage in drawing further attention to the matter.

Very probably, it is true, most of these loopholes have been made merely for practice in their construction; still, I am inclined to think that in the Army generally they are looked upon as rather necessary appendages to field defences—to be used somewhat indiscriminately. Their construction, apparently, is thought to show a mastery of the art of field fortification—in the same way that up to quite recent years the annual making of a single-lock bridge was supposed to convey a complete knowledge of the mysteries of military bridging. In any case, I feel pretty sure that the question of head protection in fire trenches or fieldworks, does not receive the attention that it deserves, and its vital importance is not appreciated.

On first considering the subject, the nomenclature is found to be vague and inadequate. In the Manual of Military Engineering there is a section called "Head Cover and Loopholes," and it is stated that head cover "will usually be obtained by making notches in the parapet for the rifle, or by loopholes." If loopholes form a means of head cover, why is part added to the whole in the name of the section ? and, as I shall show later, apparently head cover is at times only taken as referring to loopholes. Also, a "notch" is not a very technical phrase, and we have no proper word to express what is here meant by it; in old fortifications, it was called a "crenellation," or, more correctly, a "crenelle," but these expressions have died out. "Embrasure" is the term we really want, but that is only conventionally used for guns, and not for rifles. I only touch on this point as there really is some difficulty, when discussing this subject, in the paucity and uncertainty of the phraseology.

The comparison to be discussed is between the loophole, the

"notch," and the plain parapet, and this may be done under five headings.

- 1. Concealment.
- 2. Protection.
- 3. Field of view.
- 4. Labour.
- 5. Moral effect.

(1) and (2). The first two must be taken together, as they depend so much on one another.

The question of concealment is really the main point, and my contention is that, except in abnormal surroundings, where the hiding of any defences becomes so easy that the extra protection is hardly necessary, it is almost impossible to conceal ordinary loopholes within shrapnel and rifle range.

By "ordinary loopholes," are meant those constructed chiefly of sandbags or soft material, even though the top is supported by some stiff substance, which is almost a necessity. It is these that are generally referred to in this discussion.

If hard, suitable material is obtainable, such as iron or stone, head protection can be made fairly secure, and concealment may not be of such vital importance; but with any material the only really reliable method is to have iron or steel loophole plates, as these give all the advantages requisite for the other items—protection, field of view, labour, and moral effect.

Conversely, if the parapet is so exposed that concealment is out of the question, then the essential factor is to have hard, bullet-resisting material immediately round the opening. It may sound mere pedantry to say all this, but it is extraordinary how in practice the principle is neglected.

The importance of hard material is almost equally necessary in the formation of notches, and, in their case, even more often disregarded. Within the last two days-since I thought of writing on this subject-I have seen this principle absolutely ignored, first in a fire trench in sand with notches or embrasures scooped out, giving little head cover and a poor field of view, while close at hand were lving unused blocks of stone, quite large enough to protect the head, and of exactly the same colour as the sand. If only even one of these stones had been placed on the left of each notch, what a difference it would have made! The background would have prevented any hard lines of the stone from being visible. In the other case the fire trench was on a rough slope-hardly visible at any range-and notches were made in the earth, some being partly revetted with small stones; and again there were small rocks lying near, which, even if used alone, would have afforded infinitely better protection.

The saying of the Boer is not sufficiently well known, when he stated that he could always tell the British soldier from a Boer—"the one looks over the rock and the other round it." Here we have one of the fundamental principles of what I am trying to express.

If the head cover is small, the necessary factor is to get close to it; of course, when bullets are flying past, the natural tendency is to keep as low as possible, but all the same, the importance of teaching men to obtain cover in the right way is very essential. All this is mentioned in *Infantry Training*, and I have quite recently seen in a daily paper that the Army Council are taking steps to have cover made near all barracks, so that troops may be easily practiced in this very matter.

It is not generally realized that if a small block of stone, 7 inches cube, is placed on a parapet just on the edge above the elbow rest, and a man fires close round its right-hand corner to the front, his head-I am not speaking of his helmet or hat—is practically hidden, except just his right temple, which would be equally exposed if firing through any loophole, except one with a steel plate. If he fires a little to his right front, he is entirely protected from frontal "decisive" rifle fire. Make the stone 9 or 10 inches high, and he will be protected from frontal "long" range rifle or "effective" shrapnel fire. If the stone is a foot high, he will be sheltered from any except extreme range or high-angle fire. If he is only firing from behind a single stone, it is true, he will be considerably exposed to oblique fire; not so much if there is another stone on the other side of his rifle, forming a notch, but in any case, of course, not as well sheltered as by a loopholed parapet; there is, however, a vast difference between concealing a block of stone-say by tufts of grass or sods-and the top front line of an ordinary loophole standing about 2 feet above the parapet with a dark bull's-eye, marked, as a rule, by its own shadow.

If the elbow rest is not continuous, but is only made at each notch with just sufficient room for a man to fire comfortably, he will be fairly protected against oblique fire.

Comparison between a "notched" parapet and a plain one is more difficult, and in the first category must be included, for want of a better classification, any head protection from a single stone to a scooped-out embrasure, in fact, any kind that has no protection over the top of the rifle.

While there is no doubt as to the protection given, the question of its use depends on the material available, and more particularly on the immediate surroundings, although often, with a little ingenuity and common sense, a notched parapet can be made almost as invisible as a plain one. Any hard line or shadow can be obviated, temporarily, by stopping the notch with sods or other material when not in use.

If the site is not adaptable, then let means of head protection, such as blocks of stone or sandbags, filled, for choice, with small stones. be kept in the trench for use, when the enemy is so close that the advantage of invisibility has ceased to exist.

(3). With regard to the field of view, obviously the advantage lies with the plain parapet, and in the case of notches, or loopholes, this depends very much on the material available and the skill used in adapting it; but the notch would certainly have the advantage, as the parapet required to support the loophole covering must be more cumbersome.

(4). The question of labour is not a very important matter, except in hurried defences, but the time occupied in making loopholes, especially with inferior material, might be well employed in improving or extending the trench. If the width of the position is ample for the number of men available, the number of casualties would naturally be reduced by the extra length of trench, so that the men may be placed at greater intervals.

(5). The moral effect is a difficult matter to judge, and about this opinions will probably continue to differ. A very general idea is that the moral effect of loopholes is good, and it is not doubted that they give a comfortable, safe appearance to a trench; but how does the case stand when bullets begin to fly *through* the loopholes? Will there not be difficulty in making a man fire through his hole properly?

All the near bullets will be stopped except those coming through the small opening where each man will have to fire, and one knows how a particular spot where bullets are known to come is avoided; whereas in the case of notches or open parapet it gives a man confidence to hear bullets whizzing quite near without his being hit, and it is extraordinary the hail of bullets that may pass, and yet cause few casualties.

However, this matter is very problematical; but it seems that a loophole parapet may be too comfortable.

The general principles of field defences are given distinctly in our text books, and the general importance of concealment is strongly impressed, but not as regards the actual hiding of head cover.

Since the South African War attempts are certainly made at "landscape gardening," but generally in rather a perfunctory manner. It is rather a general idea—outside the Army at least that we learnt all these things from the Boers, the real fact being ignored that the South African War was the first in which smokeless powder was used against us. It is not denied that we had to learn, and did learn much from the real Boer, as in the case quoted above, and this because he was a born hunter, to whom the art of concealment and quickness of sight had become almost natural instincts.

The necessity of concealment had been mentioned in text books prior to the war, but it is doubtful if any realized, till after actual experience, the full effect of heavy rifle fire from an unseen foe; then only was the possibility of remaining hidden fully understood, and

### HEAD COVER.

the enormous superiority, both actual and moral, acquired thereby was forcibly impressed on our Army. In fact, the power of smokeless powder has revolutionized warfare as much as the increased range of modern weapons.

Exactly the same experience has been gained in the war in Manchuria, and I have recently read a report, which shows the result of the combined experience and careful thought of the Japanese.

The whole of this report by Colonel C. Hume on a Japanese camp of exercise, near Gotenba, Japan, in April and May, 1907, is well worth studying, and whenever trenches are mentioned great stress is laid on their being rendered invisible, and details for doing this are carefully given. The following sentence is quoted more than once :— "The lie of a position once known, half its value is gone."

He states that except where loopholes were constructed for practice, or experiment, head cover was conspicuous by its absence until the final stage of the attack.

Sandbags were placed in the trenches in the evening preceding the dawn at which the assault was expected. When night fell, these were put up on the parapet and loopholes formed.

"The Japanese argue that the provision of head cover enables an enemy to trace the line of a trench at a distance; and though they quite realize the value of head cover, they set a far greater value on invisibility, and therefore defer the addition of head cover, until the enemy approaches so close that further attempts at concealment are useless."

Colonel Hume then mentions an experiment carried out by a company of infantry, posted in the advanced trenches of the attack, against a section of trench, part of which was provided with loopholes, and the remainder without head cover. The distance was only between 200 and 300 yards, and the firing took place by day.

The result was that where there were loopholes the infantry had definite points to aim on, and every dummy behind the loopholes was hit. In the other part of the trench only about 50 per cent. of the dummies were touched.

As Colonel Hume in speaking of head cover evidently referred to loopholes only, I wrote to him asking whether the Japanese had used the "notched" parapet, and he has just informed me that no experiments were made with it at the Camp of Exercise, and he only remembers one case of its being used in Manchuria, and that in an unimportant trench at the Battle of the Shaho—being a portion of an entrenched rallying position which was never used.

It was, however, placed on the skyline, and was strikingly con-

It would be interesting to know whether any other officers saw cases of its employment in Manchuria.

I still believe that it is often a happy medium which can combine invisibility with fairly efficient head protection.

## TRANSCRIPT.

# FIELD FORTIFICATION IN THE RUSSO-JAPANESE WAR.

From the Mitteilungen über Gegenstände des Artillerie-und Geniewesens, January, 1908.

A SHORT time ago an officer of the Russian Engineers, who served throughout the whole of the Manchurian campaign, published a book on Types of Fieldworks Constructed During the Russo-Japanese War.

In this book are embodied the conclusions arrived at from the experiences of the campaign, and the close and careful study is evidenced by the fact that it has appeared over two years after the war was at an end.

The following is a résumé of its contents :--

#### I. INTRODUCTORY.

The principle of protection against outflanking and enveloping movements was observed in this campaign by a great extension of the flanks; in conjunction with strong defensive works in the centre.

The confidence felt in this system of defence was, however, not sufficient to overcome the natural inclination to take up a needlessly extensive position. Consequently the reserves available were generally insufficient; and supporting works were constructed as a subsidiary means of re-assembling the widely-extended troops, in the event of a defeat.

It is noteworthy that the author, a Russian, declares himself a decided supporter of a single line of defence, as opposed to multiple lines.

The strain and duration of modern battles have so great an effect on the mental and physical powers of the troops engaged, that it is hopeless to expect that they can offer from a second line of defence, anything like the resistance they showed in the original position.

The practice, adopted at the beginning of the war, of making fire trenches in the front line with a line of redoubts as a second line, was thus found to be useless.

The fire trenches had naturally the best field of fire, and were in the best position generally, and the redoubts had to put up with the second best. It was found that the front line held out to the last, and the retirement of this line upon the redoubts, at so critical a moment, resulted in enormous losses, and could seldom be executed without great confusion. Consequently any serious resistance from the second line was hardly possible.

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The result was that, during the course of the campaign, supporting points were gradually pushed up until they formed part of the front line of defence.

The opinion, hitherto held by the Russians, that "supporting points should be masked and protected by the front line in order to preserve the full effect of their fire for the decisive stages of the fight," was therefore abandoned, and it was recognized that "the true function, of supporting points, was the constant support of the fire trenches, and the active co-operation with them in a determined resistance."

As soon as it was generally recognized that even the temporary occupation of a position involves heavy losses, the principle of a single line of defence was at once championed.

It is, however, very necessary that this principle should be rightly applied, in the endless variety of conditions which different battlefields present; it must not be interpreted too rigidly, but must be regarded as a rule which not only admits, but demands, exceptions under certain circumstances.

#### 2. FIRING LINE,

At the beginning of the war the Russians thought that trenches for kneeling fire would be sufficient, and attempted nothing better, even when ample time was available; but they very soon learnt to make more complete cover.

Maximum cover from	ı the	crest	of para	apet to	the	
bottom of ditch		•••	,	• • • •		6 ft. 6 ins.
Breadth of banquette	•••		•••		•••	1 ft. 6 ins.
Width of trench	••					2 ft. 6 ins.

The height of parapet was 2 feet, and was made with a glacis slope, as it was found that changes in slope make works much harder to conceal.

The surplus earth was put at the back and spread, so as not to be seen above the parapet.

After the first few engagements, where shallow trenches were used, the Russians fell into the opposite extreme, and favoured trenches 4 ft. 6 ins. deep, without any parapet. The author does not favour this type because of the increased labour involved, and the frequent contraction of the field of fire.

Moreover, if the earth is scattered by the trench, it may make it more conspicuous than a trench with a parapet. But if the earth is removed, these trenches are extremely difficult to locate.

The campaign produced no definite conclusion as regards loopholes; right up to the end of the war there were found keen supporters of loopholes with their adjuncts of overhead cover, and equally keen opponents of them.

The author considers it definitely proved that head cover does not really afford any protection, but it has a very great moral value, as men will more willingly remain in the trenches, and will fire with greater precision, when head cover is provided.

## FIELD FORTIFICATION IN THE RUSSO-JAPANESE WAR. 45

As regards revetment, the heavy rains, and the general nature of the ground made revetment of the sides of the trench necessary in most cases.

For this purpose brushwood was generally used, made into continuous hurdlework.

When elbow rests were not provided, a rough rail was fastened to the side of the trench at the right height. This served as an arm rest when firing, and also helped the men to get out on to the parapet when it came to a hand-to-hand combat.

Steps were usually cut in the rear wall of the trench every 10 yards or so.

Traverses were arranged from 8 to 15 yards apart, and were not taken above the level of the parapet, and the top was sloped to the rear to make them less conspicuous. They were about 2 feet wide at the top and 3 feet at the bottom, and were well revetted.

The Japanese made an equally extensive use of traverses, and generally placed them closer together.

The Russians were unable to put their traverses closer—not because the firing line would be too extended, the modern rifle being so effective that a traverse might be put between every man—but because they had to exercise closer fire control over their troops.

In some instances, on this account, traverses were omitted altogether. Yet undoubtedly traverses considerably reduced the losses from high explosives, and also had a good moral effect, as the men were ignorant of the casualties occurring on the other side of their traverses.

The author favours splinterproof cover for all the men, and, if time allowed, this was generally provided.

The trenches themselves were often completely covered in and provided with "continuous loopholes," but this form of loophole was found to be extremely difficult to conceal.

It was noticed that the effect of "Schimose" powder was not nearly as bad as had been expected.

The howitzers firing this explosive were not sufficiently numerous to make it necessary to attempt any special form of cover against them.

Bombproof cover, against even field artillery projectiles, requires so much material that it was seldom attempted; and General Liniewitz ordered that only splinterproof cover should be attempted in the trenches.

As regards drainage of trenches, it was found that the actual rain falling into the trenches was not of much importance, but the difficulty was to prevent soakage from the surrounding ground. Soak pits were not very serviceable for this purpose unless they were at least 6 feet in diameter and 6 feet deep; and it was generally necessary to take the water out of the trench by a channel, although this often meant considerable labour.

Latrines were always placed in separate trenches in rear of the fire trenches, and were provided with overhead cover, and connected with the firing line by communication trenches.

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#### 3. REDOUBTS AS SUPPORTING POINTS.

The author states that, after the experiences of the campaign, it was universally admitted that the only type of work which can be rightly regarded as a supporting work, is the redoubt.

It is not so long ago since this idea was abandoned, and supporting works, consisting of groups of trenches, came into favour.

This occurred at a time when it was generally believed that the defence could be vanquished, and forced to relinquish its position by direct rifle and artillery fire. As a redoubt offers no better cover against direct fire than a trench, and is, indeed, usually more conspicuous, it was natural that a somewhat stronger form of trench should be regarded as the best type of work for a supporting point.

These premises have, however, been proved incorrect by the experiences of the Manchurian campaign. Fire alone never sufficed to drive the defence from its position.

A retirement from a defensive position was either voluntarily undertaken, in consequence of the position being outflanked, or else it was rendered necessary by the defence being overpowered in a hand-tohand combat.

Supporting points composed of trenches are very open to enveloping and outflanking movements, and are incapable of offering a strong resistance to a bayonet assault.

Redoubts are the only works which can offer a stubborn resistance to both these methods of attack; and when natural supporting points, such as villages or woods, do not exist, it is the author's opinion that redoubts only will be employed for this purpose.

The profile of such a redoubt would be very similar to that of a trench, but with a deeper trench in rear to provide more cover, and, if time admitted, with a shallow glacis-sloped ditch in front, in which a wire entanglement or other obstacle could be placed, so as to be under the close fire of the defence and screened from the enemy's view.

In addition to this, another entanglement was generally constructed, some 60 yards from the crest line and right round the work.

This latter formed the actual obstacle against assault, and was of greater importance than the one in the front ditch—though this undoubtedly added greatly to the strength of the work.

This was due to the use of hand grenades, etc., as well as other peculiar features which characterized the close attack in this campaign.

Moreover, the men still fire steadily and with accuracy while the enemy is 60 yards away, but, when he has reached the inner obstacle and is practically on the parapet, the defenders become excited and hardly aim.

Supporting works on level ground were, at first, always surrounded by a deep ditch, about 9 feet deep and 14 feet wide.

The Russians, however, soon recognized the disadvantages of such an obstacle which was not under the fire of the defence, and from the shelter of which the Japanese could throw their hand grenades with devastating effect, and they then substituted a shallow ditch, which was practically a continuation of the exterior slope of the parapet. When the deep ditch was employed, efforts were generally made to enfilade by counterscarp galleries or some other method, but it entailed so much labour and the expenditure of so much time that the work really became a semi-permanent work.

For supporting works in the front line, instead of in rear of it, the parapet should be kept as low as possible, and, in any case, the banquette should not be above the level of the ground, that is the height of the parapet must be kept under 4 ft. 6 ins.

When supporting points were placed as a second line, and so escaped the preparatory artillery fire, invisibility was of less importance, and the command could be increased if desired. The maximum command actually employed was 7 feet.

It is noteworthy that the importance of invisibility was so clearly recognized in the later periods of the campaign, that loopholes and overhead cover were abandoned, although their value as an aid to accurate shooting was not forgotten. They are, however, so hard to conceal that they almost always disclose the site of the work, and draw an extremely heavy fire on it.

The parapet was usually made with a glacis slope, the portion just in front of the crest line being so graded that a rifle laid on it at night or in a mist would sweep the foreground.

If there were a shallow ditch with an inner entanglement in it, a second step was provided to the banquette, by standing on which the garrison could sweep both the parapet itself, and the inner obstacle in the ditch.

Redoubts were always provided with traverses. For protection from artillery fire these were made 7 feet thick, so as to be proof against field artillery projectiles; if only designed to give protection against rifle fire, they were made 3½ feet thick, and well revetted.

The firing line was taken in front of these traverses so as to be uninterrupted, and the communication trench in rear of them.

Splinterproof cover should be provided for the entire garrison of every redoubt. The arrangement of one large casemate in the middle of the work was not found satisfactory; and at the end of the campaign the general practice was to make small shelters for 8 or 10 men, under the parapet itself.

Care was taken that the floor of the shelters was not at a lower level than the floor of the trenches, as otherwise it soon filled with water in wet weather. Special shelters were provided for the officers and for the telephone, and the water supply was also placed in a shelter. Latrines were usually outside the work, and connected with the gorge by a trench.

The garrisons at first varied from one to four companies for each redoubt,

When General Liniewitz took over the chief command, however, he ordered that redoubts were to be made for two companies, and, in order to strengthen the fire to the front, annexes or wing trenches were added to accommodate one company in each wing.

This arrangement has received a great deal of criticism.

At the same time it must be remembered that these redoubts were largely used as a second line of defence when multiple lines were still in favour, and were only garrisoned at the last moment, and then by troops quite strange to the environment. It was, therefore, necessary to make stereotyped works, which were at once recognized and understood.

Had the troops at the last moment entered a complicated labyrinth of trenches, parapets, and shelters, ignorant of the general design of the work, and not knowing whether one or three companies would be a suitable garrison, great confusion would have resulted.

The infantry annexes were connected with the redoubt under the parapet. Obstacles were kept at hand ready to block this entry as soon as the final assault was threatened.

At the beginning of the campaign redoubts, or keeps, were made in the centre of the larger redoubts, but these were abandoned before any actual experience of their merits had been obtained.

#### 4. VILLAGES.

Before the war it was generally thought that villages would be of little value as supporting points, because they offer such slight protection against modern artillery fire.

It was overlooked that field artillery, being designed mainly for use against *personnel*, has very little effect on buildings.

As regards field howitzers, there were but few available during the campaign; the Russian field mortar had not sufficient range, and the Japanese high-explosive shell (Schimose) exploded directly it struck the first wall, and had no effect against the second; consequently it was found that safe cover could be obtained behind every house.

During the campaign villages were very frequently included in the front line as supporting points; but this was largely due to their general design and construction, as every village in Manchuria is protected against Hunchugu raids by a walled enclosure some 2 ft. 6 ins. thick, and provided with bastions at the corner.

The houses have bullet-proof walls and are fairly fireproof, the only inflammable part being the roof, and in many cases even this is covered with a layer of clay.

Villages proved especially valuable when the time available for defensive preparation was very short. All that was necessary was to cut notches in the wall for loopholes, and provide a banquette or firing platform.

The numerous trees, which are to be found in and round the Manchurian villages, formed a natural screen, which prevented the enemy from observing the result of his fire.

This natural screen was always fully taken advantage of by the Japanese, but the Russians in some cases cut down the trees to make platforms, and for fuel, and later were put to great trouble to devise artificial screens.

In the larger villages, the boundary on the enemy's side was taken up as a first line of defence, and one of the stronger house compounds in rear was turned into a keep. A field of fire extending to 50 yards was found sufficient for the keep; and everything within this distance was demolished and carted away. Obstacles were lavishly used both in the front line and round the keep.

## FIELD FORTIFICATION IN THE RUSSO-JAPANESE WAR. 49

The actual examples of the attack and defence of villages in this campaign, offer nothing new or particularly instructive. They show enormous labour in preparation, several lines of defence, and often two or three tiers of fire in each line. A great deal of the labour of preparation, moreover, was unnecessary and useless.

#### 5. COMMUNICATIONS AND COVER FOR RESERVES.

The frequent searching, with artillery fire, of the ground in rear of the front trenches, rendered it necessary that all movement of troops, wounded, supplies, etc., to and from the front line should be concealed and covered.

Communication trenches, leading to positions on the forward slope of a hill, were extremely visible from the front, even at long ranges; consequently they had to be entirely covered in, the covering material being assimilated to the surrounding ground.

The fire trenches were not laterally connected with each other, as, in the event of the attack obtaining possession of part of the line, it would have been easier for him to extend his hold to right and left. For this reason lateral communication was arranged in rear of the front line. It was found that these communication trenches were a serious obstacle to the movement of troops in war, and, for this reason, they had to be bridged over in many places.

#### 6. COVER FOR ARTILLERY AND MACHINE GUNS.

The field artillery of the defence require three prepared positions:— The first for the artillery duel; the second for shelling the advancing infantry; and the third for dealing with the final assault. The first two will be some distance behind the front line, and can be easily concealed. The last will frequently have to be on a level with the front fire trenches. A choice of several positions should be provided for the first two purposes, as this makes it very hard for the attack to locate the artillery of the defence.

Cover must always be provided for the detachments, as, owing to the rapid consumption of ammunition, it will be found impossible to keep up a continuous fire and long pauses will have to be made at intervals, and, during these, the detachments must be protected from the enemy's fire.

During the Manchurian campaign the artillery detachments provided their own cover, and it is soldom that fatigue parties for this purpose can be provided.

For guns, brought up into the firing line to repel an assault, very stout works, resembling closed batteries, are necessary, and the front must be barred by strong obstacles.

Every endeavour should be made to foresee the assault, and to get these guns in position well in advance, as, when the time comes, the fire of the attacking infantry will be so heavy that it may not be possible to bring the guns up into position, unless covered communication for this purpose is provided, and this involves very heavy work.

#### TRANSCRIPT.

#### 7. Obstacles.

In this campaign obstacles were used on an unprecedented scale; and indeed towards the close of the war they were often misapplied, being erected in places where they could serve no useful purpose, and where they were not even under the fire of the defence.

Before the war it was thought that obstacles would be little damaged by artillery fire, but experience shows that they suffer severely if exposed, and that artillery fire is the quickest means of destroying them. It is, therefore, of the first importance that they should be concealed.

Wire entanglement, combined with large military pits, proved the most effective obstacle.

Abatis were of very little use.

Fougasses had an extraordinary moral effect, but, if worked automatically, are a great source of danger to the defenders themselves. They were usually placed some 50 yards in front of the fire trenches.

#### 8. SCALE OF WORKS CONSTRUCTED.

In order to get an idea of the growth of field fortification, some details are given of the works constructed by the 2nd Army in a portion of the Sipingai position.

Length of Front of Works of the 2nd Army-24 miles.

1st Line of Defence.—At the foot of the hills, consisting of redoubts surrounded by entanglements, and with fire trenches in the front of and between them.

2nd Line of Defence.—About 800 to 1,000 yards in rear; also redoubts and trenches.

The following works were constructed for this army :-

91 redoubts and 4 lunettes.

60 villages were put in a state of defence.

100,000 yards of wire entanglement, combined with military pits.

165,000 yards of plain wire entanglement.

99 bridges, amounting to 2,600 yards.

250 miles of road.

This programme gives some idea of the enormous *rôle* played by the field fortification in modern warfare.

C. OTLEY PLACE.

## NOTICES OF MAGAZINES.

#### Note.

Back numbers, dating from the 1st January, 1907, have been received of the *Boletin del Ministereo de Guerra y Marina*, a journal issued fortnightly by the War Office at Lima. Besides containing a mass of interesting matter, and information regarding the National Army, there are numerous valuable articles on the organization and material of foreign armies, and on military hygiene, geography, tactics, etc. The journal clearly shows the high standard of military knowledge attained by the officers of the Peruvian Army.

MEMORIAL DE INGENIEROS.

October, 1907.

EXPLOSIVES AND THE SAPPERS AND MINERS .- By Capt. D. Carlos Requena.-One of the principal missions of modern engineers, is that connected with the use of explosives and the execution of all kinds of demolitions. In the German Army, an endeavour is made to train all the sergeants and corporals of an engineer company, so that they may be able to carry out, by themselves, all smaller demolitions. The sappers are only taught to make joints, to place the charges, and to have a knowledge of the material used and of the properties and precautions that must be taken in the use of fuzes and explosives. The instruction is almost all of a practical nature, though a few night classes are held for teaching the N.C.O.'s the use of the formulæ and tables of explosives, without, however, explaining how they are arrived at. The results of the instruction are exceedingly good, and military engineers are constantly called in to assist in civil matters, such as accidents on the railways, rivers choked with ice, or when anything occurs to interrupt traffic, and also when walls or chimneys have to be felled.

Capt. Requena was recently attached to a battalion of engineers at Coblence, and took part in some interesting demolitions. He describes, with the aid of numerous plans and sketches, the blowing up of the church tower at Scherweiler, and of a tower at Weissenburg. In the first case, the party charged with the work consisted of 1 officer, 3 N.C.O.'s,

and 10 sappers, all mounted on bicycles, on which also were carried all' the requisite materials. It left Strasburg at 4.15 a.m. on the 10th July, and arrived at Scherweiler (46 km., or 261 miles) at 8.15 a.m. Whilst. the men were resting the officer examined the tower, which was detached and built of masonry set in lime mortar. Its height was about 92 feet, and the thickness of the walls about 6 ft. 8 ins. On the north and south sides there were houses, the nearest being about 40 feet distant, to the east was an open space, which, however, it was desired to keepclear, and to the west were the ruins of the church, which had already been destroyed. It was consequently decided to cause the tower to fall on the top of the ruins. Ten mine chambers in all were made in thewalls at the ground level, and were built up after they had been charged, and 3 feet of earth was then banked up against the walls. In order toprevent stones being blown out and damaging the surrounding houses, a wall 6 ft. 6 ins. high was built up, all round the tower, with the materials of the old church. The positions of the charges, and the amount of explosive in each, were carefully calculated according to the rules given in the official text book, and when they were fired the tower fell exactly as had been intended, and none of the material was blown. The total time occupied was 14 hours. out.

MOTOR TRACTION IN OUR ARMY (continued).—By Capt. D. Ricardo Goytre.—The two motor cars, described in the last number, were overhauled and partly rebuilt in the regimental workshops, and a number of N.C.O.'s were trained to drive them; they were then placed at the disposal of the Captain-General of Madrid, and of the headquarter staff of the army. The king has obtained the services of four of the engineer chauffeurs to drive his own cars. Last March two new cars werepurchased, the one a 35-h.p. Panhard, the other an Itala of the same horse power.

THE DUESO PENITENTIARY COLONS.—By Major D. LORENZO de la Tejera.— For very many years convicts, sentenced to penal servitude, have been transported to the Spanish possessions on the north coast of Africa, but it has lately been decided to discontinue this practice, and in February, 1907, a commission was appointed, of which Major de la Tejera was a member, to select and report on suitable sites for convict establishments in the Peninsula. The places chosen were the castle of San Fernando at Figueras, close to the French frontier of Catalonia, and the fortress of Dueso at Santoña.

Spanish convicts, on commencing to serve their terms, are placed in solitary confinement for about nine months; they are then put on the public works and are locked up at night; in the third stage they are allowed to live in houses in a semi-free condition, but are forbidden to leave the place (in Ceuta, for instance, many of the waiters in the inns' and servants in private families are convicts). This system governed the plans of the Dueso prison, which is to contain 1,000 men. It has been decided to build a central block containing 200 cells arranged on both the ground, first, and second floors, each floor containing a separate class. of prisoners, and the severity of the confinement decreasing as they are transferred from the lower to the upper stories. Under normal circumstances three months would be spent in each story. There are also two blocks, each accommodating 300 men of the second class, viz., those who only sleep in the prison but work outside it; and a building is provided for 200 men of the third class. Each building is in the shape of an L. A hospital, chapel, and the necessary offices are provided, and all are surrounded by the old fortifications.

MILITARY REVIEW.—The War in the Far East, by the Military Correspondent of The Times.—The book is very well reviewed, but the reviewer remarks that the views of the author on the subject of fortification are certainly not shared by English engineers. He quotes the author's observation that when engineer officers reach a high position in the councils of the State, they often become a danger to it, and says that there seem to be no grounds for such an assertion, and that it is a most inopportune one at the present time, when the most distinguished generals of the British Army have come from the Corps of Royal Engineers.

' M.'

#### REVISTA DE ENGENHERIA MILITAR.

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#### February and March, 1908.

The February and March numbers of the review are combined into one.

THE KING D. CARLOS I. AND THE CROWN PRINCE D. LUIZ FILIPPE.— The deepest regret and sorrow is expressed for the loss suffered by the Portuguese nation and army by the death of the King and Crown Prince, and for the abominable outrage to which they fell the victims. The King, before he ascended the throne, was brought into close personal connection with the Corps of Engineers, as he was a member of the Defence Committee of the port of Lisbon of which most of the members are Engineer officers. He was president of the sub-committee which worked out the defences of the port, and took a very active part in the preparation of its report.

HARMONIC SYNTHESIS OF THE TIDES.—By 1st Lieut. Jayme Wills d'Aranjo, of the Portuguese Navy.—The author gives a short summary of the laws regulating the tides, defines what is meant by harmonic analysis and synthesis, refers to the tide predicter, and then shows how to calculate the height of the water at any fixed time. The paper contains two tables, one of the elements of the most important tidal waves, the other of the composite waves.—To be continued. Some Projects and Works Executed in the Province of Moçambique DURING THE LAST NINE YEARS.—By Capt. Machado de Faria.—The author was Director of Public Works to the Moçambique Company. The first part of this period was marked by great financial and economic depression, and the Governors-General were often compelled to pass from extreme economy to lavish expenditure on provisional works of an urgent nature. It was not until Gaza had been pacified and the Transvaal War ended, that the Public Works Department could be organized on modern lines.—*To be continued*.

A great deal of money seems to have been wasted in providing provisional buildings, which could only last but a short time, instead of permanent ones. Little attention seems to have been paid to the recommendations of the engineer in charge, and his difficulties can be understood when it is stated that within the short period of three years he served under one Royal Commissioner, three Governors-General, and four Acting Governors-General.

The works were as a rule constructed by day labour with materials provided by the Department. Finance was a difficulty, especially as corruption had to be very carefully guarded against.

Name of the Work.	Total Estimate Milreis.	Number of Square, Cubic, or Líneal Métres,	Cost per Square, Cubic, or Lineal Mètre.	Mode of Execution of the Work,	Short Description of the Works,
Defensible Barrack at liha da Inhaca.	6,000	367 (cub.m.)	16.348	Open tender.	Defensible barrack of rubble masonry in lime mortar, material from the old barracks, walls t'8" thick, 10' to 16' 6" high, on a masonry foundation, roof of wood and zinc and felt, quarters for I com-
Telegraph Station at Ponta Vermelha.	1,430	102	14`430	Open tender.	pany of infantry. Building in the form of a chalet, brick, cement, and sand, roof of wood and zinc, verandas and pavement of mozaic stone, heidt 11' 6".
Iron slied for the Custom House at Lourenço Marques,	16,898	1,440	11.734	Contract.	On a masonry foundation and basement, 3' 3" high iron shed, costing 13 contos, 120 m. long, 12 m. wide, in 6 inde- pendent compartments, height 11' 6", lined with galvanized iron.

The following table gives details of some of the works executed :-

THE HAGUE CONFERENCES (continued).—A continuation of the proceedings of the 1899 Conference. It contains nothing which is not readily accessible in English.

OBITUARY NOTICE OF GENERAL RODRIQUES GALBERDO.

#### REVUE DU GÉNIE MILITAIRE.

#### February, 1908.

THE BALLOON "PATRIE."—This balloon was practically made to the same design as the "Lebaudy." It was 61 mètres long, and 103 mètres in diameter at its greatest cross section, and held 3,250 cubic mètres of gas. One of the principal improvements introduced was a balanced vertical rudder, pivoted towards the centre instead of at the front edge. This arrangement made it much easier to put the helm over, and proved quite satisfactory. Two horizontal planes, one on each side of the balloon, were also added. These were pivoted about their centres, and could be set at any angle. When the propellers were working, the air pressure on these planes induced the balloon to rise or fall. In this way a great saving of gas and ballast was effected. In July, 1907, the balloon was enlarged by adding another longitudinal section to the envelope, thus increasing its capacity to 3,650 cubic mètres. It was then able to attain an altitude of from 1,000 to 1,500 mètres with a crew of four.

The balloon made 43 ascents. Its speed was about 40 kilomètres per hour, and its radius of action about 150 kilomètres. It could rise with safety to a height of 1,500 mètres. The circumstances, under which it was lost, are too well known to be retold here.

THE INFLUENCE OF THE SIEGE OF PORT ARTHUR ON THE CONSTRUCTION OF FORTS.—The conclusion of the previous articles. Judging by the experience of Port Arthur, it seems desirable to have counterscarp galleries to protect the ditch, but the galleries themselves must be protected by a system of countermines. The front wall of the galleries need be only 3 feet thick, but the roof and back wall should have a thickness of 9 feet.

The search lights should be placed on the musketry banquette, or preferably on the covered way if there is one. Small search lights should be provided in the counterscarp galleries to light the ditch when required.

It has been found that a fort cannot be efficiently protected at night by sentries stationed on the parapet. The counterscarp galleries, at Kikwan North and Ehrlong, were captured without the sentries on the fort parapets perceiving the approach of the Japanese. It seems desirable, therefore, to reintroduce the covered way, and to garrison it at night for the protection of the glacis.

A modern fort will usually have about 160 mètres of parapet on the front and flanks. To defend this about 80 men will be required, or, allowing for a reserve, a total of 100. Four reliefs will be necessary, so the total garrison must be 400 men. When the fort is closely attacked it may be necessary to increase the garrison to 600.

The garrison of the gorge should be protected by a parados of the same height a the front parapet, or even higher. This parados should extend to the flanks, and should be joined to the front parapet by one or more traverses built over the underground passages. The interior of the fort will thus be divided into a number of small enclosures, and the effects of shells will be localized.

Regular slopes and continuous lines of parapet render a work very conspicuous, and should, therefore, be avoided. Trees should be planted both in front and behind all works.

The author gives three plans, which represent (1) a portion of an ideal fortress; (2 and 3), a type of fort for a garrison of one company (200 men). The latter consists of a work nearly square in trace, the front face being a little shorter than either the flanks or gorge. In the two front corners, are concrete emplacements for light O.F. guns, roofed in with 4-inch chrome steel plates. Similar emplacements for machine guns are provided in the two rear corners. The flanks, in addition to having an ordinary musketry parapet, are provided with a concrete musketry gallery built in the parapet itself; the gallery is roofed in with a-inch armour plates, the roof coinciding with the superior slope of the parapet. A continuous loophole exists between the front edge of the roof and the concrete wall. The gallery is provided with 2-foot concrete traverses. 9 feet apart. It is the author's opinion, that the enemy's fire, taking the flanks in enfilade and reverse, will render the ordinary parapet untenable, and he has therefore provided this bombproof gallery, so as to enable the flanks to maintain an efficient fire upon the adjacent intervals.

The interior of the fort is divided into a number of small compartments, by two parados and a central traverse. Both parados are furnished with musketry parapets. The casemates are under the gorge parapet, the windows looking into the gorge ditch. The shelters for the relief on duty and officers' quarters are situated under the front parapet. There are escarp and counterscarp galleries, and a gorge caponier. The counterscarp galleries are provided with embrasures for Q.F. guns, machine guns, and search lights. The galleries themselves are protected by countermines.

The internal communications of the fort are secured by an elaborate system of underground passages, of which the chief are (1) a central passage connecting the casemates with the front parapet shelters, and the escarp and counterscarp galleries; (2) a transverse passage, under the parados, which connects the two flank musketry galleries with the central passage. There are two exits from the central passage behind each parados. An underground passage leads out of the fort, under the gorge ditch, to a hollow in rear. The fort is provided with a covered way.

All concrete roofs and walls which could by any possibility be reached by the enemy's shells are 9 feet thick. The author gives no estimate of the cost of such a work.

#### March, 1908.

THE SIEGE OF TOUL.—A short description of the siege and capture of Toul in 1870. The fortress was small and out of date, and was commanded at close range by the hills all round. It held out from the 16th August to the 23rd September. The Germans—after assaulting it twice, and then attempting to reduce it by artillery captured from the French—were finally compelled to bring up a Prussian siege train. After -a bombardment, which lasted  $9\frac{1}{2}$  hours, the place capitulated. The losses of the garrison were 115 killed and wounded, out of a total of 2,290. The besiegers' losses were 25.

FOUNDATIONS.—A description is given of an apparatus used for determining the safe load that any particular soil can carry. It consists of a wooden platform sliding up and down between four wooden uprights. It is supported on a vertical wooden post, 64 square inches in cross section, the foot of which rests upon the ground. Weights are placed upon the platform, and the amount that the post is driven in for each increase of weight is measured. Experiments made in this way show that soils, which are of apparently the same consistency, vary greatly in their power of resistance.

INSTRUCTIONS IN SIEGE OPERATIONS AT THE ÉCOLE SUPÉRIEURE DE GUERRE.-In June, 1903, a siege course was started for officers in their second year. It is directed by one engineer and one artillery professor. The course consists of nine lectures ; the first three are purely theoretical, the next three discuss the application of principles to a particular case, and the last three deal with a historical example-such as the siege of Port Arthur. The lectures are followed by practical work. As a preliminary to this, each officer is called upon to write an essay on the attack of a given sector of one of the modern French fortresses. Imaginary works are introduced into the data, and the essay writer is left to some extent in the dark as to the details of the enemy's defences. In this way the fog of war is introduced. These essays are then criticized. in class, by the professors. Finally, a practical exercise, lasting four days, is carried out on the ground. For the latter the officers are divided into three groups, two being allotted to the attack, and one to the defence. Each officer is given a command such as O.C. Artillery, O.C. Engineers, O.C. Engineer Park, etc., and is allotted a special task on which he has to write a report. During the last two days the professors go over the whole ground with the class, taking the works in their proper sequence. Each officer reads his report on the site of his proposed work, and the professors make the necessary criticisms. The practical work done each year is explained and criticized the following year, as part of the theoretical instruction of the next class. This course, entailing as it does the co-operation of all arms, has been found to be very valuable as an instructional exercise.

#### April, 1908.

THE FOREIGN MILITARY ESTABLISHMENTS IN CHINA.—This article gives a description of the various barracks and other buildings erected for the foreign detachments in North China, including the Legation defences in Pekin. The German works are dealt with in the present number. The German garrison consists of 303 infantry and artillery at Pekin, and 430 infantry and mounted infantry at Tientsin. Tongku is garrisoned by a detachment from Tientsin. In the German Legation at Pekin there is accommodation for 336 men. The barracks consist of 14 single-storey blocks. The officers' mess and quarters are roomy and very well furnished. All the buildings are fitted with electric light. The barracks were built by Chinese contractors. The author is of opinion that the French system of employing Chinese workmen under European foremen is more satisfactory.

The defence of the south-eastern corner of the Legation quarter is entrusted to the Germans. Their defence works consist of a fortified gate across Legation Street fitted with armour-plate doors, a loopholed wall forming the eastern boundary of the Legations, and a blockhouse on the Tartar city wall. The German wall is prepared for two tiers of fire, and is protected on the outside by a wide ditch. The blockhouse is designed to flank the wall with machine-gun fire. It is, however, commanded at close range by the Ha-ta-men gatehouse, and in the event of hostilities it would be necessary for the Germans to seize or destroy the latter.—*To be continued*.

FIELD TRAINING OF SAPPER COMPANIES.—Suggestions for the tactical training of the French companies of Sappers and Miners. The system advocated is similar to that employed in training British infantry recruits.—To be continued.

CLEANSING THE AQUEDUCT AT LAGHOUAT.—This aqueduct brings water from the river to the barracks. The water is collected in a tunnel built of dry masonry in the bed of the river. Heavy floods in 1906 and 1907 laid bare the roof of this tunnel, and swept a great deal of mud into the tunnel and aqueduct. To prevent the further ingress of mud the upper part of the tunnel was rebuilt in mortar, so that the water can only enter by filtration through the lower portion. A breakwater was also built out from the bank to protect the tunnel from the force of the current. These methods appear to have been effective, and the water in the aqueduct is now free from mud, even during the heaviest floods.

J. E. E. CRASTER.

## RIVISTA DI ARTIGLIERIA E GENIO.

#### December, 1907.

#### AUSTRIA-HUNGARY.

AUGMENTATION OF DETACHMENTS FOR MITRAILLEUSES.—With referenceto the orders regarding detachments for mitrailleuses, mentioned in the *Revista* for September, p. 342, a statement is made in the *Neue Militärische Blätter* of 2nd December, that the war administration has decided on a large allotment of such detachments to the troops on the frontiers, so that while formerly each of the three regiments possessed only one detachment of mitrailleuses for mountain warfare, eleven more will now be allotted, one to each of the three battalions of the 2nd Regiment and of the: 4th Infantry Regiment of the Landwehr, and to five of the 1st Regiment of national riflemen.

Each detachment consists of 1 captain-commandant, 2 subalterns, 1 sergeant-major, 5 under officers, 2 section sergeants, 4 corporals, 4 marksmen (appuntati), 24 gunners. 1 trumpeter, and 3 officers' servants, or a total of 3 officers and 44 N.C.O.'s and men, with 3 horses for officers, 8 pack horses or mules, and 4 mitrailleuses (Schwarzloze system). The detachments will be stationed at the commands of battalions (Schlanders, Bolzano, Riva, Trento, Pergine, Cavalese Cortina d'Ampezzo, Innichen, Hermagon, and Klagenfurt), and in the summer will follow the companies. Conforming with the custom adopted for the cavalry saddle horses, the pack animals necessary in event of war will be distributed for private use to the owners of land, etc. For the defence of the southeastern frontier, the mitrailleuse detachments will prove a valuable reinforcement. Each of the 12 mountain brigades and of the 27 infantry divisions (except the 14th Corps) will be provided with a mitrailleuse detachment. For the Hungarian Landwehr (Honved), new formation ot such detachments are not yet provided. The number of 50 detachments (39 for the army of the first line, 11 for the Landwehr) is considered proportionally deficient, as Bulgaria, for example, intends to assign one for each of its 36 infantry regiments.

#### DENMARK.

VOLUNTEER MOTOR CYCLISTS.—La France Militaire of the 16th December has extracts from the Vorst Forwar, showing that a corps of volunteer motor cyclists has been organized in Denmark by Sigr. Westenholz, who has placed at the disposal of the new corps, 3 automobiles, 80 motor cyclettes, 80 Rekylgewehre (automatic rifles), with 3,000 cartridges per rifle, all at his own expense.

Each motor cyclist will carry with him an automatic rifle with 800 cartridges; the remainder of the ammunition will be carried in the automobiles,

The corps will have a military organization under a captain of engineers, assisted by a lieutenant. Military instruction will be given by four or five officers of the active army. The rifle range and *place d'armes* at Copenhagen, will be placed at the disposal of the new volunteer corps, where it will go into camp for 14 days' service in each year at the time of the manœuvres.

#### January, 1908.

ENGINEER SERVICES DURING THE RUSSIAN-JAPANESE WAR.—By Capt. Cardona, General Staff.

#### BRIDGES.

Most of the water courses of Northern Corea and Manchuria are, for the greater part of the year, either dry or fordable at many points, and the severe winter in Manchuria freezes the rivers, so that they can be crossed on the ice with safety.

Towards the end of March at the commencement of the melting ot

the snow, or in June and August in some rainy stations, the rivers are in full flood, with a great depth of water and swift current, and the low grounds are inundated. The small rivulets may then present obstacles difficult for crossing.

At the commencement of the war the railway bridges were the only means by which the armies could cross the rivers, although the vehicles of commerce crossed by the fords, or by small bridges not strong enough to bear the weight of heavy military carriages.

Russian Army.—Each pontoon battalion had a bridge equipment divisible into two half equipments—consisting of 104 wagons with 28 boats, which would serve on the average for 218 metres of bridging, or for a span of 240 metres. The whole of the bridging material, in the theatre of operations, consisted of bridging equipment for the 1st Pontoon Battalion of Eastern Siberia ; three other half equipments of pontoon companies ; bridge equipment for the 1st European Pontoon Battalion with material on the new system (Schwebzow), and the reserve bridging material. In addition, each sapper battalion had 21 metres of light bridging equipment on six wagons. As, however, the Manchurian rivers, owing to their width and depth and the condition of their banks, did not allow of the use of these light equipments, they were relegated to the rear of the columns, and formed obstructions to the movements of the troops, especially in the retreat on Liaoiang.

After the Battle of Vafangu-15th June, 1904-the great part of the Russian Army was split up, with one part near Tachicaio and the rest south of Haitcheng; but it commenced to reunite on the 26th July, about 15 kilomètres south of the last-named village.

Two bridges were constructed for the retreat of the Russians from the position of Tachicaio—27th July—across the Haitcheng-ho, each about 150 mètres in length.

On the 29th July, two other bridges were commenced with materials found on the spot, and were completed on the 1st August. Both these bridges were about 150 mètres in length. Two pontoon companies were employed in the construction of these four bridges.

A great portion of the Russian Army crossed the Haitcheng-ho on the 31st July and the 1st August. On the 2nd August the great part of the Russian Army was in retreat on Liaoiang.

On the 24th August the Russians occupied a line from Antsciantscian (right wing) to the Taitse-ho (left wing) with the Xth Army Corps, at about 23 kilomètres east of Liaoiang. On the 26th to 28th August, still fighting, they continued the retreat, thus necessitating the bridging of the Tan-ho.

On the 29th August their position extended to about 10 kilomètres south of Liaoiang on the railway to Siapu, and the army corps were constituted as follows :---

1st Line .- Ist Siberian, IInd Siberian, Xth Army Corps-left wing.

2nd Line.-Near Liaoiang, IVth Siberian; south of the Taitse-ho, part of IInd Siberian.

3rd Line.—To the north of the Taitse-ho, XVIIth Army Corps—5 to 10 kilomètres north-east of the left wing of the Xth Army Corps.

In the region of Liaoiang the following bridges were found or constructed :--

Ist. Composed of Chinese boats and passable for all arms, at the hill of Liaoiang behind the Russian left wing.

2nd. Composed of regular boats, 219 mètres long and passable for all arms, at the valley of the preceding. This was constructed by a pontoon company on the 29th August.

A third—3 kilomètres from the preceding—was constructed with Chinese boats, and, taking advantage of an island, the bridges were in two portions, one 175 mètres, and the other 160 mètres in length; these were passable by all arms.

4th. By the side of the railway bridge, passable for all arms; composed of Chinese boats and piles, and constructed by a company of sappers.

5th. One kilomètre from the preceding, composed of regular boats. As there was an island, the bridge was in two parts, one 92 mètres, and the other 67 mètres long, and it was constructed by a pontoon company and was accessible for all arms.

6th. Across a small canal of the Taitse-ho, passable for infantry only.

7th. 2 kilomètres from the fifth; built of Chinese boats, and passable by all arms.

Destruction and Repair of the Bridges.-Between the 3rd and 8th September, the Commandant at Liaoiang received the following orders:

(1). On the 3rd September: "This evening all the troops will retire on Mukden. After the crossing of the last of the troops, the permanent wooden bridges are to be destroyed, and those of other materials are to be dismantled.

"The transporting of the bridges is to be by way of the north. All materials of the reserve bridges, excepting the carriages, are to be destroyed and sunk, if of iron, and burnt, if of wood." Notwithstanding these orders, as much was saved of the materials as possible, but it was not possible to load and transport the fifth bridge of Liaoiang by rail.

All the permanent wooden bridges—as well as the superstructure of the railway bridges—were burnt.

Retreat on Mukden.—The pontoon companies, with their awkward and heavy bridge equipments, were with the rear guard of the Russian Army; their retreat was carried out under great difficulties. The equipments should have been pushed rapidly towards Jantai—22 kilomètres north of Liaoiang—but owing to the scarcity of horses and the wretched state of the roads, they were greatly retarded. For instance, a pontoon company had to advance with part of the equipment for about 5 kilomètres, and then to send back its horses to bring up the remainder ; but after 3 kilomètres the horses, which transported the first half of the equipment, were so exhausted, that it was impossible to continue this system. Becoming unserviceable, 18 wagons with equipment, 2 tool wagons, and 1 forge wagon had to be burnt.

Four pontoon wagons, also, had to be destroyed, so as to be able to supply other carts with their horses.

The march was very slow, owing to the bad roads and the want of
bridges over the water courses. On the 5th September only 10 kilomètres were covered; the day after only 6.

On the 7th September a pontoon company was employed in constructing, with regular materials, a bridge across a broken portion of the road; another pontoon company constructed a bridge 53 mètres in length with iron rails, and each of two other companies made a small bridge.

The pontoon companies reached Mukden on the 8th September.

Near Mukden there was only the railway bridge, and a bridge for carts. Twelve bridges were constructed over the Hun-ho, but space does not here admit of their description.

Considerations.—The need of bridges was much felt by the Russians. The fault did not lie with the pontoon companies, but with their organization, which was incomplete, and with those in high command, who did not always supply the bridging companies in time. The pontoon companies were, in fact, not permanently assigned to any large unit, but were attached to one or the other of the commands as needed for the time being, and this produced confusion and uncertainty.

A lamentable want of care was also shown in allotting troops for the protection of the bridges.

After the passage of the Xth Army Corps over the Tan-ho, and under the pressure of the Japanese advance, there was only a detachment of 90 riflemen for the bridge of Kindiatunsigu, and these same men had later on to protect also the bridge of Siotuntsi.

### March, 1908.

TRIALS OF PORTABLE SAPPER TOOLS IN FRANCE.—La France Militaire (No. 7,078 and 7,082) is informed that the French Minister of War has given orders for trials to be made by some of the troops with new sapper tools. One of these is the invention of Colonel Bruzon, of the 24th Infantry, and is called *beche-Bruzon*; the other is the invention of Commandant Seurre (chief of the central depôt for engineer war material), and is called *pelle-pioche*.

The following descriptions of these tools are given.

The Bruzon spade consists of a blade, a handle, and a case. The blade, which is shaped like a halberd, consists of a trapezoid prolonged with a triangular part and has sharpened edges. The trapezoidal part is slightly curved to allow the excavated earth to be easily gathered up. The handle is of ash; the case is of brown leather with a fastening for attachment to the belt.

The tool with its handle weighs S25 grammes; the case weighs 175 grammes, the whole weight being 1 kilogramme. It is usually carried suspended from the belt, rather far back on the right side. However, during rapid movements in the field it may be temporarily suspended between the third and fourth button of the great coat.

The Bruzon spade may be used (1) as a spade, holding it like a dagger and digging into the earth; (2) as a shovel; (3) as a billhook; (4) as a pickaxe for cutting loopholes in walls; (5) occasionally as a

hatchet for opening loopholes in a wooden palisade. The instrument may also serve?to cut iron wire, and, placed on its point on the ground, may act for a rest for the rifle when firing from the lying-down position.

The Seurre spade-pick consists of a blade, a handle, and a case. The blade is a special combination of a portable spade, and of the pick now in use. It is formed by substituting for the pick a flattened blade with another having the form of a spade; the point is retained with slight modifications in the dimensions. The two edges of the spade serve, one for cutting wood, and the other—less sharpened—for hard material.

The handle is like that of the pick, only somewhat shorter. The case, of brown leather, is like that now in use.

The spade-pick may be used (1) as a tool for digging, and can be used either as a spade, shovel, or pick; (2) as a billhook, using the sharpened edge; (3) as a pick for opening loopholes in walls; (4) as an axe for cutting loopholes in wooden stockades. It can also be used to cut iron wire and as a rest for the rifle when firing from the lying-down position.

### GERMANY,

ON THE EMPLOYMENT OF AUTOMOBILE CARRIAGES.---The military journals are informed that an allotment of 1,800,000 marks has been agreed to by the Reichstag for the purchase of automobile carriages.

At the end of last year the sum of 700,000 marks was allotted for the purpose, and the increase in the current year shows that the German Army propose to make great use of automobiles in the event of war.

It now appears that these allotments are not only destined to increase the automobiles for the army, but also to provide on the frontiers a large number of automobiles, which could be placed at the disposal of the local authorities and used by them in peace time, on condition that they be at the disposal of the military authorities on a declaration of war.

The intention to use automobiles extensively in war time may also be deduced from the Cabinet Order of 27th January, 1908, which appoints 52 officers of the reserve as automobilists (Kraftfahrtruppen). These officers are given the rank of lieutenant, and are charged with the duty of seeing that the automobile carriages are kept in a good state and in proper working order.

EXERCISES FOR TRANSPORT WITH AUTOMOBILES FOR HEAVY CARRIAGES.— It is understood from the *Neue Militärische Blätter* that the drill season of the "communication" troops will very soon comprise a journey of two weeks in the Hartz district with the following types of carriages :— (1) Vehicles of the Daimler type for heavy loads. These are stated to have given good results in the trials of 1907 during the manœuvres at the fortress of Posen; (2) an omnibus of the Bussing-Braunschweig type, and a train, Siemens-Schuckert, of five carriages in tow; (3) a steam locomotive, Fowler, with two carriages in tow. There will also be other automobiles for the transport of men.

The itinerary will be via Berlin, Magdeberg, Halberstadt, and

Quelinberg. On arrival at the Hartz the vehicles will run on several roads.

Under an order of 23rd January, 1908, the War Minister has decreed that all wagons and carriages for service with troops for the detachments of mitrailleuses, and for the pioneers of the troops of communication and trains (including those for sanitary purposes), shall be painted grey-green, called "feld-grau."

The discussion on the military balances in the Reichstag resulted in an allotment of one million marks for the purchase of kitchens on wheels. Their utility was shown in the Russian-Japanese War, and this was further proved by the models which were experimented with at the last Imperial manœuvres.

REGULATIONS FOR THE CONSTRUCTION AND REPAIRS OF MILITARY HOSPITALS IN FRANCE.—Pasetti.—Programme for a District Military Hospital.—According to the regulations of 7th July, 1877, each army corps should have in the district that it occupies—and if possible at the headquarters of that district—a military hospital for the cure of the sick, for special instruction, and for the preparation and maintenance of sanitary material required by an army corps in case of mobilization. The capacity of these hospitals is not fixed; it will depend upon the strength of the garrison and on the sickness in each district, calculated on the average of the last 10 years. In order to fix precisely the programme to be adopted for the organization and construction of these buildings, it is supposed that the district hospital should contain 300 beds.

Site.—The area of the site should be about 200 square mètres per patient, equivalent for a hospital of 300 beds to an area of 6 hectares, or 14.8 acres.

General Disposition of the Wards.—A hospital or 300 beds should consist. of two wards for ordinary diseases, two wards for injured patients, and one ward for contagious diseases. The last should be completely isolated from the rest of the hospital.

The barracks for the hospital attendants, the laundry, disinfecting rooms, mortuary, laboratory, etc., should be within the hospital enclosure. An enclosure wall should surround the whole.

The vacant spaces of the enclosure should be laid out as gardens and walks, and arranged so as to allot a section to each category of the sick (common diseases, injured patients, and the several contagious groups).

Special Arrangements.—The wards should be arranged parallel to one another so as to ensure the best orientation. In the central districts of France the wards should face cast and west. The wards should be comprised in a ground floor and a first floor. Each ward should contain from 50 to 60 beds, divided between the ground and the first floors. The common rooms should not have more than six beds; the space between the beds should not be more than 1.50 mètres. The dimensions of the rooms should be calculated on the basis of 10 square mètres per bed and 40 cubic mètres per patient.

Common Wards for the Sick .-- The auxiliary rooms should be grouped at the centre of the wards and -- both on the ground and first floors -- should. consist of the following :—A refectory, a room for conversation, a small room for letters and correspondence, a dispensary, gas furnaces for heating plates, a lavatory, a waiting-room, water closets.

Wards for Injured Patients.—One of these wards should be assigned for injured patients; the other for cutaneous diseases, etc. The two groups should be completely separated, and each should consist of an operating room, a room for the instruments and apparatus, and places for undressing and washing. In each of the operating rooms there should be special arrangements for heating.

Wards for Contagious Diseases.—A hospital for an army corps does not usually receive a large number of sick affected with contagious disease, because there are other hospitals to which such patients may be sent.

Administrative Wards.—These should be on the ground floor. The first floor should be reserved for officers and non-commissioned officers.

A separate building of one story only should be erected for the following services :- Bacteriology, hydropathy, ophthalmia, dentistry, etc. This building should be united to the sick ward by a covered gallery.

Infirmary Barracks.—These should be provided on the ratio of one convalescent to five patients. On the ground floor there should be rooms for N.C.O.'s, a dining and sitting room for N.C.O.'s, a dispensary, a visiting room for the medical officer, a room for the sick confined to the house, a hygienic closet, a refectory, a recreation room, a reading room, lavatories, water closets, and, lastly, two cells for men undergoing punishment. On the first floor: the common ward for 15 beds, lavatories, and water closets.

EDWARD T. THACKERAY.

VOËNNYI SBÓRNIK.

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### February, 1908.

REMINISCENCES OF THE SIEGE OF PORT ARTHUR.—This article contains some information on hand grenades. In the arsenals at Port Arthur many old Chinese shells were found; these were filled with black powder, and the end of a piece of Bickford's fuze was inserted, the remainder of it projecting 2 to  $2\frac{1}{2}$  inches. Such grenades weighed from 6 to 7 lbs. each, and were therefore too heavy to throw far. Tins filled with pyroxiline, weighing 2 to  $2\frac{1}{2}$  lbs. each, were also used as grenades. Another most useful grenade was made from the empty cartridge case of the 47-millimètre gun filled with pyroxiline. Some of the Japanese grenades were made of bits of bamboo filled with melinite.

The heavier type of grenade could not be thrown more than 20 paces, and was only used because the supply of pyroxiline was limited. Other explosives such as "rackarock" and "samson" were used instead, but were more dangerous to handle. Sometimes as many as 1,500 grenades a day were used by the Russians; at close quarters the men preferred them to their rifles.

A hand grenade, to be thoroughly satisfactory, should, apart from its explosive qualities, satisfy three conditions :---

- (1). It should be safe to handle.
- (2). It should not weigh more than from 2 to  $2\frac{1}{2}$  lbs.
- (3). It should be easily and simply ignited.

The Japanese melinite bombs only satisfied the second condition; when struck by bullets they were ignited and then exploded; Japanese men carrying grenades were frequently blown to pieces.

A supplement in connection with the trial of Generals Stoessel, Folk, and Reuss contains the minutes of six councils of war held in Port Arthur. In one of them questions arising from the defective state of the fortifications were discussed and the conclusions arrived at were shortly as follows :--

I. At the outbreak of hostilities a small portion only of the fortifications was finished, those on the sea front being in a more advanced state than the remainder. This necessitated the construction of temporary fieldworks to take the place of permanent works, some of which were not even started.

II. The forts were too near the harbour and town, and did not prevent them being bombarded by field guns.

III. The fortress was exposed to fire both from land and sea, only a small part of the sea front being defended by coast batteries.

IV. The high ground in front of the fortress allowed the enemy to manœuvre and plant his batteries without being seen.

V. The source of water supply was in front of the line of forts, and was only protected by fieldworks, constructed after the outbreak of war.

VI. Owing to the configuration of the ground the forts were laid out in one line; the whole defensive front was too thin and could be easily pierced.

VII. All the guns in the forts on the land front were exposed.

VIII. At the beginning of the war the batteries on the land front were not armed.

IX. The defence of the ditches was weak, and adapted exclusively to rifle fire.

X. The majority of the forts were badly sited, having no field of fire at close ranges.

XI. The number of guns allotted to the fortress was inadequate, and the guns themselves were not of modern pattern. About 1 to guns were taken from the fleet and mounted. The supply of ammunition was insufficient.

XII. There was no balloon equipment.

XIII. There was no fortress railway.

XIV. No telephonic communication between the forts existed before the war began. Aerial lines were subsequently put up, but were frequently cut. XV. The length of land front was 21 versts and of sea front  $8\frac{1}{2}$  versts; a force of two divisions was quite inadequate for the defence of this perimeter. The general reserve was far too small. (A verst = 3,500 feet).

### March, 1908.

REMINISCENCES OF THE SIEGE OF PORT ARTHUR (continued).—Hand grenades could not always be thrown far enough to reach the Japanese saps, which were moreover usually laid out in such a way as to be out of view of the artillery. It occurred to the writer, a naval officer (Lieut. N. Podgyrsky), that light torpedoes might be employed with some effect.

The type of torpedo used has no motive power of its own, but is fired from a tube by a charge of powder. It has a striker at its fore end, with a percussion apparatus for exploding the charge, which is in a chamber immediately behind and consists of 77 lbs. of pyroxiline. The after half of the torpedo is hollow to give buoyancy, whilst at the tail end there are fins which have to be set when the torpedo is aimed; it is  $7\frac{1}{2}$  feet long, has a greatest diameter of 10 inches, and weighs 180 lbs. in all. With a charge of powder about one-third bigger than that used at sea these torpedoes could be thrown to a distance of about 70 paces. Seven tubes were mounted at different positions and did good service.

A. H. Bell.

### CORRESPONDENCE.

## COAST EROSION AND ITS PREVENTION.

DEAR SIR,

Since the publication of my Paper on the above subject in the R.E.Journal for the month of June, I have learnt that the map which accompanied it, illustrating the "Development of Dungeness Point," was compiled by Colonel S. A. E. Hickson, p.s.o. My acknowledgments are therefore due to him for the use of it. The map in question embodies the results of a great deal of research and is a very valuable record. Colonel Hickson modestly refrained from putting his name on the drawing, and I was quite unaware that he was the author of it.

The Editor, R.E. Journal.

WM. PITT, Celonel.

### DUST PREVENTION ON ROADS.

DEAR SIR,

The following notes on an experiment with calcium chloride as a dust preventer are extracted from the *Engineering Record*, and may possibly be considered of sufficient interest for reproduction in the R.E. fournal.

The roadway, on which the experiment was carried out, is situated in the Agricultural Department grounds in Washington, B.C., and is built of Trap rock, held in position by a soft limestone binder.

In preparation for the treatment, all dust and dirt were scraped away from the surface of the road. A solution was prepared by thoroughly mixing 300 lbs. of commercial calcium chloride (granular containing 75 per cent. of calcium chloride and 25 per cent. moisture) with 300 gallons of water in an ordinary street sprinkler. It was then applied to the road, the sprinkler passing slowly to and fro to facilitate complete absorption of the solution. Each application consists of 600 gallons over an area of 1,582 square yards, or '38 gallons per square yard. After the surface was once thoroughly saturated no watering was required for some time. The solution affects the appearance of the road, which varies in colour from a light grey when dry to a greyish brown when moist. The texture of the road surface was completely changed. Before treatment the whole surface appeared loosely knit together, but after treatment the surface became smooth, compact, and resilient. The total cost for two applications, ranging over a period of about three months, worked out at about 1d. per yard super.

No mention is made of the nature of the mud formed in wet weather, or whether the road surface becomes more than ordinarily slippery.

The experiment proved that as a dust preventer the solution of calcium chloride was more effective and lasting than water, and acted in a slight degree as a preservative of the road surface.

The Editor, R.E. Journal.

R. N. HARVEY, Major, R.E.



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- G. C. Merrick, D.S.O., R.G.A.
- W. H. Moore, D.S.O., R.G.A. \*\*
- J. P. Mackesy, R.E. ...
- B. W. B. Bowdler, R.E.

F. D. Farguhar, D.S.O., Coldstream \*\* Guards.

\*Capt. R. G. Parker, Rl. Lancaster Regt.

Capi. G. N. T. Sinyth-Osbourne, Devon-

- shire Regt. Capt, V. H. M. de la Fontaine, East Surrey Regt.
- Capt. and Bt. Major F. R. Hicks, Hampshire Regt. Capt. H. S. Williams, Dorsetshire Regt.
- B. D. L. G. Anley, D.S.O., Essex Regt. Capt. R. S. Hamilton-Grace, Durham Light
- Infantry \*Capt. H. F. Baillie, Seaforth Highlanders.
  - P. S. Allen, Gordon Highlanders.
  - \*\*
  - J. K. Cochrane, Leinster Regt. ,,
  - R. L. Ricketts, Indian Army. W. K. Bourne, Indian Army. ...
  - 13
- F. W. Lumsden, R.M.A. ,,

The following Officers received nominations :---

- Capt. H. C. Bickford, 6th Dragoon Guards,
- Capt. C. J. C. Grant, Coldstream Guards. Capt. W. D. Wright, v.c., Royal West Surrey Regt.
- Capt. C. H. Harington, D.S.O., Liverpool Regt. Capt. H. Wake, D.S.O., King's Royal Rifle Corps. Capt. H. Wake, D.S.O., King's Royal Rifle Corps. Capt. and Bt. Major N. J. G. Cameron, Cameron Highlanders. Capt. G. P. Grant, D.S.O., Indian Army.

### SANDHURST, JUNE, 1006.

FIRST A. G. Armstrong 5,541	129th
48th	181st
67th D. Macdonald 4,299	186thP. J. I. Synnott
89th	190thR. M. Aylmer
90th	197th
93rdA. P. Williams-Freeman 4,094	201st P. W. J. A. Stomm 3,151
115th D. M. Black 3,940	21 3th, B. W. Molony 2,881
125th W. J. King-King	

### WOOLWICH, JUNE, 1006.

... I. S. Barkworth ... ... 6,483 31st ... ... ... ... \*\*\* DECEMBER, 1905.

SECOND H. G. MacGeorge	16th         R. Crofton         6,330           45th         D. Stephenson         5,899						
This was the First Examination under the new regulations, and our pupils secured THREE out of the first FIVE blaces,							

### MILITIA COMPETITIVE, MARCH, 1906,

A.	E.	Hardy	2,304	W. F. Anderson	1.047	
N.	Ħ.	Hutcheson	2.105	D. C. Robinson	.870	
F.	D.	Frost*	1.940	F. A. Bowring	.876	
*Read partly at the Army College, Aldershot.						

#### ARMY QUALIFYING, 1006.

Nineteen passed.

Special Arrangements have been made for the Army Qualifying in next Examination.

Sole Advertisement Contractor :

Mr. C. GILBERT-WOOD, Dacre House and Granville House, Arundel Street, Strand. (Telegraphic Address :~ "GILBERWOOD, LONDON ": Telephone No. 4680 Gerrard.)