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CONTENTS.

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LIST OF PHOTOS AND PLATES.

LIST OF MAPS.

LIST OF CONTRIBUTORS.

Subject Index.

Original Articles are entered in thick type; Reviews and Notices of Magazines in thin type.

THE INSTITUTION OF ROYAL ENGINEERS.

All communications for the Institution should be addressed to :—

The Secretary,
The Institution of Royal Engineers,
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CONTENTS

 [2150—1. 8. 22].

THE R.E. WAR MEMORIAL.

A FULL report of the Unveiling Ceremony of the R.E. War Memorial at Chatham, on July 19th, 1922, by H.R.H. The Duke of Connaught, is published in the *Supplement* to the *R.E. Journal* for this month. Reprints in pamphlet form can be obtained from the Secretary, Institution of Royal Engineers, Chatham, post free, price 6d.

ASSAULT BRIDGING.

A lecture delivered at the S.M.E., Chatham, on 20th Jan., 1921, *by* LIEUT.-COLONEL C. E. P. SANKEY, D.S.O. (late R.E.).

INTRODUCTION.

WHEN I was honoured by an invitation to lecture at the S.M.E. on the subject of bridging by Divisional Engineers during the advance of the British Armies in the latter part of 1918, I came to the conclusion that the most useful form my lecture could take would be the description of one bridging operation from the time when its possibility became apparent, through the various stages of reconnaissance and preparation, up to and including its actual accomplishment. For this purpose I have selected the bridging operations in connexion with the forcing of the Sambre-Oise Canal by the 1st Division on the 4th November, 1918, as I have a personal knowledge of the details of those operations, being at that time the C.R.E. of the Division.

From the point of view of actual bridging I am afraid that you may be somewhat disappointed; the obstacle to be bridged presented absolutely no engineering difficulties, though it is possible that some of the details in the designs of the bridges may prove suggestive. My real object, however, is to give you an idea of the preparations that have to be made and the difficulties likely to be encountered when carrying out an operation of this nature in the face of the enemy.

The telegraphic dispatch from G.H.Q., France, dated 9.5 p.m., 4th November, 1918, appearing in the morning papers of the 5th, contained the following paragraphs:—

> "This morning troops of the Fourth, Third and First British Armies attacked between the Sambre Canal at Oisy and the River Scheldt, north of Valenciennes. . . . . On the right of the attack the 1st and 32nd Divisions advanced to the assault in conjunction with French forces operating to the south of them. With great dash and gallantry, these two Divisions stormed the formidable obstacle presented by the line of the Sambre Canal and, in spite of strong resistance from the enemy, have pressed on to a depth of over three miles to the east of it. In these operations the 1st Division, under the command of General Strickland, having captured the town of Catillon, forced passages of the Canal opposite that place and near the lock, two miles south of it. At

the latter point, assisted by Royal Engineers, the 1st Cameron Highlanders effected the passage of the Canal in six minutes. In the subsequent advance this Division captured the villages of Fesmy, Hautrève and La Groise, with 1,500 prisoners."

POSITION OF FIRST DIVISION.

As you all know, the German advance towards Amiens and the Channel Ports, in which they had made such large territorial gains in the Spring of 1918, was finally stayed, and, in July, the Allied Armies, in their turn, began to sweep forward towards the Rhine.

The 1st Division, after supporting the Canadians in their successful attack on the Drocourt-Quéant line on the 2nd September, was moved down to the right Corps of the British line, which was in contact with the French left.

It is not necessary for my present purpose to describe in detail the progress made by the Allied Armies during the months of September and October. Suffice it to say that the 1st Division, after the operations of the 17th and 18th October, was on the approximate line—Oisy–Rejet de Beaulieu-Mazinghien, and it was apparent that the passage of the Sambre-Oise Canal was a possible task for this Division in the near future ; see *Diagram* A.

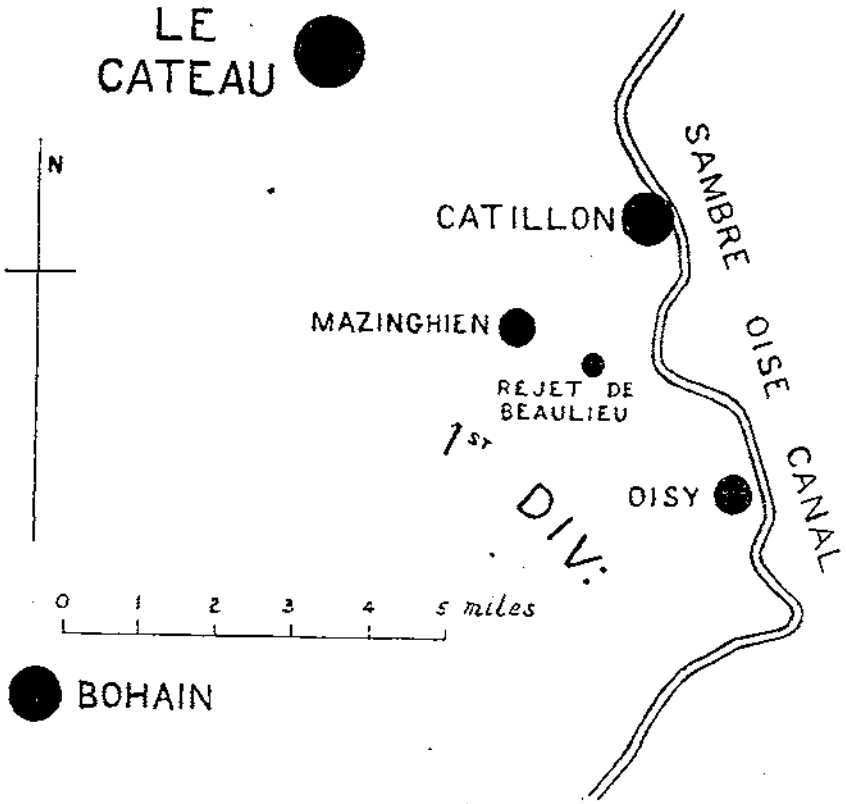


DIAGRAM A.

Reconnaissance.

Reconnaissances were accordingly started with the following main objects :—

(*a*) The discovery of the available materials from which bridges could be constructed ;

(*b*) The collection of all possible information about the Canal, which formed the obstacle to be bridged.

Three points may be noted in this connexion :—

(i) Although all engineer officers do or should keep their eyes open and note in a general way the resources of a neighbourhood for various purposes, and although details of all the canals in the theatre of war were available in publications, yet these special reconnaissances were necessary to get down to numbers in the case of materials and to obtain the minutest local details in the case of this canal.

(ii) When these reconnaissances were started, the actual sites where the bridges would be required had not been determined, and, in fact, the whole operation had only just entered into the region of possibility.

(iii) All the officers and men of the Field Companies were already fully occupied with other work and it was difficult to find the personnel for these reconnaissances.

Reconnaissance for Bridging Material.

The reconnaissance for bridging materials was a safe and fairly simple operation, being conducted of necessity within our own lines. A miscellaneous collection of material was discovered or known to be available, in addition, of course, to the pontoon bridging equipment which always accompanies a Division, and which can be supplemented from that forming a Pontoon Park. Of the materials thus discovered, the following may be mentioned :

Timber of suitable scantlings, in ample quantities for the operation in question, and also miscellaneous stores, such as steel joists, wire rope and cordage, were found in Bohain. Bohain had been an important German Pioneer Park, and the accumulation of various engineer materials there was almost intoxicating ; my stores officer was so delighted with it that I had the greatest difficulty in getting him to come home, even for his meals.

Barrels of various sizes, from 26 gallons upwards, were found in the neighbouring villages. These were collected at the respective Headquarters of the three Field Companies composing the Divisional Engineers, and the coopers of these companies were turned on to bring them up to concert pitch ; a cooper is not a man who can be

frequently employed at his trade on active service, but the men in question performed prodigies with these barrels.

It was known that a quantity of cork, made up into floating piers, would be available, but the exact amount was not known; and it may be mentioned here—though, strictly speaking, not a result of this reconnaissance—that 700 empty petrol tins were allotted to this Division just before the operation.

A considerable number of Berthon collapsible canvas boats were known to be at the Base; these were sent for, in case it should be decided to effect the crossing by a ferry service, rather than by a bridge proper. Eventually these boats were used as a stand-by only and were not actually employed.

The Germans had also kindly left in Bohain a number of portable bridges of 12-ft. and 15-ft. span, capable of carrying field artillery; see *Fig.* 1. Some of these were mounted on wheels and so could be readily transported, and they could also carry one or two bridges without wheels on their decks. It was realized that these bridges might be useful for crossing small streams, but their span was, of course, too short for the Canal itself.

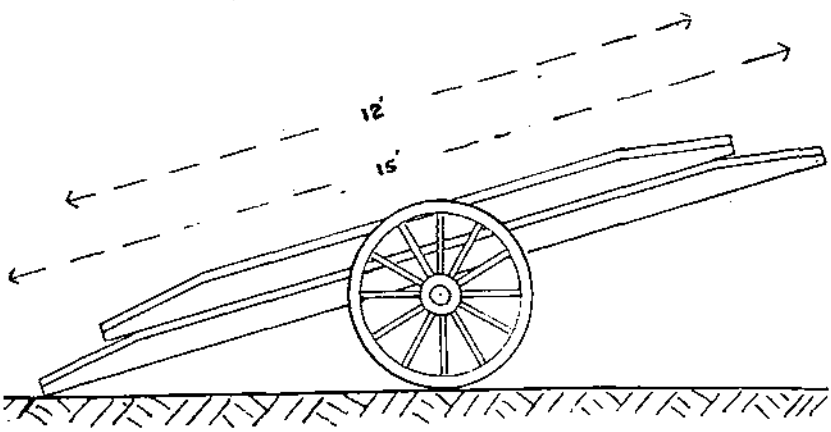


FIG. 1.

Most important of all, Bohain furnished a considerable number of light steel floats, used by the Germans in their assault bridging operations, notably when they attempted to cross the La Bassée Canal near Hinges; see *Fig.* 2. The following is an extract from the letter of the *Times* Special Correspondent, appearing in the issue of the 20th April, 1918:—

> "From Paeaut Wood and opposite Hinges, large parties of Germans, covered by machine-guns, made rushes to the canal bank and tried to build pontoon bridges. The earlier rushes were completely broken and wiped out. At last the enemy

succeeded in reaching the Canal and tried to throw a pontoon bridge, supported on "balloons," across. The pontoon was not long enough and the enemy party was terribly reduced by our rifle-fire."

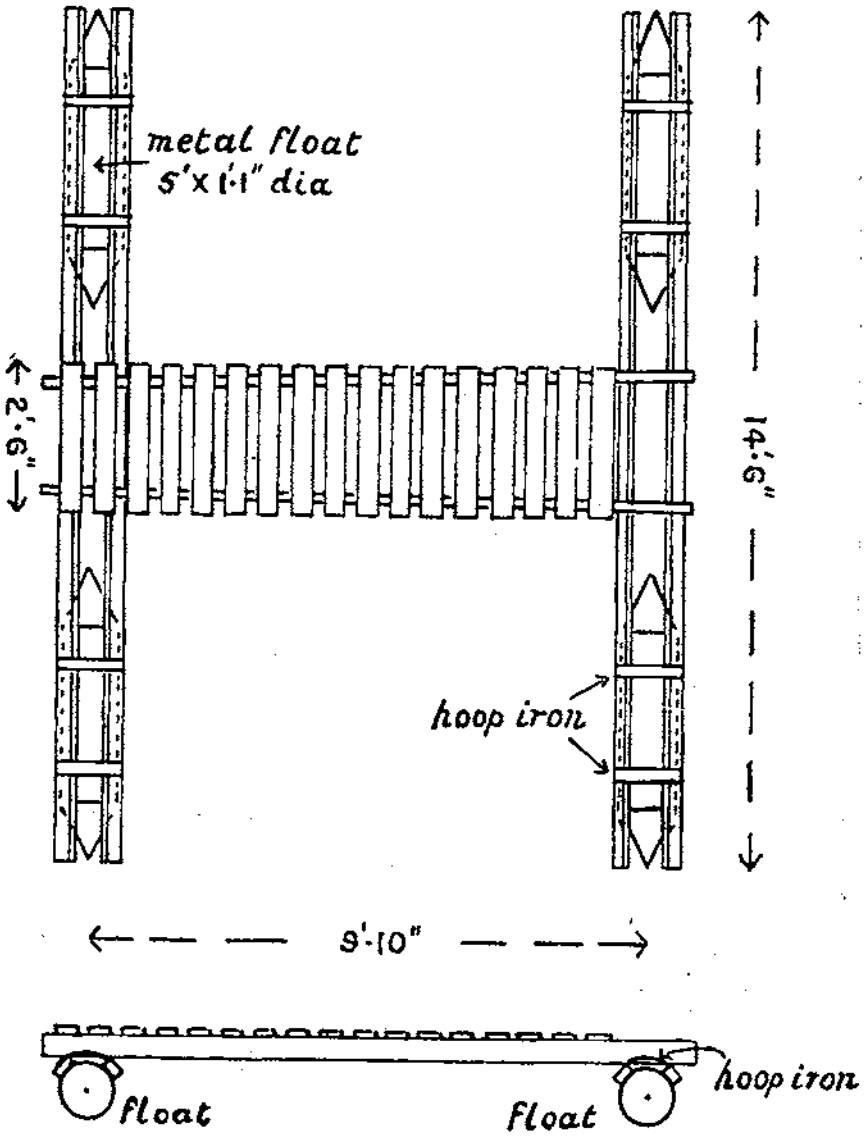


FIG. 2.

These light steel floats appeared so certain to be useful that wagons were sent to take them all away before they appealed to the cupidity of any other Division.

RECONNAISSANCE OF THE CANAL.

Information about the details of the Canal itself was obtainable from various sources; General Staff publications and information issued by the Intelligence of the Staff of the IXth Corps provided certain details about the width and depth of the water in the Canal at the time of its construction, and about the height and slopes of the banks bounding it on either side; this information also established that the River Sambre flowed in several channels on both sides of the Canal, these subsidiary streams considerably increasing the obstacle

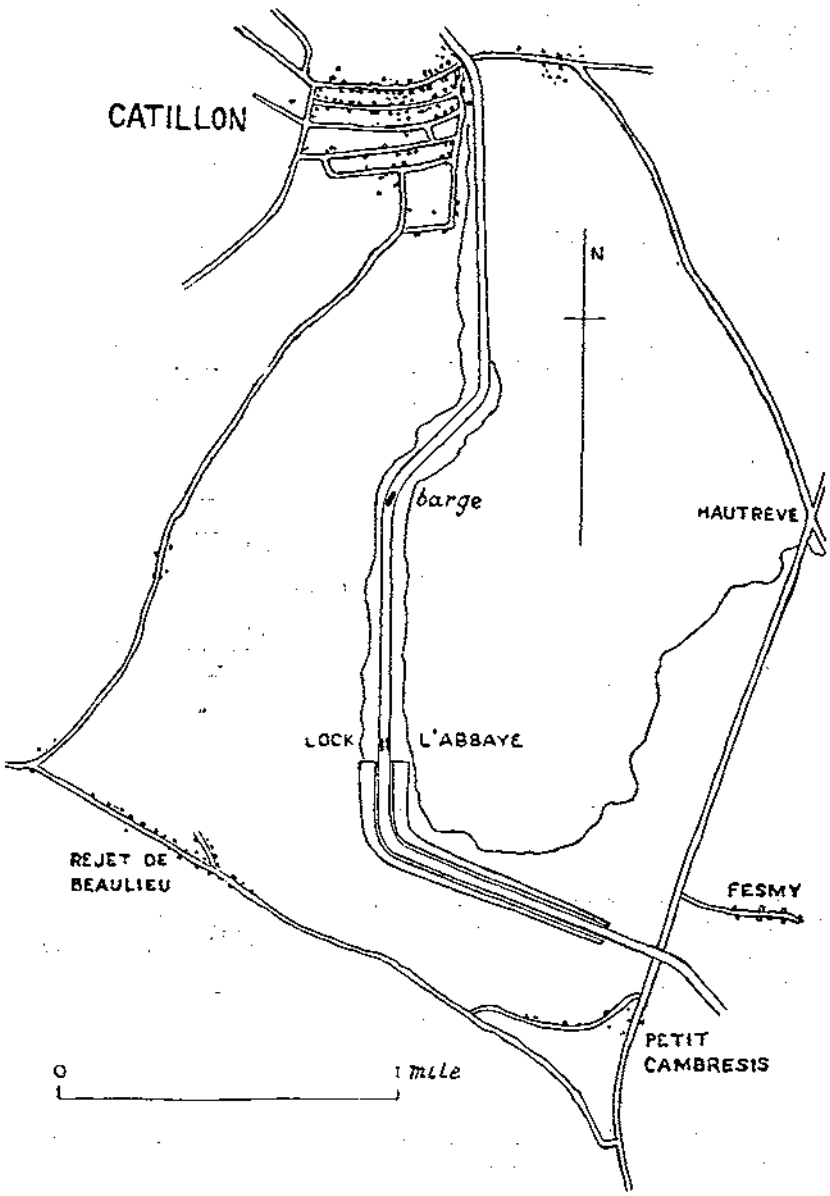


FIG. 3.

from a bridging point of view. Details were also given of the bridges that had existed over the Canal in peace-time. See *Fig.* 3, which shows Catillon, the Canal and the main roads.

The information obtained in this way was necessarily of a somewhat general nature, and it was supplemented, checked and corrected by statements from prisoners and from civilians, of whom a few had been rescued from Catillon. The main facts established from these sources were that the existing bridges had been blown up and that the level of the water in the Canal had fallen.

A large number of air-photographs were examined most minutely and furnished much valuable information. Oblique air-photographs give a good general idea of the ground, but for actual measurements photographs taken vertically must be used.

Finally, there were the results of the reconnaissances carried out by officers and men of the Field Companies; the difficulty of carrying out such reconnaissances can be realised when it is stated that both banks of the Canal were in possession of the enemy, and it was only due to the great gallantry displayed by these officers and men that so much valuable and accurate information was obtained. An interesting example of the possibilities of this form of reconnaissance may be mentioned. An attack was made by us towards the Canal on the 23rd of October, and a corporal and a sapper of the 26th Field Company were sent with that portion of the assaulting troops most likely to reach the Canal. During the fluctuations of this open fighting, our troops at one time reached the Canal, and, although, when our line had stabilized itself, both banks of the Canal were still in the hands of the enemy, yet this patrol had been able, during the fighting, to get up to the Canal and return with most valuable information. I am glad to say for this feat the corporal was awarded the D.C.M., and the sapper the Military Medal.

The main results of the reconnaissance of the stretch of the Canal opposite the front of the 1st Division may be summarized as follows (see *Fig.* 3):—

(*a*) The bridge at Catillon had been blown up;

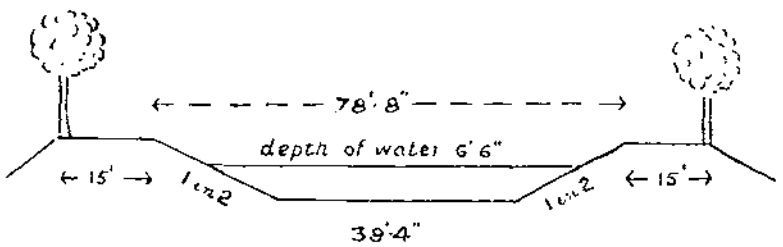
(*b*) There was little to characterize any particular portion of the stretch from Catillon to the Lock, except that a sunken barge was in the bend;

(*c*) The Lock at L'Abbaye was naturally of great interest, as the narrowing of the Canal here simplified the bridging problem;

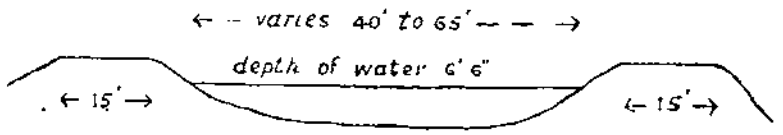
(*d*) Between the Lock and Petit-Cambresis there were two reservoir basins, one on each side of the Canal, each about twice as wide as the Canal proper at their northern ends, diminishing to points just north of the bridge at Petit-Cambresis. These naturally increased the difficulty of the bridging problem along this stretch.

(*e*) The bridge at Petit-Cambresis had been blown up.

Diagrams of the normal section of the Canal were issued by IXth Corps Intelligence (see *Fig.* 4). The two lower sections in this *Figure* are referred to subsequently. The width of the Lock was given in publications as 17 ft. 1 in., and measurements from air-photographs showed that this dimension would not be largely exceeded.

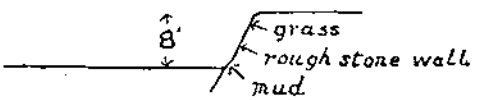


Section issued by IX^Th Corps Intelligence

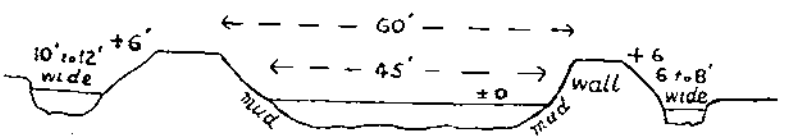


Revised section issued by IX^Th Corps Intelligence

WEST EAST



Lt. Roberts' reconnaissance



Subsequent measurement.

FIG. 4.

Although the various reconnaissances that have just been described were put in hand on the 19th October, it must not be supposed that they were completed on that day. In fact, in one shape or another, they were proceeded with up to the very eve of the operation, but the general results have been presented in this place for the sake of clearness.

Project for the Operations.

Returning to the chronological order, on the 21st of October, I held a conference with the three Field Company Commanders, at which the various possible means for crossing the Canal were discussed at length; the Company Commanders were asked to consider the problem thoroughly and to submit projects for the bridging operation, both over the normal section of the Canal and also over the constriction at the Lock.

The attack of the 23rd October has been mentioned already; this attack carried the Division to within reach of the Canal from Catillon to Petit-Cambresis, though nowhere did we actually hold the western bank itself; the new line enabled the stretch of Canal along the Divisional front to be divided into three portions, each portion being allotted to one Field Company for the purpose of detailed reconnaissance (see *Fig.* 5).

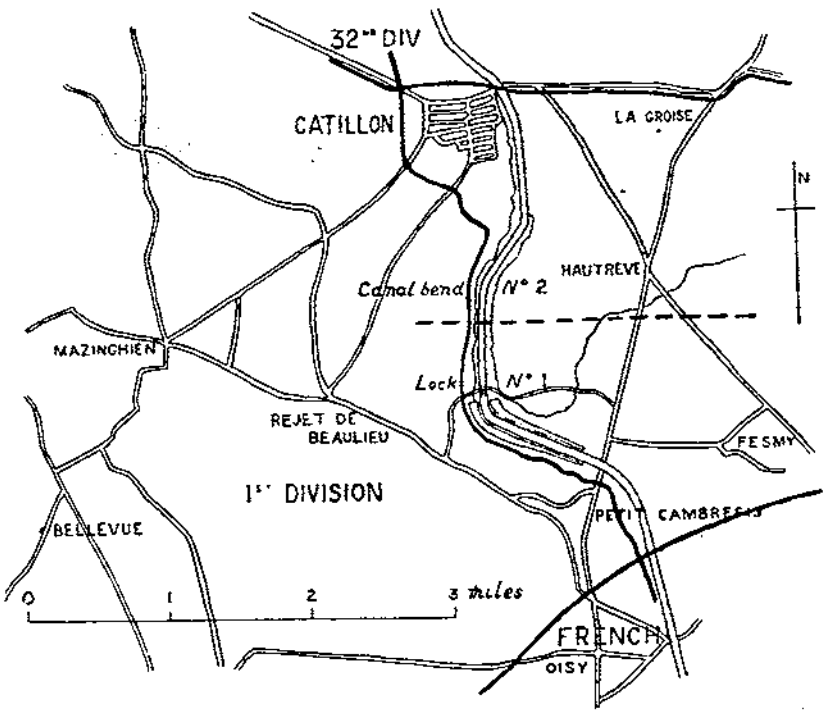


Fig. 5.

On the 27th October a preliminary project for the operation of forcing the passage of the Canal was issued by the General Staff of the Division. This dealt with the general tactical aspects of the problem, but for the present purpose the most interesting portion was the selection of the sites for the actual bridging operations. These were two in number and were as follows :—

Crossing No. 1—at the Lock.

Crossing No. 2—at the Canal bend, about one mile south of Catillon.

DESCRIPTION OF THE BRIDGING SITES.

The fact that the bridging sites had been definitely selected made it possible to determine the types of bridges to be used at each. The two crossings were of entirely different natures.

Crossing No. 1, at the Lock, was a comparatively short span, with hard abutments. According to the information available, the span was 5·2 metres (17 ft. 1 in.), and by measurements on air-photographs it was made out to be not more than 19 ft. ; it was measured subsequently to be 17 ft. The length available for bridging operations was 130 ft. according to information and about 190 ft. by measurement on air-photographs ; actually, by pacing, it proved to be 180 ft. (see *Fig.* 6). The buildings on the east were nearly intact ; but the house on the west was ruined ; the towpath was higher than the ground level.

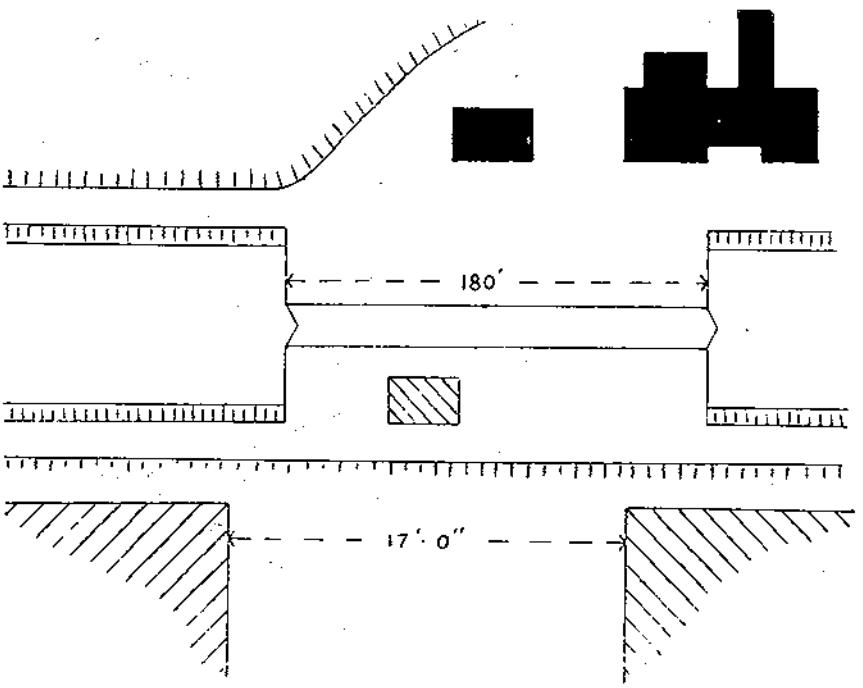


FIG. 6.

Crossing No. 2, at the Canal bend, was a wet gap with apparently 40 ft. to 60 ft. of water, and the sides were muddy. A reconnaissance by Lieut. Roberts had established that there was a steep masonry wall on the east side, and, though he had not been able to see the western face, it was possible that this side also had a steep wall. The actual width of the water was found to be 45 ft., and the western face was much flatter than the eastern (see *Figs.* 4 and 5). The section by subsequent measurement is not strictly to scale ; towpaths were about 15 ft. wide, but are shown smaller to allow room for the subsidiary streams.

Preparation of Material.

On the 28th of October a preliminary demonstration was given to the Divisional Commander of some experimental bridging material which had been prepared, and when his assent had been secured to the general principles proposed, another conference of Field Company Commanders was held, at which the responsibility of the several Companies was settled for the preparation of the material and for the erection of the bridges.

On the 29th October I issued a project in which the details of the bridging operations were given fully, including the various numbers and types of bridges to be used at each crossing, dimensioned drawings of each type of bridge and the allotment of the responsibility for the erection to the several Companies. It is not necessary to give this project here in full, but a general idea of the arrangements proposed is as follows :—

Although air-photographs and reconnaissance reports showed the existence of several foot-bridges and other means, such as the sunken barge, of crossing the Canal, it was not thought advisable to rely on the use of any of them for the operation, especially as they were stated to be prepared for demolition. It was also decided that the bridges to carry the first waves of assaulting troops should be carried up bodily from the assembly positions as completed bridges, and that no constructional work should be required on their arrival at their sites for erection. These assault bridges, as they may be called, were to be supplemented by other bridges for infantry and also by bridges to carry other forms of traffic ; in the case of all those other bridges it was decided that constructional work at the site should be reduced to a minimum, and their details were designed in accordance with this principle.

Description of Bridges.

The assault bridges at Crossing No. 1, the Lock, were four in number and were designed as single-span bridges, as light as possible consistent with their being able to support five or six men on them at one time. They were fitted with a lever, and a pair of wheels, something like a fire escape, so that they could be launched from the

near abutment without requiring anyone on the far side to receive them (see *Fig.* 7). These assault bridges were to be supplemented by four bridges, also designed to carry infantry in single file, but of stouter construction and without the special launching device.

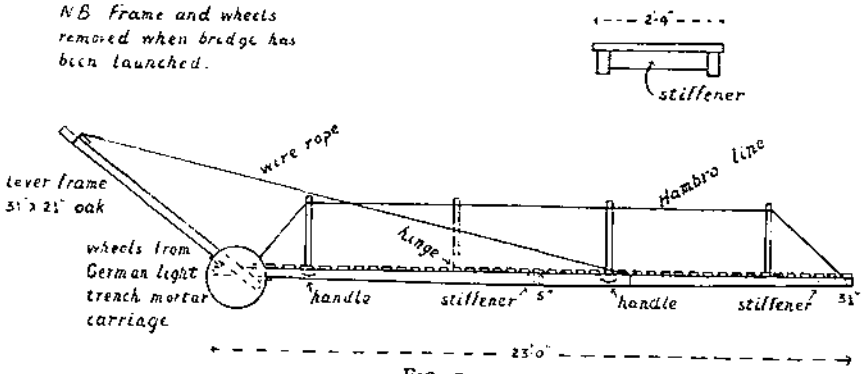


FIG. 7.

The assault bridges at Crossing No. 2, the Canal bend, were also four in number and were floating bridges carried on the German steel floats already mentioned; these, from their lightness and shape, seemed capable of producing the most portable bridge and the one best adapted for sliding over mud. This material was not used in accordance with the standard German method; it was taken to pieces and reconstructed in the manner here illustrated (see *Fig.* 8). The several bays of each bridge were hinged together in

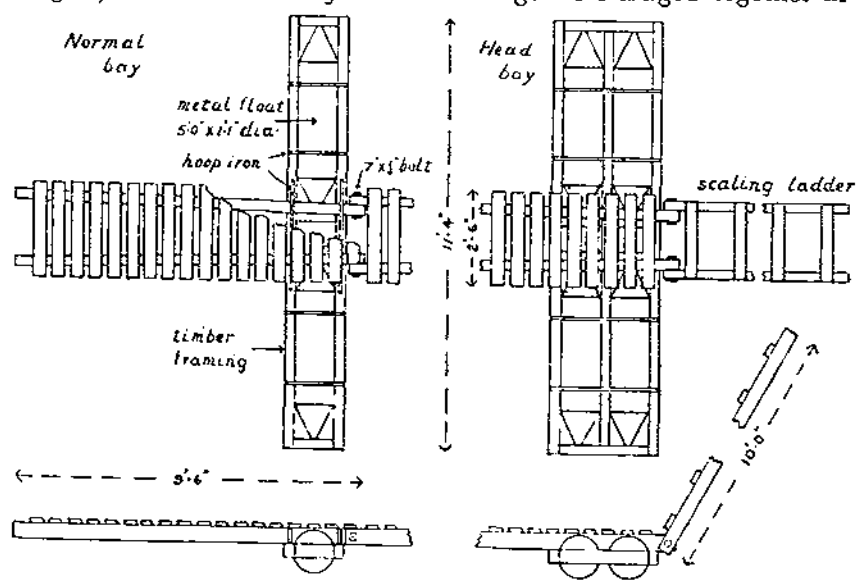


FIG. 8.

such a way as to give the maximum vertical flexibility, and the head of each bridge was provided with a hinged storming ladder, to enable the far bank to be scaled with ease. These assault bridges were to

be supplemented by eight other floating bridges also designed to carry infantry in single file, but supported in different manners. Two were on cork floats, a standard equipment of separate roadways and piers, joining together with hooks and cleats (see *Fig.* 9).

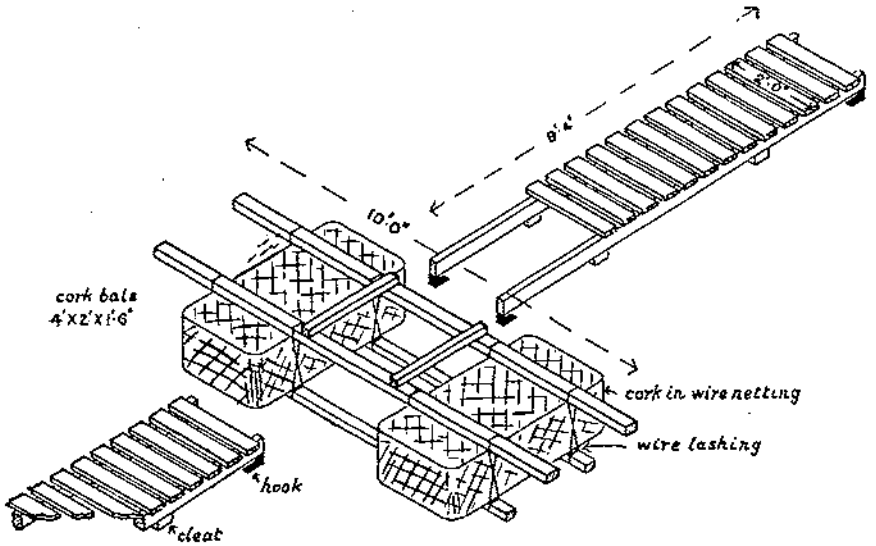


FIG. 9.

Four on barrels, in which one bay of roadway and one pier were made together, and formed into bridge similarly to the steel floats (see *Fig.* 10); the piers were not lashed with cordage, but were secured with hoop-iron.

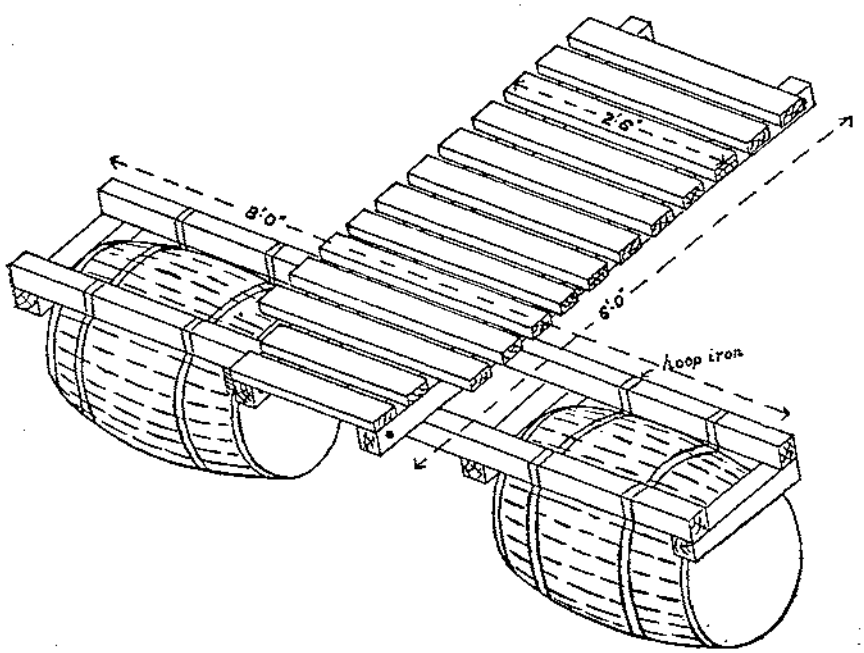


FIG. 10.

And two on petrol tin floats, secured by wire lashings and hoop-iron (see *Fig.* 11).

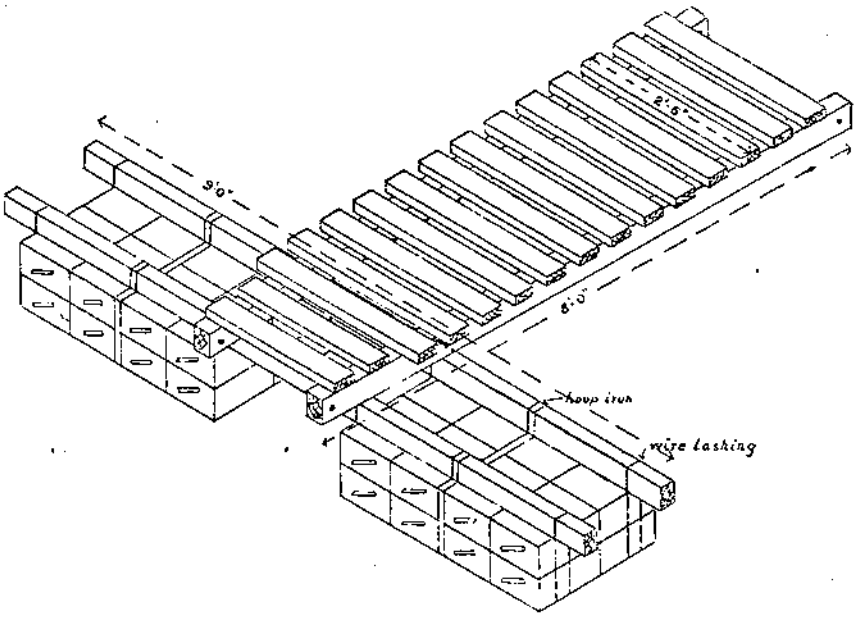


FIG. 11.

It was not proposed to erect any but bridges for infantry at No. 2 Crossing, but at Crossing No. 1, the Lock, a more ambitious programme was arranged.

Two bridges, each capable of carrying pack-transport or cavalry in single file, were to be erected when the infantry bridges were in position. These could also carry infantry two abreast and compensated for the smaller number of supplementary bridges at this crossing. They were made in two longitudinal portions for convenience in carrying (see *Fig.* 12).

One bridge of simple single-span design was also prepared for this crossing to carry horse transport, but, as the material was blown to pieces by a shell before it was erected, it is not worth while to describe it in detail.

Finally, at the Lock, was to be a bridge to carry Tanks. The fact that such a bridge would be required was sprung upon me at the last moment, to be precise, about 36 hours before the operation. It was not included, therefore, in my project, of which the foregoing has been a summary ; but, for the sake of clearness, it will be better to mention it here. When I learnt that this bridge was wanted, all my men were engaged up to the neck in preparing the other bridges, whose erection would also occupy them fully ; I was, therefore, lent a section of the 1st Australian Tunnelling Company for the preparation and erection of this bridge, and I would like to place on

record that nothing could have exceeded the gallantry and loyal co-operation shown by the officers and men of this unit.

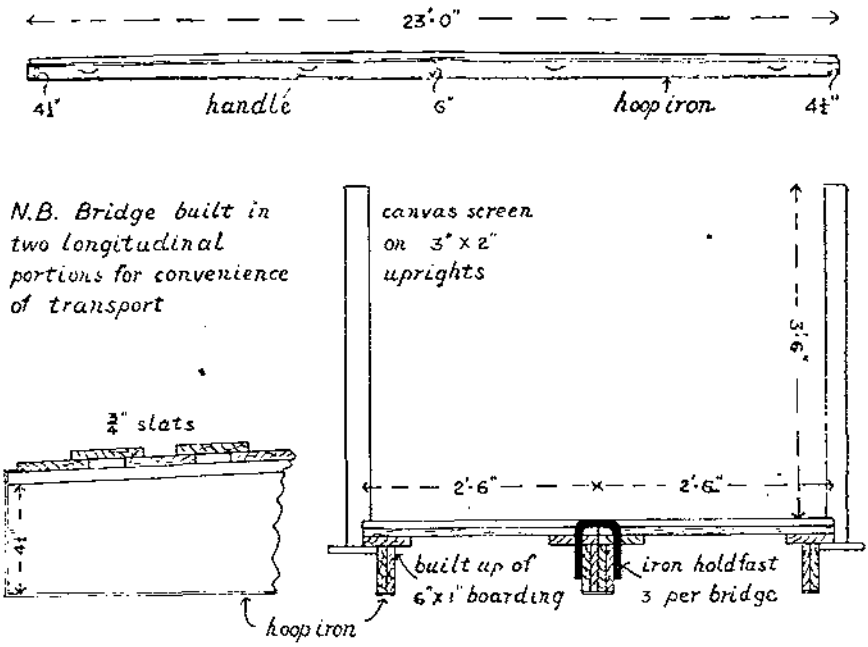


FIG. 12.

A bridge to carry tanks was, of course, far too heavy to be carried up complete, but it was designed in such a way that it consisted of two types of members only, steel joists and timber deck-planks, thus enabling a large party to be employed in its erection without fear of confusion; this is a good example of what may be called the Egyptian method of construction, in which simplicity of design and a large labour force result in a great economy of time. The shore-transoms or bed-plates were identical with the deck-planks, and the only constructional work required at the site was the prising-out of the coping-stones of the Lock, and the spiking-down of the wheel guides when the bridge had been erected (see *Fig.* 13).

The horse transport bridge at this crossing, already mentioned as having been destroyed, was only retained in the programme after the decision to include a tank-bridge, as a precaution in case the latter either could not be erected or was erected in an inconvenient place for horse transport. Luckily, neither proved to be the case, and the tank bridge took all the horse transport, for which it was naturally more than amply strong.

In addition to the bridges which have just been detailed, over the Canal itself, many subsidiary bridges were required over the small streams west and east of it. The spans were short and the

design of these bridges presented no unusual features, but very careful organization was required to ensure that they should be properly erected at the right time and in the right place, and that the total capacity of these bridges should not be less than that of the bridges over the Canal itself.

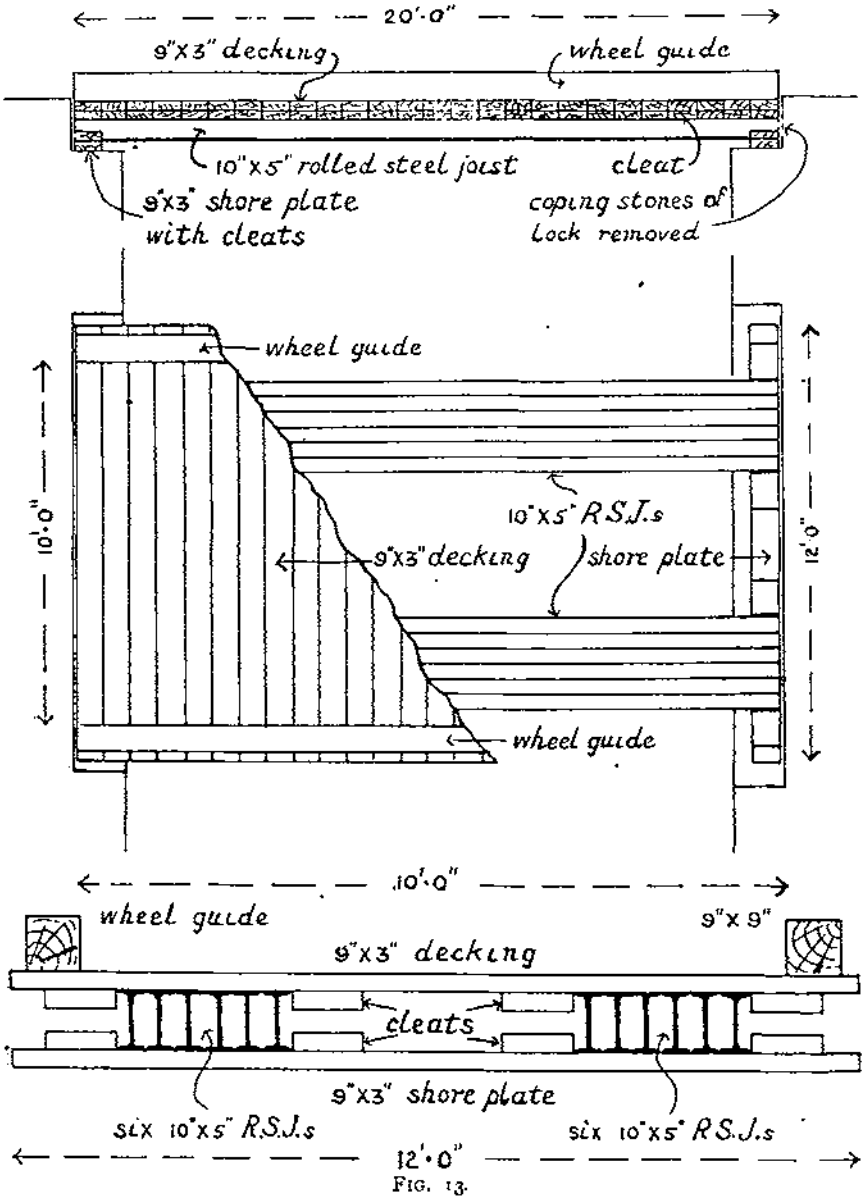


FIG. 13.

Twelve Berthon boats were also to be provided to run ferry services, above and below Crossing No. 1, and one at Crossing No. 2, in case the bridging proved a failure. These boats were all in readiness, but the necessity for their use did not arise.

Supplementary Bridging Preparations.

The bridges so far described have had to do with the two crossings where the assault was to be made, but the projected operation, as a whole, demanded other bridging preparations. A subsidiary attack was to be directed against the town of Catillon (see *Fig.* 3), and a section of a Field Company was to accompany the force detailed for this portion of the operation, provided with materials for improvising foot-bridges over the Canal in that town. In the event of the attack being successful, the main-road bridge at Catillon would also need renewal, but with that, the 1st Division was not concerned, as the repair was to be carried out under the orders of the Chief Engineer of the IXth Corps. Again, the road crossing the Canal at Petit-Cambresis would have to be thrown open to traffic as soon as possible. Here a pontoon bridge to take horse transport was to be constructed by the 1st Division and also, possibly, a bridge to carry lorries; the renewal of the main-road bridge was to be in the hands of the Chief Engineer. It was also arranged that the Engineers of the 46th Division should throw three pontoon bridges over the Canal between the two crossings; these were not to be made until the operation had been in progress for some time and were intended to facilitate the forward movement of artillery in the case of success.

Technical Criticism of Bridging Methods.

To depart once more from chronological order, it will here be convenient to give the conclusions arrived at, in the light of experience, as to the suitability of the bridging methods employed, and so finish with technical details.

The assault foot-bridges, with special launching device for the Lock, were found to work very well (see *Fig.* 7). They were light, and could be carried easily by six men; no difficulty was found in up-ending them and in this position they could be run forward on their wheels or pivoted about them. It would have been better if the steel guys had been double, the two ends being secured to different points on the bridge; a difficulty was experienced with the first bridge launched, of which one of the guys was shot away.

The bridges on German steel floats were excellent, they were very light and the complete bridge was carried easily by two men per pier; the hinged joints, eccentric to the long axis of the piers, gave great vertical flexibility to the bridge and allowed it to be carried up and down banks (see *Fig.* 14).

Owing to the small height of the roadway above the water, this form of joint did not produce unsteadiness in the bridge when it was floating (see *Fig.* 8), in fact, these bridges successfully carried loads, such as stretcher-parties returning with wounded, for which they had not been designed. The storming-ladders, hinged to the

head of the bridges were perfectly efficacious, though, as a matter of fact, the far bank presented a smaller obstacle than had been anticipated.

The barrel bridges were also carried up and launched as complete bridges; owing to their greater weight they were not so easy to handle and required a larger carrying party. To enable these bridges to be carried over the canal bank they were also constructed with the same eccentric-hinged joint, which, in their case, introduced a ludicrous instability when floating.

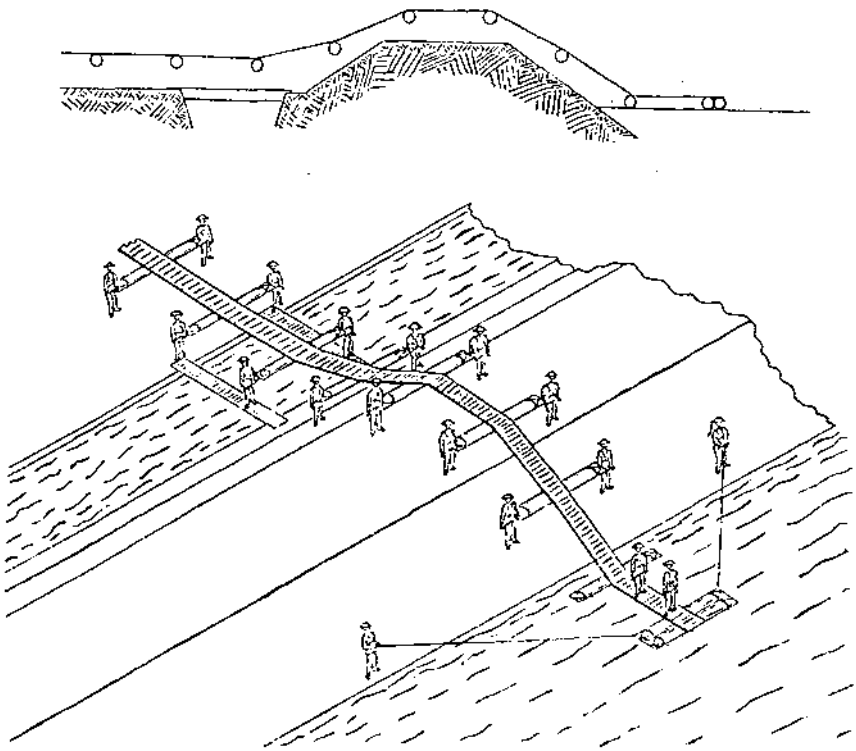


FIG. 14.

This was due to the greater height of the roadway above the water, so that the lever-arm of the hinged joint about the axis of flotation of the pier was sufficiently long to throw the whole bridge into a succession of " V's " as soon as a man put his weight on one end; as he moved forward each bay, the bridge re-adjusted itself into a fresh series of " V's " (see *Fig.* 15). This effect might prove a serious rival to the switchback at an exhibition, but was out of place in a military bridge. Luckily, this peculiarity was discovered during practice and was remedied by nailing tie-baulks across the gunnels of every three piers, after the bridge had been launched, and before it was opened for traffic, as shown in the top right-hand

corner of *Fig.* 15. This made the bridge into a series of three-pier rafts and produced the necessary stability.

The bridges carried on petrol tins proved to be light and steady; they were also launched as complete bridges.

Bridges on cork floats are undoubtedly the best for comparatively permanent work, especially in positions exposed to enemy fire. They were, for example, the only kind of bridge that could be kept going at Nieuwpoort in 1917. They do not lend themselves to launching as complete bridges, however, and are, therefore, not suitable for use at the actual moment of assault.

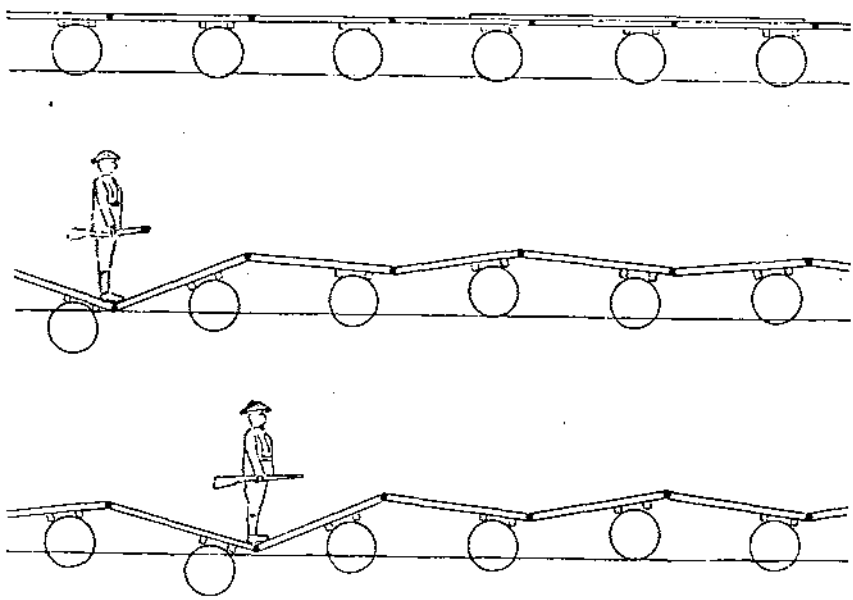


FIG. 15.

The tank bridge over the Lock proved very simple in construction and amply strong (see *Fig.* 13). It took two hours to make—a time which could have been considerably reduced if the materials could have been placed nearer to the site; they had to be at some distance, however, in consequence of the tactical situation, and also of the necessity for having the infantry bridges as near the Lock as possible.

PRACTICE.

As soon as the first few of the assault bridges previously described had been made, practices were carried out by the Field Companies responsible for their erection in conjunction with the Battalions detailed to cross over these bridges in the actual operation. A gap to imitate the Lock Crossing was easily made out of timber, as the depth was immaterial, and for the Canal bend crossing, a pond near the billets of the Field Company concerned was turned into a full-size section of the Canal by building revetted banks at each end.

BRIDGE ASSEMBLY POSITIONS.

The next move in this bridging problem was to get the bridges as near as possible to the sites where they were to be used, and naturally all this movement had to take place at night.

The infantry and pack transport bridges for crossing No. 1 at the Lock were sent up in four wagon-loads, three pontoon and one G.S., the evening before the operation, that is on the 3rd November, and were taken to two forward dumps, whence they were carried by hand during the night to their final assembly position. The tank bridge for this crossing was sent up in six wagon-loads, three pontoon and three G.S., on the same night and carried forward similarly to an assembly position in rear of that occupied by the infantry and pack transport bridges. The horse transport bridge for this crossing was not sent up in advance.

The bridges for Crossing No. 2, at the Canal bend, were far more bulky and occupied 32 wagon-loads in all, 21 pontoon and 11 G.S., being sent up on three successive nights—1st, 2nd and 3rd November, dumped under trees and hedges and in orchards some 500 or 600 yards from the Canal and covered with camouflage material.

The assault bridges were put together and carried forward to their final assembly position on the night of 3rd November.

BATTLE DISPOSITIONS.

The battle dispositions of the 1st Division, as far as they affect this account of the bridging operations, were briefly as follows (see *Fig.* 5) :—

The artillery and machine-guns were disposed so as to bring a heavy barrage on the line of the Canal at zero hour. The 2nd Infantry Brigade was detailed to force the passage at Crossing No. 1, at the Lock, the 409th Field Company being responsible for the bridging operations, with the section of the 1st Australian Tunnelling Company for the tank bridge. The 1st Infantry Brigade was detailed for Crossing No. 2, at the Canal bend, the bridging being in the hands of the 23rd Field Company. The 3rd Infantry Brigade found the troops for the attack on Catillon, and with them was a section of the 26th Field Company, with a wagon containing a suitable selection of timber for improvizing foot-bridges. The remainder of the 26th Field Company was in reserve in the hands of the C.R.E., and was assembled in a position of readiness some three miles from the Canal. This Company had with it all the pontoon wagons of the three Field Companies, fully loaded with their pontoons and trestles, for the bridge at Petit-Cambresis, a wagon containing the material for the horse transport bridge at the Lock, and a German wheeled portable bridge carrying two others on its back. Advanced Divisional Headquarters were at Bellevue.

Summary of the Operation.

We have now arrived at the 4th November, the day of the attack. Before the events at the two crossings are described in detail, it seems advisable to give a *résumé* of the whole operation. Zero hour was at 5.45 a.m., and about 7.30 a.m. news was received at advanced Headquarters that the passage of the Canal had been successfully forced at both crossings and that the 1st and 2nd Brigades were advancing to their objectives. Shortly afterwards orders were given to the 26th Field Company to move forward, supplemented almost immediately by another order for a section of that company to proceed to the Lock to reinforce the 409th Field Company, which had been seriously weakened by casualties, taking with it the wagon containing the horse transport bridge and the German portable bridges. A report having been received about 10 a.m. that the site of Petit Cambresis Bridge had been captured by the 2nd Battn. Welch Regt., the 26th Field Company was ordered to reconnoitre this site and shortly afterwards to begin making the pontoon bridge there for horse transport. The operation at Catillon having been successful, the section of the 26th Field Company engaged there was returned to its Company and assisted it in the pontooning. Shortly before 6.30 p.m., the infantry having reached their objective, the following orders were issued:—23rd Field Company to withdraw, leaving a maintenance party at Crossing No. 2. 26th Field Company to continue work on the bridge at Petit-Cambresis and to maintain the bridges and horse transport route at Crossing No. 1. 409th Field Company and Section 1st Australian Tunnelling Company to withdraw.

Zero Hour.

I now want you to picture the state of affairs in the neighbourhood of the Canal during the early hours of 4th November. The Germans, with their machine-gun posts every 50 yards or so along the east bank of the Canal, and, in some cases, on the western bank as well, must, no doubt, have been keeping an anxious watch, feeling sure that an attack was bound to come sooner or later, though not knowing the day nor hour. Our own infantry, crouching down in the dark in their exposed assembly positions—for the days of assembly trenches disappeared with the advent of open warfare—and the sappers silently engaged in putting together their bridges and cutting gaps in the hedges through which to rush them up, must have wondered what the morning would bring for them. As the first faint light of dawn became visible, providentially veiled by a white mist, our men stood to, all their preparations ended. The sappers stooped down to pick up their bridges and punctually at the appointed hour the artillery and machine-gun barrage came down like a crash of thunder on the line of the Canal. The intensity of the fire prevented

the Germans from putting up their heads for a few minutes and in those few minutes our men had picked up their bridges and had carried them down to the Canal. Let us see what happened to them there.

FORCING OF THE CANAL AT THE LOCK.

At the Lock the great possibilities of bridging must have been apparent to the Germans and it was not more than a minute or two before their counter-barrage fell in its vicinity. As it was held by their own men they could not actually shell the Lock itself, and the line of their barrage was about 50 yards to the west of it, though a few shells were dropping short (see *Fig.* 16). To a certain extent our men were already within this line, but still they suffered very heavy casualties. The bridge parties were divided into two groups, northern and southern, and at 5.49, the northern group with two assault bridges and other smaller bridges had encountered a small stream, which was bridged with two of the smaller bridges; one assault bridge had crossed and the second following when the whole party of this second bridge was put out of action by a shell; the first assault bridge and one small bridge reached the stream immediately west of the Lock at 5.50. Here it was evident that, owing to obstructions—such as roots, fallen trees and barbed wire—it would not be possible to find places where two of the smaller bridges could span the stream side by side, and orders were sent for the supplementary bridges, designed for the Lock itself, to come forward at once. Examination showed that the bank south of the ruined house was covered with barbed wire, whereas the bank north of this point was free from it and also afforded a suitable site for placing two of the supplementary bridges side by side; at this place, moreover, the surface of the Lock was clear of debris and so it was selected for the passage.

During this examination of the Canal bank two of the smaller bridges of the southern group arrived and were placed over the stream by men wading up to their waists, and two others arriving shortly afterwards were used in conjunction to form a single crossing.

While this was going on, some infantry scrambled over the bridges and the stream and silenced the enemy post in the ruined house which had been causing a considerable number of casualties by bombs. About five minutes past six, two of the assault bridges had been taken up on top of the lock and their wheels and launching levers were fixed; one of the guys of the first bridge was shot away, but, by lowering it gently, it was put into place at ten minutes past six, and Major Findlay, Commanding the 409th Field Company, followed by two of his N.C.O.'s, crossed over it and rushed a German machine-gun post on the eastern side. The infantry now began to cross and with them smaller bridges for the stream east of the Lock. Other

bridges also arrived for the Lock itself and by half-past six, there were six bridges over the Lock in addition to a German foot-bridge made out of ladders, which was found and utilized. This completed the

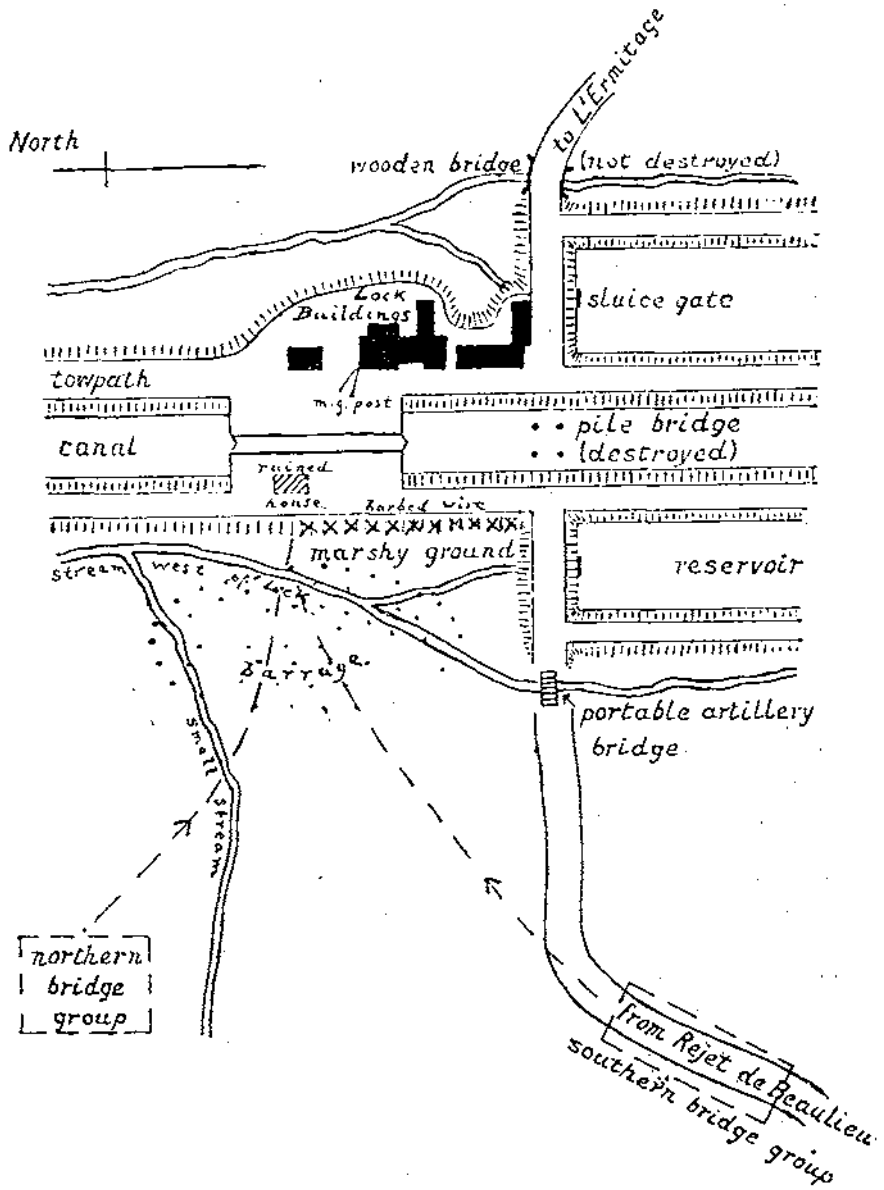


FIG. 16.

programme of infantry bridges, as two of those intended for the Lock had had to be used over the stream west of it. The remnant of 409th Field Company—for casualties had been very heavy—were collected in the cellars of the Lock buildings for a brief rest.

About 7 o'clock the work began again and the pack transport bridges were carried up from a distance of 500 yards, in which work great assistance was given by the drivers of the pack animals which had arrived by this time, and also by men of other units; at half-past eight these bridges had been completed, including screens, and the pack animals began to cross over; as the 409th Field Company had completed the task allotted to them, they were withdrawn to shelter in the vicinity.

About this time the first steel joists for the tank bridge reached the Lock, and this bridge was completed at half-past ten; the successful accomplishment of this task demanded the greatest gallantry on the part of the Australians, for the Germans, realizing that their men no longer held the Lock, had begun to shell it intensely with 8-in. and other heavy shells at about 9 o'clock; this intense shelling continued till about half-past three in the afternoon.

About the time that the tank bridge was completed, the section of the 26th Field Company arrived near the Lock with the material for the horse-transport bridge and the German portable bridges; as has been mentioned already, the former was destroyed by a direct hit by a shell before it was erected, but the latter were successfully placed over the stream west of the Lock; the stream east of the Lock did not require bridging, as the original wooden bridge was found to be intact.

In endeavouring to give a clear account of the very confused happenings which occurred during the forcing of the Canal at this crossing, I have, perhaps, failed to indicate sufficiently the great bravery demanded from the men of every unit engaged in this operation, resisted as they were by every preparation the enemy could make in the way of obstacles, artillery, machine-gun and rifle-fire, but there is no doubt that this successful action was a very fine feat of arms. It is perhaps natural for me to emphasize especially the gallantry of the 409th Field Company; this unit had invariably given the highest proofs of bravery, endurance and good work, but on this occasion they surpassed even their own high standard. During this action they incurred casualties, in killed and wounded, amounting to 50 per cent. of their numbers engaged, while of their officers, every one was killed or wounded; in spite of this dreadful loss, they stuck to their work until it was completed.

Major Findlay, who, though wounded early in the morning, remained at duty until nightfall, was given the Victoria Cross for his extreme gallantry during this operation.

CANAL BEND CROSSING.

We will now see what happened at Crossing No. 2, at the Canal bend, where the 23rd Field Company, under the command of Major

Smith, was responsible for the bridging (see *Fig.* 17, which shows the assembly position, with the routes of the bridges from their concealment up to the Canal.)

At 5.45 a.m. the barrage fell on the line of the Canal and the assault bridges, some 250 or 300 yards from it, were lifted and carried forward. They reached the western bank of the Canal five minutes

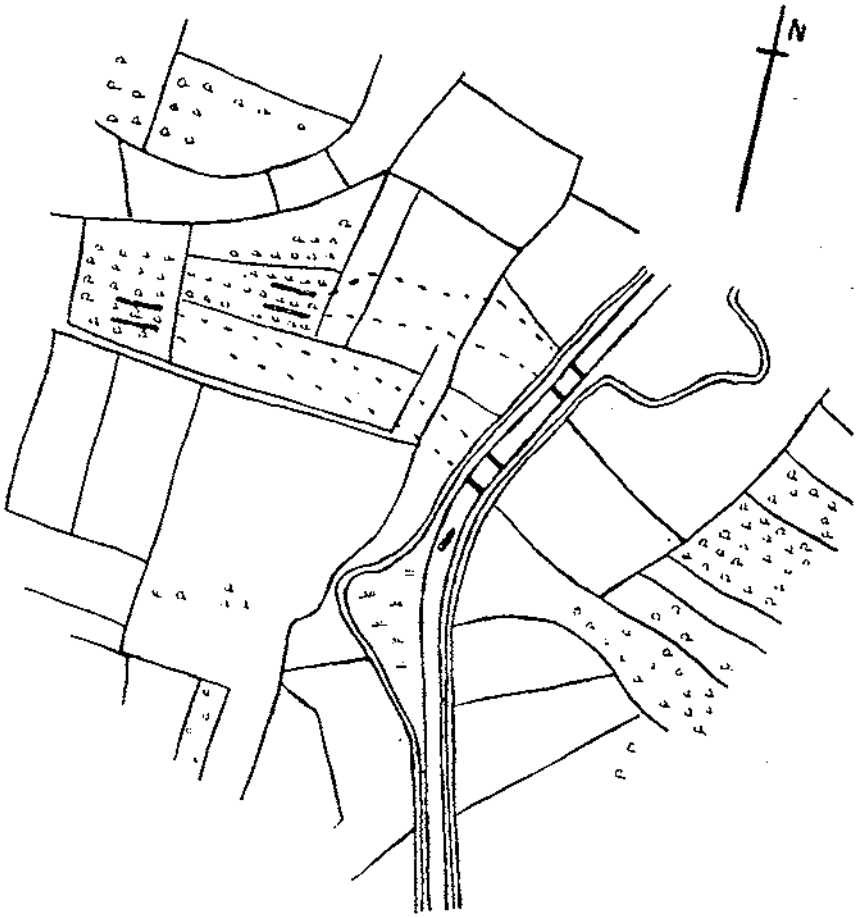


FIG. 17.

later at 5.50 a m.; the party with the southern-most bridge found a German machine-gun post of five men on the bank, just where the bridge would be launched. Sergt. Cook, of the 23rd Field Company, who was in command of this bridge party, rushed this post single-handed, killing three and capturing the other two. The bridges moved forward up the Canal bank and down the other side, and entered the water,

At 5.54, nine minutes after zero, and four minutes after arriving at the Canal bank, Sergt. Cook's bridge was in position and the 1st Camerons were crossing; one minute later the other three assault bridges were also in position.

Each assault bridge carried two sappers at its head, who threw up the storming ladder on arrival at the far bank, went ashore and anchored the bridge. These leading sappers then formed themselves into a party and captured two enemy posts behind the east bank of the Canal.

In addition to the physical differences between this crossing and that at the lock, there was the tactical one that there was nothing to indicate to the enemy the precise point at which a passage would be attempted; it was presumably in consequence of this that there was no hostile shelling during the bridging operation, and casualties were surprisingly light.

Although the assault bridges were in position and the infantry crossing rapidly, the work of the Field Company was not yet completed; the sappers returned to the dump for the supplementary bridges, two of which were found to have been destroyed by shell-fire.

These bridges were much heavier and the distances were considerable; consequently, it was not until 9.15 that ten bridges were in position across the Canal, in addition to a corresponding number of smaller bridges over the streams west and east of the Canal.

SUPPLEMENTARY BRIDGING OPERATIONS.

The story of the bridging operations at sites other than the two assault crossings can be told very briefly. The Section of the 26th Field Company, engaged in the attack on Catillon, was only called upon to repair some German foot-bridges which were discovered practically intact.

The pontooning at Petit-Cambresis proved to be a very awkward job for the 26th Field Company, owing to the extremely thorough manner in which the original bridge and its abutments had been blown up by the Germans and the marshy nature of the surrounding country.

Eventually, a trestle bridge was erected over a huge crater in the road and a pontoon bridge placed well south of the alignment of the original bridge, with long ramps leading down to and up from it.

A lorry bridge had also been meditated here, but, when the site had been reconnoitred and the amount of work involved realized, it was not thought necessary to undertake it, as the semi-permanent bridge for this site, to be erected by the Chief Engineer of the IXth Corps, would shortly be in hand.

Conclusion.

In conclusion I would like to give some idea of the amount of material preparation required for an operation of this nature; the total number of bridges, prepared or erected, and designed to carry loads from infantry in single file up to tanks, was 133, and their total length was 2,414 feet, or nearly half a mile, as shown in the following tabular statement:—

Summary of Bridges prepared or constructed.

Unit by which used.	*No. of Bridges.*	*Designed for Load.*	*Length in Feet.*	*Foot run of Bridge.*
409th Fd. Co., R.E. ...	8	Infantry, single file	23	184
	8	,, ,, ,, ...	16	128
	8	,, ,, ,, ...	12	96
	2	Pack Transport	23	46
	2	,, ,, ...	16	32
	2	,, ,, ...	12	24
23rd Fd. Co., R.E. ...	4	Infantry, single file (steel floats) ...	81	324
	2	,, ,, ,, (petrol tins) ...	72	144
	4	,, ,, ,, (barrels) ...	66	264
	2	,, ,, ,, (cork) ...	60	120
	36	,, ,, ,, (single-span) ...	10	360
	48	,, ,, ,, (ladders) ...	10	480
26th Fd. Co., R.E. ...	1	Horse transport	21	21
	1	,, ,, (portable artillery)	15	15
	2	,, ,, ,, ,,	12	24
	1	,, ,, (pontoon equipment)	51	51
	1	,, ,, ,, ,,	81	81
1st Austr. Tunn. Co., A.E.	1	Tanks	20	20
	133			2,414 ft. or nearly half a mile.

THE TWYDALL REDOUBTS.

By COLONEL H. D'A. BRETON, (late R.E.)

THE reference in *R.E. Journal* for May to the Twydall Redoubts and Lord Sydenham raised a suspicion that you might possibly care to know the history of these works.

They are the relics of a project prepared by a civilian draftsman under the instructions of the officer who was then the "Station Officer" for Chatham at the War Office. The design consisted of a continuous gun parapet with 10-ft. command and a detached infantry redoubt on each flank.

We had by then adopted the glacis slope for Port Defence batteries because of the disruptive effect of heavy Naval projectiles on steep exterior slopes. The principle was applied at Twydall because of the effect produced on some minds by the Russo-Turkish War, and the defence of the Gravitza redoubts, from which it was concluded that the only defence necessary was rifle fire and the addition of passive obstacles was therefore obsolete.

Lord Sydenham was at the time advocating the substitution of "provisional" fortification, which could be applied when war appeared probable, for "permanent" fortification, which was apt to be out of date when wanted, and the construction of the northern redoubt was sanctioned. The contractor was given an entirely free hand, the object of the experiment being to ascertain the least time required for the construction of such a work. The redoubt was begun and completed in three weeks. The cost was, of course, not of the "essence of the contract"!

I visited the work on completion and judged it untenable. A man standing on the terreplein was visible over the parapet towards the right front, there being no attempt at defilade, and I misdoubted the capability of the concrete shelters to stand the shell of the light field howitzer when the howitzer was improved, as it was bound to be, within a few years.

After Chatham affairs were transferred to me, I had to get out the detailed plans for the southern redoubt, and tried, so far as possible, to remedy some of the defects without altering the general design or trace; but I never believed in the design of either redoubt, and remained curious to know how they would stand the test of war. It was therefore interesting to read that the chain of half-a-dozen super-Twydalls, with two-tiered casemates, at Kiao Chao were all carried by the Japanese in one night.

I know the histories practically of all the Chatham works, with amusing instances of how-not-to-do-it.

AN OUTLINE OF THE EGYPTIAN AND PALESTINE CAMPAIGNS. 1914—1918.

By MAJOR-GENERAL SIR M. G. E. BOWMAN-MANIFOLD, K.B.E., C.B., C.M.G., D.S.O., *p.s.c.*

(Continued).

CHAPTER III.

THE WESTERN DESERT OPERATIONS AGAINST THE SENUSSI.

THE WESTERN DESERT OPERATIONS AGAINST THE SENUSSI.—Turkey tries to harass Egypt from the west—The Oases of the Western Desert—The Coastal Plain—Senussi Attack on Sollum—Action at Hazalin, December, 1915—Action at Agagir, February, 1916—Rescue of the Tara prisoners.

AFTER the fiasco of the attack on the Suez Canal in February, 1915, the Turks became fully occupied by the Allied landings in Gallipoli and the British advances up the Tigris. They could then spare no more troops for Sinai to move against Egypt from the east. So they looked to Italian Tripoli to find a means to harass Egypt from the west. (See *Sketch Map* 1).

West of the Nile Delta, the desert is relieved by a narrow coastal plain, inhabited and sparsely cultivated by the Bedouin Arab tribes. This plain was traversed by a standard-gauge railway from Alexandria for 100 miles to Daaba, and thence there existed a cleared track, called the Khedivial Motor Road, to Matruh, Barrani and Sollum (small harbours on the coast). This plain provides camel grazing; it carries a small scrub; the ground is friable and dusty in summer and becomes intensely sticky after rain, which is frequent between December and March. A rocky escarpment rises from the plain on the south, and a table-land of limestone hills and hard desert about 180 miles wide, meets near Siwa the limitless sand dunes of the Libyan Desert. Siwa is the gateway to a series of oases (Baharia, Farafra, Dakhla, Khargha) which lie about 100 miles west of the Nile valley. That cultivated valley presented a frontier, some 800 miles long, exposed to raids from these oases.

The Mohammedan nonconformist sect, known as the Senussi, was founded by a religious leader in 1835. Its centres of influence lay mostly in the great oasis of Kufra and at Siwa, and its outlet to civilization was through Tripoli. The sect had many adherents in Egypt, too, particularly in the Fayum, Behera, and in the coastal plain. Under the Turks, the Senussi were quiet, but when the Italians took over Tripoli and restricted their caravan trade, they became hostile and supported the Turkish cause. They therefore were susceptible to fresh Turkish propaganda.

In the spring of 1915 Jafar Bey, or Pasha, was sent to the Senussi with arms, and bearing a letter from the Kaiser to their leader, Sayed Ahmed. The Tripoli coast had convenient coves for landing, and further consignments of munitions and money were conveyed by submarine from Greece. The movement took form in May; the Senussi tribesmen were drilled, and furnished a tolerably regular force, which by the autumn of 1915 numbered about 5,000 riflemen, with a few machine-guns and 10-pdr. mountain artillery with camel transport. In November, the Senussi displayed open hostility. They carried off captive the shipwrecked crew of H.M.S. *Tara*, which had been torpedoed near Sollum; and on 6th November, they shelled Sollum itself, and raided in the coastal plain.

This movement of the Senussi alarmed the authorities in Egypt. Our deadlock in the Dardanelles had reacted unfavourably there. Egypt had been drawn on for troops, for stores, and for native labour, and she was encumbered with the wounded. The Egyptian began to give ear to the Senussi agitation, supported as it was easily from within by strong Turco-German propaganda. A rising in Egypt was feared.

Action at Hazalin.—General Sir John Maxwell withdrew the Egyptian garrisons from Sollum and Barrani, but held on to Mersa Matruh and Daaba. A composite force of British, South African, New Zealand and Indian troops, under Major-General Wallace, was assembled at Matruh to cover the western flank of the Nile Delta. The Senussi occupied Sollum, moved on to wells near Matruh, and raided the Daaba–Alexandria railway. General Wallace drove them off on 13th December, and again on 25th, but was not able to follow up. The Senussi forces withdrew to Hazalin, about 25 miles south-west of Matruh. More troops were concentrated, and on 23rd of January, 1916, General Wallace set out from Shola (16 miles west of Matruh) to engage the enemy. The night had been wet. Our force marched at 0600 hours in two columns:—

Right Column.—One squadron, Notts Battery, R.H.A.
Three battalions (15th Sikhs, 2nd S. A. Regt., 1st Batt. N. Z. M. Brigade.) These moved by compass-bearing, direct on Hazalin.

Left Column.—Six squadrons, M.G. Section, Battery, H.A.C. On the left front of the infantry.

Reserve.—Two troops Yeomanry, half-battalion, Royal Scots.

The enemy were encountered about nine miles out. They held a front of some 1½ miles, approached by quite open ground; and a heavy mirage rendered observation difficult. At 1000 hours the 15th Sikhs advanced to attack, supported by the other two battalions. The enemy steadily fell back for three miles, and about noon began seriously to threaten our right flank. About 1330 hours the mounted troops also were being pressed until infantry

got up to support them. But, by 1530 hours, the infantry had overrun and burnt the hostile camp, and the tribesmen drew off, and the action terminated indecisively. The weather was miserably wet and cold. The train was stuck in the mud nine miles away, and the troops spent the night in the rain, devoid of supplies, shelter, or blankets.

Next morning the column marched back to Shola, most of the wounded carried by hand, and the troops dragging their first-line transport, until they came up with the supply train about mid-day. Our casualties were 12 killed, 291 wounded; the enemy casualties were estimated at 200 killed, 500 wounded.

After this affair the Senussi became active in the oases bordering the Nile; and, lest they should invade the Nile valley, the 53rd Division and five brigades of Yeomanry (dismounted) were tied up in garrisons between the Fayum and Assuan. All the Senussi in these oases would have been cut off if we could have occupied Siwa; but, at this time, this was not considered possible.

Action at Agagir.—After the action at Hazalin, Major-General Peyton relieved General Wallace, and further steps were taken to oust the Senussi from the coastal plain in order to reoccupy Barrani and Sollum.

A depôt of supply was formed at Amgeila, about 50 miles west of Matruh; and, on 20th February, a column under Brig.-General Lukin was sent out from Matruh to attack the Senussi assembled near Barrani.

General Lukin's column consisted of:—

3 squadrons Dorset Yeomanry,
1 squadron Bucks Yeomanry,
1 battalion Royal Scots,
2 battalions South African Brigade,
1 battery Notts R.H.A.

After three days' marching, the column halted on 25th February in the Wadi Maktilla, and the enemy were located nine miles off, at Agagir, 14 miles south-east of Barrani.

They were about 1,500 strong, with three guns and five machine-guns. At 0600 hours on 26th February, General Lukin moved on; the Senussi stood until the infantry attack came on—when they broke, and their position was captured by 1400 hours. The pursuit was taken up by the Dorset Yeomanry, who charged the retreating column, with the result that the enemy lost heavily, were completely scattered, and Jafar Pasha was captured. Barrani was reoccupied next day. After replenishing, the column moved on, and retook Sollum on 14th March. Here, the armoured cars cut off all the enemy's artillery and transport. On 17th March, an armoured car detachment, under the Duke of Westminster, set out to try and find the camp in which the crew of H.M.S. *Tara* had been imprisoned.

After travelling over 116 miles of unknown wastes, they hit on the camp and brought back some 40 survivors of the crew. The cars covered 240 miles of desert in 24 hours.

CHAPTER IV.

THE SECOND TURKISH ATTACK ON EGYPT—THE BATTLE OF ROMANI. THE BRITISH ADVANCE TO EL ARISH.

THE SECOND TURKISH ATTACK ON EGYPT—BATTLE OF ROMANI—BRITISH ADVANCE TO EL ARISH.—Difficulties of the *Entente* Powers at the End of 1915—Lord Kitchener's visit to Egypt—Evacuation of the Dardanelles—Complex Command in Egypt early in 1916—Formation of the Egyptian Expeditionary Force—Postponement of the Turkish Operations against Egypt—Revision of the scheme for defending the Suez Canal—Sir Archibald Murray's decision to occupy the Romani-Katia area—Release of 150,000 Troops from Egypt for other theatres—Turkish raids on Katia and Dueidar—Employment of mounted troops in the Sinai Desert—Advance of 18,000 Turkish troops into Sinai—The Battle of Romani, 3rd–4th August, 1916—Turkish plan of attack—The British counter-stroke—Difficulties of pursuit—Traffic over Sand; the palm leaf and the wire roads.

OTHER EVENTS IN THE EGYPTIAN THEATRE IN 1916.—Revolt of the Arabs of the Hedjaz—Defeat of the Sultan of Darfur—Occupation of Siwa Oasis—Advance of the E.E.F. to El Arish—Actions at Maghdaba and Rafa—Extension of the Military Railway—The Lines of Communication.

IN the latter half of 1915, things had not gone well for the *Entente* Powers. Germany had broken into Russia. The Austrians had overrun Serbia. Bulgaria had declared against us. Greece was looking askance at us. The Salonika expedition was having a very anxious time. Mesopotamia was our bright spot. At the end of October, General Nixon was authorized to move on Bagdad, and General Townshend, with the remains of the 6th Division and a cavalry brigade, pushed up the Tigris to Ctesiphon, 11 miles from Bagdad. But the Turks, no longer so pressed in the Dardanelles, had sent down 30,000 men, and on 22nd November General Townshend was checked, obliged to retreat, and hemmed in at Kut.

Lord Kitchener had visited Egypt early in November, and after this, the scheme of defence on the Suez Canal was entirely recast. Instead of allowing the enemy to approach the canal itself, he was in the future to be engaged in the desert. The canal was to be immune from long-range artillery fire. A line of strong posts and almost continuous entrenchments was laid out eight to ten miles east, parallel to the canal. To execute this work, metalled roads, railways, and pipe-lines, had to be built out into the desert from eight to nine points on the canal; and an immense amount of material and labour was expended. (See *Plate* IV.).

In December, 1915, at Gallipoli, Suvla and Anzac were evacuated. Just then, an intended Turkish attack in force on Egypt was widely reported; in fact, so aggressively was it advertised that it seemed to be overdone, and the information spread to mislead us. However, the troops from Gallipoli were brought to Alexandria to re-equip, and, to cope with the Turks, fresh divisions streamed out to

Egypt from home. In February, 1916, we had some 13 infantry and mounted divisions there, nearly 400,000 men. Egypt, in fact, had become a rendezvous, and contained the general strategical reserve for the whole Empire.

Formation of the Egyptian Expeditionary Force.—The command and administration in Egypt at the end of 1915 was in a complex state. General Sir John Maxwell was in command of the "Force in Egypt." But, the War Office had a branch organization, mainly of Q.M.G. directorates, called the "Levant Base." This dealt with Salonika, Gallipoli, Mesopotamia, and India, independently of Sir J. Maxwell, and was controlled by General Altham. On the top of these two, there arrived the "Mediterranean Expeditionary Force" from Gallipoli, and the reinforcing divisions from the United Kingdom, with Sir Archibald Murray as Commander-in-Chief, and also independent of Sir John Maxwell. Thus, an extraordinary triangular situation existed. A dividing line about Zagazig separated the command of Sir Archibald Murray from that of the "Force in Egypt." G.H.Q., Mediterranean Expeditionary Force was at Ismailia; G.H.Q., Force in Egypt, at Cairo; H.Q., Levant Base, at Alexandria. Such complexity could not long continue. General Altham became the Inspector-General of Communications under Sir Archibald Murray. The Levant Base disappeared as an independent administration. Sir John Maxwell proceeded home; and, on 19th March, 1916, the Mediterranean Expeditionary Force and the Force in Egypt were amalgamated to constitute the Egyptian Expeditionary Force.

During December, 1915, and January, 1916, the concentration of troops in Syria was confirmed. Their numbers were estimated at 250,000, and the Turks were seriously at work developing the water supply in Sinai and extending the railway from Beersheba. The German Flying Corps with the Turks was increased, and our machines were outclassed all through 1916. In Mesopotamia, too, the Turks were very alert. General Townshend was shut in at Kut, the 3rd and 7th Indian Divisions from France, and the 13th Division (General Maude's) from Egypt, were diverted to the Tigris. Two attempts to relieve Kut, in January and March, failed.

The Western Desert Arabs, who had been driven off the northern coast of Egypt, but who were still assisted with arms and money conveyed by submarine through the Italian Tripoli coast, were still troublesome. And, in March and April, they invaded the oases of Farafra, Dakla and Khargha, and threatened the Nile valley. The Sultan of Darfur also was drawn in; Ali Dinar repudiated the suzerainty of Egypt, and raided into the Sudan province of Kordofan. In fact, in the spring of 1916, the Turk had made Egypt anxious for her frontiers on all sides.

But, the Grand Duke Nicholas' invasion of Armenia, and capture of Erzerum in February, and later of Trebizond, obliged the Turks

to draw reinforcements largely from Syria; and their forces there became reduced from 250,000 to 60,000 in March, 1916, and their offensive towards Egypt was delayed.

Occupation of the Katia-Romani area.—Sir A. Murray had been directed to maintain as active a defence as possible, compatible with ensuring that no formed bodies of the enemy came within artillery range of the Suez Canal. And, as soon as he settled into his G.H.Q. at Ismailia, he reviewed the existing plan left by Lord Kitchener in November. The whole front was reconnoitred, and especially the area about Katia-Romani. It became clear that this water-bearing area offered far greater accommodation for large numbers of troops than had been previously realized. It was essential to any enemy advance in strength against Egypt. It afforded a place of assembly within two marches of the Suez Canal. Besides, it was established that Kossaima and El Arish wells were the two key points to the Sinai desert. It seemed preferable to guard the 45 miles between these points with mobile troops, rather than to anchor some 11 divisions in the Suez Canal fortifications, over 80 miles long. The desert may be a formidable obstacle, but it also affords a valuable screen for the enemy's moves.

Sir A. Murray decided as a first step to deny the Katia-Romani area to the enemy, and to occupy it at once. A force of a division of infantry, and another of mounted troops there, would enable the elaborate fortified belt in the desert to be abandoned, and the troops in Egypt to be reduced. As a first step, Yeomanry were moved out to the wells at Katia. Sir A. Murray proposed to reduce to seven the 13 divisions then in his command—six divisions were re-embarked for France, Salonika, or Mesopotamia by the end of March, 1916.

At this time steps were taken to assemble three Australian and New Zealand mounted brigades into one formation—the Australian and New Zealand Mounted Division. This division concentrated at Salhia early in April, and four T.F. Horse Artillery batteries furnished its artillery.

On 11th April, a reconnaissance and raiding column set out from near Ismailia to Jifjaffa—52 miles. (One squadron, a light horse regiment, some Bikaneer Camel Corps, Engineers, a pack wireless set, and camel transport.) The enemy post at Jifjaffa was surrounded, 16 Turks were killed, the Austrian officer in charge and 33 others were captured, and the camp and water boring plant destroyed. Our losses were one man, one horse killed. The column covered 120 miles in three and a half days, and the utility of cavalry for desert work was fully established.

A railway was necessary for the supply of the divisions destined for the Romani area. The standard gauge was decided on, fortunately; for a narrow gauge would never have sufficed for the subsequent traffic. The local water was supplemented by a pipe-line for Nile

water as the former had proved unsuitable for British troops. These works were commenced in April. This small beginning opened the offensive from Egypt. The initiative passed to us, which took us on, through Palestine and Syria, to the Taurus and Upper Euphrates.

The Turks now undertook one enterprise. On 24th April at 0500 hours, a flying column of 2,000 Turks, stiffened with Germans, successfully surprised our advanced posts at Oghratina and Katia. In all, three squadrons of Yeomanry were captured. A similar surprise by 1,000 Turks against Dueidar, held by a mixed detachment of Royal Fusiliers and Indian troops, totally failed. The enemy left 70 dead and 25 prisoners in our hands. We have it on German authority that the object of these big raids was to demonstrate to our leaders the danger to the Suez Canal, and to discourage the withdrawal of divisions from Egypt. But, Sir A. Murray had already sent away 150,000 men.

During the hot weather, from May to July, numerous long-distance reconnaissances and raids were undertaken by detachments of mounted troops, and much experience was gained. The conditions were arduous. The travelling was all over sand and rocks. The heat was often intense, especially during the periods of scorching Khamsin, or sandstorm. The only shelter were the scattered palm groves—called Hods. Water was the greatest difficulty. The Arab wells were always fouled, and unfit for our use, and often were too saline for horses. The horses had to be acclimatized to go unwatered for long periods; often 24 hours, occasionally as much as 60 hours. On the flat desert, horses got along well; but, in the big sand dunes, they sank up to the hocks. Generally, vehicles were given up and camel transport used. Guns were moved by means of pedrails—a device akin to the "Parsons' chain" for motor tyres—consisting of stout squares of planking, 2½ in. by 12 in. by 12 in., linked to each wheel by two circumferential chains. Teams were eight horses, one pair wheelers, three in the centre, and three leaders.

The second Turkish advance.—From June onwards, the Turks—no longer anxious about Bagdad—proceeded with their greater attack on the Suez Canal. Germany and Austria gave effective help, especially in aircraft and howitzers. The first step was to evict us out of the Katia–Romani ground. The expedition was led by Kress von Kressenstein, the Bavarian colonel who had previously organized the 1915 attack.

The Turkish force consisted of the 3rd, and part of the 23rd Divisions (15 battalions), two batteries of mountain artillery, heavy artillery (which was late in arriving), Engineers, and two companies of Camel Corps..

In all, about 18,000 men set out from Shellal, near Beersheba, on the 9th July, and, marching rapidly 120 miles, were in Abd and Oghratina by the 19th July. Here they remained in the palm

groves, moving little. It was obvious that either they were awaiting more echelons, or they intended to stay to block our further advance. As soon as the Turks appeared at Abd, they were kept under close observation by the 2nd Australian Light Horse Brigade, whose orders were to watch, harass and delay any advance; to cover the right or southern flank of the infantry back at Romani; and, when opportunity offered, to envelop the left flank of the Turks.

The 1st Australian Light Horse Brigade took turn at this task. Sir A. Murray at once prepared to take the offensive, so as to be ready by full moon on 13th August.

On 3rd August, the Turks occupied Katia and Rabah, and pushed back our screen of mounted troops. The 2nd Australian Light Horse with two regiments covered the three-mile front from Khatib Gannit to Hod el Enna, leaving one regiment in reserve at Romani.

Battle of Romani.—The troops in this left section of the Canal defences were commanded by Major-General H. A. Lawrence at Kantara. He had the 52nd and 42nd and Australian and New Zealand Mounted Divisions, and some Yeomanry (seven infantry brigades, six mounted brigades, nine batteries), altogether about 30,000 men. Three of the four brigades, with the 52nd Division in front, were entrenched on a seven-mile position, facing east, from Khatib Gannit to the sea at Mehemdia. Five battalions were in general reserve south of the railway, about Etmaler. The mounted troops formed a line along the sand dunes, facing south, parallel to the railway. The brigades of the 42nd Division were echelonned along the railway from Kantara to Pelusium. General Lawrence's intention was to await the Turkish attack, involve the enemy in the heavy sand, and counter-attack with the 42nd Division and dismounted troops.

Von Kressenstein's plan, broadly, was to hold us in front, and to drive in our right, and cut in on the railway between Kantara and Romani. At midnight, on 3rd–4th August, the Turks advanced, supported by artillery about Bir Abu Hamra. Our right extended south further than they knew; and their troops, intended to interpose behind our Romani force, lost touch with their main attack, and got involved in very heavy ground, as our commanders expected. The Turkish frontal attack gained some ground at first, but the British counter-attack from the direction of Mt. Royston, Dueidar and Pelusium was successful. The enemy fell back in disorder, especially his left. The mounted troops were sent in pursuit, but the difficulties of ground, weather (August) and water, were too great for them; and the infantry could not follow up effectually. The Turks, well covered by rearguards, rallied at El Abd, and turned on the pursuers and checked them. The enemy lost about 5,000 killed and wounded. The British took about 4,000 prisoners.

In comparison with February, 1915, this attack was a disaster for the Turks. Von Kressenstein had lost 50 per cent of his force

and much material. The British kept the initiative, and Egypt was never threatened again.

In this advance, the Turks brought up their heavy guns by spreading palm branches and mats on the sand. At the same time the British began to develop the "wire road," made of two layers of rabbit netting, 12 to 16 ft. wide, tightly pegged out at the sides. Infantry, cycles, and Ford cars travelled easily over sand covered with this wire; but mounted troops, or ordinary touring cars destroyed it. Hundreds of miles of such road were put down during 1917 and 1918.

Other events in the Egyptian Theatre during 1916.—In June, 1916, the Sherif of Mecca, long restive under the rule of the Turks, led the Arabs of the Hedjaz in revolt. Jeddah was taken on 12th June, Mecca soon after, and Taif surrendered on 23rd September. Only Medina resisted, and was blockaded by the Arabs.

In the Sudan, Sir R. Wingate sent a force under Colonel Kelly to settle with Ali Dinar, Sultan of Darfur. The Egyptian Army troops defeated the Sultan's army, about 5,000 strong, outside El Fasher on 23rd May. Ali Dinar escaped with 2,000 men, but was followed up and killed on 5th November. In the western desert the Western Frontier Force penetrated to the Baharia oasis on 19th October, and then occupied in turn all the western oases and eradicated the pro-Turk element. The chief Senussi leader fled to Siwa just before our troops entered Baharia.

The oasis of Siwa was the key to all the western desert oases, and hitherto it had been considered inaccessible to attack in force. Siwa lies 200 miles from the coast over a hard but waterless desert. The experience gained in the previous two years with Rolls Royce and Ford cars had proved that such deserts could now be negotiated with suitable mechanical transport. A column under General Hodgson was formed and equipped with armoured cars, Ford vans, and light lorries. These crossed the 200 miles of desert in a few hours, drove the Senussi out of Siwa, and occupied that oasis on 5th February, 1917. This finally settled the Western Desert trouble.

After the Battle of Romani, Sir A. Murray decided to clear the Sinai Peninsula of Turks and to reoccupy El Arish. All the troops on the east of the Suez Canal were placed under Sir Charles Dobell, and constituted the Eastern Force. The 42nd, 52nd and Australian and New Zealand Mounted Divisions under Sir Philip Chetwode were formed into the Desert Column to advance on El Arish. This advance was to be deliberate, accompanied by the standard-gauge railway, and a 6-in. pipe line from Kantara. Subsequently, a 12-in. pipe was ordered from America.

The railway advanced about 20 miles a month. El Abd, Salmana, and Mazar were occupied in turn; and just as the Desert Column was about to attack El Arish, the Turks evacuated it on 20th December and retreated up the Wadi el Arish. The British Forces

occupied El Arish at once, and the Australian and New Zealand Mounted Division pursued and surrounded the Turks at Maghdaba on 23rd December, and captured the bulk of their troops.

The Turks also had garrisoned and entrenched the old frontier post at Rafa. This entrenchment was surprised by Sir P. Chetwode's Desert Column on 11th January, after a 29-mile night march. The garrison resisted stubbornly; reinforcements were hurrying down to them from Shellal, and our open flank was threatened. The New Zealand Mounted Rifles stormed the main redoubt, and then the rest of the Turks surrendered. The Desert Column took 1,000 prisoners, and withdrew to El Arish.

The Turks now abandoned the defensive position at Weli Sheikh Nuran in front of Shellal. The Desert Column remained about El Arish during January and February while the railway was being brought up. The advantage of sea power and communication was now reaped, for El Arish drew part of its supplies by sea, landed on the open beach.

Comments.—It is worth noticing that the operations in the North-Western, and Sinai Deserts were carried out under very differing conditions. In the former case, the troops were scratch formations, far from their base, ill-equipped, precariously supplied, and floundering in mud and water. They engaged the enemy and beat him, but were unable to pursue so as to reap the fruits of victory. In Sinai, at Romani, the troops were in proper formations, they had a railway; all the resources of Egypt were at their elbow; their physical difficulties were drought and sand. The mounted troops were able to pursue, and large captures were made, but the infantry were unable to back up their mounted troops, so that the pursuit was soon checked, and after four days of anxiety, the enemy was able to retire unmolested with most of his artillery. Later on, the advance became deliberate, depending for progress upon the railway construction, and the opportunity arose of the mass employment of mounted troops in cutting off retreating forces, as at Maghdaba, and in cutting out an isolated detachment, in the case of Rafa.

The Lines of Communication.—A detailed description of the remarkable services organized for the advance through Sinai, and into Palestine is beyond the scope of this narrative in outline. The following, however, contained features of peculiar interest a few of which can be touched upon.

The Military Railway was constructed, operated and maintained by Railway Companies, R.E. Much assistance was furnished by the Egyptian State Railways; rolling stock was lent, branch lines in Egypt were pulled up to provide rails, sleepers and bridges, and the workshops of Bulac did most of the heavy repairs for locomotives and vehicles. All the heavy labour was furnished by the Egyptian Labour Corps, whose railway companies (at one time 26,000 men) became skilled in bank work and track-laying. The line, of standard

gauge, was carried along at a rate of about 20 miles a month—as much as two miles being sometimes completed in one day. From Kantara to the Wadi Ghuzzee the line was 140 miles long, and the branch line from Rafa to Shellal 17 miles. When Palestine was entered, the Turkish railway of 3 ft. 6 in. gauge had to be adapted for our use; and ultimately it was converted to standard gauge (4 ft. 8½ in.). Light railways were built in front of Gaza, and later on used extensively in Palestine. These lines were of 2 ft. 6 in. and 60-cm. gauges.

The water supply of the troops depended upon the development of wells, and conveyance of the water by train, by camel convoy, and by pipe-line. Moreover, the water thus provided had often to be filtered and chlorinated. In the coastal area of Sinai, water is generally obtained by digging shallow wells in the sand close to the sea shore, or in the wadi beds. The supplies thus procured are scanty and saline. This water served for the animals, but it was unsuitable for constant use by troops; and even the railway locomotives could not use it without loss of efficiency. At first, Nile water was brought out by train. Then pipe-lines—6 in., 8 in., and 12 in.—were laid and followed railhead from Romani to Deir-el-Belah. The water was distributed to the troops by camel convoy from railhead; each camel carried two 12½-gallon tanks, known as *fanatis*. Much water development was done in the vicinity of the Wadi Ghuzzee. Large reservoirs were built at Deir-el-Belah, Tel-el-Jemmi, Abu Sitta, Khan Yunus, Shellal, and Rafa. A quarter of a million gallons of water daily were available for supply to the troops in October, 1917, and could be transferred by large pipe-lines to the distribution centres in need of it.

The Camel Transport Corps in 1917 amounted to 35,000 camels, organized in companies, each of about 2,000 camels. These companies were employed as first-line transport with Corps, or further in rear for convoy duty, bringing up supplies and stores from railhead to the fighting troops. The casualties in 1917 in camels were about 9 per cent.; and again the camel showed his capacity for work under varying and adverse conditions, and his imperturbability under shell-fire. Donkey transport also proved very useful. Four companies, each of 2,000 donkeys, were formed, and the Egyptian donkey proved to be hardy and reliable on service.

The Egyptian Labour Corps provided over 55,000 labourers during 1917. The company organization was adopted, but the working unit was the "gang" of 50 men with headman; 12 gangs formed one company and, as a rule, the men of a gang all belonged to one village. The work carried out was very varied in character. The E.L.C. made the roads, laid the pipe-lines, built the railway embankments, loaded the trams, manned the surf boats, stowed or discharged the cargoes of supply and store-ships, and were employed everywhere on conservancy duties. Every service and department gratefully made use of this valuable Corps.

CHAPTER V.

PALESTINE: THE FIRST OFFENSIVE. THE FIRST AND SECOND BATTLES OF GAZA.

PALESTINE; THE FIRST OFFENSIVE. FIRST AND SECOND BATTLES OF GAZA.—Various events early in 1917—The Capture of Bagdad—Russian Revolution; Need for pressure on Turkey—The Sykes-Picot agreement with France—Natural Features of the South Palestine Frontier—The Wadi Ghuzzee—Beersheba and Gaza—First Battle of Gaza—Attractions of a *coup de main*—Plan for the envelopment of Gaza—Capture of Ali Muntar and Green Hill—Decision to withdraw the Mounted Troops—Relief of Gaza—Second Battle of Gaza—Increased strength of the position—General Plan, Two stages—The first successful, the second checked—Further attack postponed—Railway developments—Destruction of the Auja-Beersheba Line—Observations: Results of Sir A. Murray's offensive—Arrival of Sir Edmund Allenby.

Events in Mesopotamia, etc., early in 1917.—Simultaneously with Sir A. Murray's advance to the border of Palestine, General Maude, in Mesopotamia, had struck at the Turks at Kut on 13th December. The Turks there were kept very busy in January and February, 1917, so that their High Command were not disposed to reinforce their Palestine front. (See *Plate* V.).

On 24th February, the Turks were driven from Kut; and a fortnight later General Maude had evicted them from Bagdad; and the loss of Bagdad was an immense blow to Turkish pride, prestige and resources. In order to keep up the pressure on Turkey, and especially as Russia was in difficulty and faced with revolution, our higher command now decided on a further advance into Palestine; and Sir A. Murray was directed to press the Turks to the utmost—and directly.

The French took special interest in Palestine and Syria, and, as soon as it was decided to enter Palestine, it became necessary to arrive at a clear understanding with France, and delimit the extent of her territorial interests. Sir Mark Sykes, who had made a study of the political problems of Mesopotamia and Syria, and M. Picot, formerly French Consul at Beirut, were empowered to confer. The agreement which they arrived at has since been the subject of much controversy. Broadly, under this agreement, Great Britain got a free hand in Palestine, and a French contingent of all arms was to be attached to the Egyptian Expeditionary Force. The French territorial interests in Syria were recognized by us, but the agreement did not take into consideration—sufficiently to satisfy the Arabs—the possibility, which afterwards arose, of the formation of a separate Arab State centred in Damascus. The Arab movement at that time (May, 1917) was in a very nebulous condition.

Natural Features of the South Palestine Frontier.—Palestine is made up of a great mountain ridge running north and south, rising to 3,500 ft. On the east it falls very steeply to the trough of the Jordan and the Dead Sea. On the north and west the spurs run down gradually to the three great plains of Esdraelon, Sharon, and Philistia. The mountain ridge has been compared to the skeleton of a flat fish. All the spurs run out at right angles to the

main ridge or back bone, and render very difficult the advance of a large force along it through Judea and Samaria. Only one road traverses this mountain ridge from north to south, passing through Nazareth, Afule, Nablus, Jerusalem, and Hebron, to Beersheba; and one road runs across it from west to east from Jaffa, through Jerusalem to Jericho.

The coastal plain of Philistia, on the south-west and south of the Judean Hills, is for the most part rolling downland. It has ample water for local needs from wells, and a regular rainfall from November to March. It is under crops from April to June. The inhabitants are partly Arabs with flocks, and partly village Fellahin.

There are many tracks over this area which, in dry weather, are passable for vehicles.

The principal roads over the Plain of Philistia are :—

(*a*) Jaffa–Ramleh to Gaza, keeping near the coast;

(*b*) Jerusalem to Gaza, *via* Latrun;

(*c*) Gaza to Beersheba.

All these roads were metalled in parts, but unfit to carry heavy traffic. The plain is about 15 to 20 miles across, but widens between Gaza and Beersheba to some 35 miles, and then merges into the Sinai Desert in a sandy scrub, with sparse cultivation when the soil admits.

The Judean Hills drain across the Plain of Philistia to the Mediterranean, and cut a series of deep *wadis* (dry in summer). The most important of these enters the sea six miles south of Gaza and, running north-west for the last 25 miles of its course, is known as the Wadi Ghuzzee. Its extensions penetrate far inland. The wadis Saba and Khalil run past Beersheba and skirt the Hebron road. Two other branches, the wadis Sheria and Khalassa, provide alignments for the railway to the north and the road to the south of Beersheba, respectively. The Wadi Ghuzzee resembles the Wadi el Arish in its spates; but they are more violent in character. The banks are usually precipitous, its bed is 100 to 300 yards wide and often stony. Water is obtainable in it by digging, especially near the coast, and there are perennial springs at intervals: Shellal, Tel el Jemmi, etc.

Beersheba and Gaza are the two historical gateways into Palestine. Gaza, in particular, has seen many armies pass over it, and has endured many sieges and sacks. The city of Gaza is built on a plateau about 200 ft. high, about two miles inland, and separated from the sea by a belt of sand hills. On the north-east and east are cultivated downlands, whose ridges at first tend to run parallel to the coast. The country becomes rocky and arid by Sheria as the foothills of the Judean range are approached. The Gaza plateau is irrigated on the south and south-west of the city, and the plots and paths are surrounded by dense cactus hedges. On the south-east and south-west are two prominent features, Ali Muntar and Samson Ridge, re-

spectively. The former is a conical hill, dominating the surrounding plateau and the city. Samson Ridge marks the boundary between the sand dunes and the cultivation. To the south of Ali Muntar, over some 5,000 yards of open ground lie the Mansura Ridge, and Sheikh Abbas, whence the ground falls to the Wadi Ghuzzee, and it becomes much intersected and water-worn. At Sheikh Abbas, the ridge turns south-east and so the high ground forms a salient.

Across the Wadi Ghuzzee, the hills of Inseirat rise sharply to about 400 ft., and are scored with lesser watercourses, which afford good cover from view. All the ground, except in the sand hills by the coast, is easy to dig in and stands up well while dry. The country between Gaza and the Wadi Sheria offers little obstacle to mounted troops, but is almost devoid of water.

The First Battle of Gaza.—In the middle of January, 1917, the troops about El Arish comprised the Australian and New Zealand Mounted Division, and 42nd, 52nd, and 53rd Divisions. Besides, we were raising in Egypt the 74th Division and the Imperial Mounted Division. The 42nd Division was under orders to go to France, but was to be replaced by the 54th Division. The whole were known now as the "Eastern Force," under Lieut.-General Sir Charles Dobell.

The situation was remarkable. The Turks still held Auja and Kossaima, about 50 miles up the Wadi el Arish, with some 4,000 men by means of their light railway from Beersheba and Shellal, based on the Afule—Junction Station—Beersheba main line. They had only small detachments in Khan Yunus, Gaza, and Huj, and about Ascalon—where a landing was feared. The Desert Column had successfully mopped up their outpost at Rafa, and had fallen back to near the Wadi el Arish.

The positions of El Arish, Rafa and Gaza, relative to Kossaima, Auja and Beersheba are interesting. The distance from El Arish to Gaza is no more than from Kossaima to Beersheba; but, if the British could secure Gaza, they would have got behind the Turks' base at Beersheba, and the enemy would have to abandon South Palestine. Gaza was a tempting morsel, but it must be taken by a rush movement.

Just then, Sir Charles Dobell was unable to maintain his troops much beyond El Arish. The railway was not beyond the Wadi, and the available camel transport had only provided for the first line needs of the fighting troops in the heavy sand along the coast. No further move could be made until supply depôts had been built up, and train was improvised. But the aspect of the country was changing; the sand dunes were merging into gravel plains and sandy soil, passable for horsed vehicles and light motor transport. Water, too, was plentiful at Rafa and Khan Yunus, and in large pools on the Wadi Ghuzzee, and at Deir el Belah in a great lake.

The raid on Rafa alarmed the Turkish command. By the end of

January the enemy cleared out of Auja, and put 5,000 men into Gaza. Besides, they had prepared an entrenched position on a regular glacis facing south-west in front of Shellal. But for all this, Gaza still offered an attractive objective for a *coup de main*.

Sir A. Murray decided to continue the advance by the coast, rather than by Beersheba. He had to cover the construction of the railway, and for this must occupy the line of the Wadi Ghuzzee. At the end of February, after the Desert Column had made a reconnaissance to the Wadi, the Turks abandoned the position they were preparing in front of Shellal; and it seemed likely they would also evacuate Gaza, as they had done at El Arish. The Commander-in-Chief determined, therefore, to advance rapidly on Gaza, as soon as the transport for the move could be ready, and when the railway reached Rafa in the middle of March. He would thus secure the Ghuzzee line, bring the Turks to battle, and, it was hoped, capture the garrison of Gaza. To increase the radius of action of the divisions, 15 improvised trains were assembled; a mixed assortment, consisting of:—

7 camel trains, first line transport (55 camels; 72 tons each train.)
6 divisional trains (72 limbered G.S. wagons; 72 tons.)
2 mixed horse and motor transport (70 tons each train.)

Secrecy and celerity were the essence of the intended operation. The aim was to capture and occupy Gaza before relief could arrive. The supply trains would admit of one day being devoted to the action, no more. If the coup did not come off, the troops must withdraw to be within reach of their food and ammunition. Once in Gaza there was plenty of water, and the force would draw supplies by sea.

The plan was to send the mounted troops across the Wadi Ghuzzee to the east and north-east of Gaza, to hold off reinforcements and to hem in the garrison. The 54th, 53rd and 52nd Divisions were to push into Gaza from the south and south-west, from Ali Muntar to Samson Ridge. A detachment advancing up the coast was to cover the left flank. (See *Plate* V.)

The divisions were unostentatiously assembled, between Sheik Zowaid and Rafa, by 24th March. Next day, they were concealed in the groves round Khan Yunus; and on the evening of 25th March, they were situated as follows:—

A. and N. Z. Mounted Division Imperial Mounted Division 53rd Division (attached)	The Desert Column, at Deir-el-Belah.
54th Division	About Inseirat.
52nd Division	Khan Yunus.

The main task in the infantry attack was given to the 53rd Division (158th, 159th, and 160th Brigades.)

The 54th Division was to be in support on the right; and the 52nd Division was kept in general reserve.

The 53rd Division set out over the plain from Deir el Belah about 0100 hours; 158th Brigade leading, in line of battalions in column of route, and had reached El Breij at 0400 hours. A dense fog then came on. At 0435 hours the leading battalion groped its way over the Wadi Ghuzzee, and on towards its first objective, El Burjaliye, by compass bearing. By 0615 hours the 158th Brigade had concentrated near El Burjaliye, and it pushed on and occupied Mansura heights at 0745 hours. The fog lifted at 0820 hours, and then the Turks sounded the alarm. But the brigade kept moving, and by 0900 hours it was about 4,000 yards south of Ali Muntar, and, as yet, unopposed.

Meanwhile, the 160th Brigade had reached El Sheluf, the top of the rise to the Gaza plateau. The 159th Brigade, in reserve, was following up the 158th Brigade *via* Mansura. On the left, the 2/4th Royal West Kent Regiment had advanced over the Wadi Ghuzzee until held up by Turks, in the sandhills about Sheikh Hasan.

The mounted troops had done well. In spite of the fog, they effected their march, and reached their positions east and north-east of Gaza by 1000 hours. The Imperial Camel Corps were about Mendur. The Imperial Mounted Division faced east from Gaza. The Australian and New Zealand Mounted Division was at Beit Durdis, with patrols to Huj and Deir Seneid; and the 2nd A. L. H. Brigade was working to the coast through Jelabiyeh and isolating Gaza.

After a conference of brigadiers, orders for the 53rd Division's attack on Ali Muntar were issued at 1100 hours. The 158th Brigade moved from near Mansura at 1140 hours supported by the 159th Brigade. The 1/5th Royal Welsh Fusiliers were leading, in artillery formation (*i.e.*, lines of platoons, in fours, at 100 yards interval and 300 yards distance: "A" and "B" Cos. leading, "C" and "D" Cos. following.) The Turkish artillery opened fire when these troops were about 2,000 yards from the enemy on Green Hill, at about 12 noon; and the brigade got on to within 800 yards of the enemy, in full view, and was then checked. The 159th Brigade now came up on the right (less one battalion in Divisional Reserve).

At 1300 hours, to hasten matters, the A. and N. Z. troops had been ordered to close in on Gaza, and by about 1530 hours their pressure took effect. The 2nd Australian Light Horse Brigade from the north actually broke into Gaza; and the New Zealand Mounted Rifle Brigade penetrated into the suburbs from the east.

About Ali Muntar and Green Hill, the whole line moved on at 1345 hours and got to within 500 yards of the trenches, under very heavy fire. The 160th Brigade had now come up and were attacking on the left. At 1530 hours the 158th Brigade pierced the enemy defences by Ali Muntar Mosque, and took many prisoners; but at Green Hill the Turks held on stubbornly. About 1600 hours the

161st Brigade of the 54th Division was brought across from Sheikh Abbas, and put in on the left of the 158th Brigade. It attacked Green Hill, well supported by the artillery, and carried its objective just as the sun set. Von Kressenstein at Huj was encouraging Gaza to hold out, and by 1700 hours his reinforcements were pressing the Imperial Mounted Division, until only a gap of four miles remained for the Australian and New Zealand Division to get back through.

At 1630 hours the situation was as follows: Gaza was enveloped, nearly all the Turkish trenches outside it had been taken. The 53rd Division held the Ali Muntar Ridge, but their right was covered only by a thin line of mounted troops.

The 54th Division's left was 2½ miles from the 53rd Division's right. The Australian and New Zealand Division—much extended—was engaged in street fighting, except one brigade which was holding off the Turkish reinforcements from the north. The Imperial Mounted Division was resisting the Turks from the north-east, and east, and south-east, and under artillery fire. Many horses had been 36 hours without water. It was, therefore, necessary to bring in the mounted divisions; and, it was then considered unsafe to leave the infantry on the captured ground with their flank exposed.

So, about 1830 hours, Sir C. Dobell ordered the 53rd and 54th Divisions to take up a line from Gaza on the left through Mansura and El Burjaliye, refusing our right. Thus we gave up the commanding position gained. Turkish reinforcements entered Gaza that night.

Next morning, although our advanced troops reoccupied Ali Muntar, the 53rd Division was unable to keep it against the violent Turkish counter-attack delivered at 0800 hours. The 54th Division also was attacked from Sheikh Abbas.

The time limit for the operation had arrived; the troops could not be maintained so close to Gaza; and during the night 27th–28th March the force fell back to Deir-el-Belah and Khan Yunus to replenish and refit.

Although the commanders did not know it at the time, victory had been in our grasp. The Turks in Gaza had lost heart, and the German Commandant had burnt his papers, bid farewell to his friends, and destroyed his wireless station.

The course of the action remarkably resembled that of the two preceding actions, Maghdaba and Rafa. In each case, the enemy was surprised, but resisted stubbornly until his reinforcements were at hand, and the breaking off of the action was under serious consideration. Only, in the case of Gaza, the risks of continuing the attack seemed to outweigh the offers of success. The two hours of daylight, lost in the morning by the fog, could never be made up, and Gaza was not taken until seven months later, under very altered conditions. Here certainly was a case in which fog had favoured the defence by its delaying power.

The Second Battle of Gaza.—Immediate steps were taken to prepare to continue the attack on Gaza. The railway was extended to Deir el Belah by 5th April, and also supplies were landed there on the open beach from suitable vessels, with surf boats. Much was done in opening up roads and crossing places over the Wadi Ghuzzee, and in developing the water supply.

Lieut.-General Sir Charles Dobell was reinforced with the newly-raised 74th Division, formed from Yeomanry regiments dismounted; and the assistance of the Navy was secured for the next assault.

The difficulties Russia was now encountering also obliged us to maintain pressure on the Turks; and the second attempt on Gaza was accelerated for this cause; in fact, Sir A. Murray received orders on 30th March to advance on Jerusalem. The next attack was fixed for the 17th April.

The Turks were thoroughly roused and elated, and gave up all idea of evacuating territory. The garrison of the Gaza area was raised to 20,000 or 25,000 rifles (3rd Cavalry Division, 16th, 27th, 53rd and 54th Turkish Divisions, and much heavy artillery). The immediate defences were greatly strengthened and extended south-west, some 12,000 yards to Atawineh; and beyond that, a chain of strong works stretched to Hareira and Sheria, for about 16 miles towards Beersheba. About 8,500 rifles were kept in Gaza itself. No opening was left for mounted troops to pass through, and the watering difficulties prevented a wide envelopment. The enemy reserves were held on the north-east of Gaza, about Huj and on the Wadi el Hesi.

The plan now was to attack Gaza in two stages. The first step was to reoccupy the Sheikh Abbas–Mansura ridge, consolidate there and bring up the tanks and heavy artillery. The second move would be to subject the Turks to a severe bombardment, and then to deliver the assault.

The first stage opened at dawn on 17th April. By 0700 hours, the 54th and 52nd Divisions had crossed the Wadi and taken Sheikh Abbas and Mansura Ridges, and Kurd Hill. On the right, the mounted troops about Shellal reconnoitred in force towards Hareira and Sheria, in order to hold the enemy to his ground there. At dark, these troops fell back across the Wadi Ghuzzee, but covered the right flank of the 54th Division with an outpost line. So far, the operations had gone well.

The next stage was fixed for 19th April. The 54th and 52nd Divisions, under G.O.C., 52nd Division, were to take Ali Muntar, the 54th Division had also to deal with part of the Kh. Sihan group of works, south-east of Gaza. The 53rd Division had to move up the sand dunes between the Belah-Gaza road and the sea, its first objective being the line Samson Ridge–Sheikh Ajlun. The Mounted troops were to attack (dismounted) the trenches at Atawineh, and to seize the Birket el Sana spur across the Wadi Sheria.

The mounted divisions moved at dawn. Birket el Sana was taken, and the Atawineh lines were attacked by the Imperial Mounted Division, but without material progress. On the right of the 54th Division, the Imperial Camel Corps ejected the Turks from one line of the Kh. Sihan trenches. The 54th Division made progress at first, but came under severe enfilade fire from Ali Muntar, and was heavily counter-attacked and checked. The 52nd Division got up to Lee's Hill, but could not cross the open space to the west and north-west in face of machine-guns. The tanks, from which much had been expected, were unlucky, and several sustained direct hits. But, the 53rd Division, moving along the coast, secured Samson Ridge by 1500 hours.

By that time, the situation was that the attack had been brought to a standstill. Two of the brigades of the 52nd Division, and all the 74th Division, had not been seriously engaged. But the enemy was unbroken; he was still in possession of the Ali Muntar works; and his strong reserves were seen to be still intact. Our casualties, so far, had amounted to about 7,000, and it was considered that the time had not come yet to put in the reserves. No further progress was made. The ground gained on this day was consolidated. The line now ran from the Wadi Ghuzzee round the Sheikh Abbas salient, Mansura–Samson Ridge–Sheikh Ajlun.. The further assault intended for the next day was countermanded, as the conclusion reached was that the Turkish defences and forces were too strong to be overcome except by very deliberate process.

After the Second Battle of Gaza, Lieut.-General Sir P. Chetwode succeeded Sir Charles Dobell in command of the Eastern Force. Position warfare set in on the Gaza front from Tel el Jemmi to the sea. Inland from the Tel el Jemmi, the hostile lines diverged east and west from the Wadi Ghuzzee. The country was open, but movement was restricted by the summer water scarcity. Neither side could effectively attack the other across the open space.

The Turks were strongly reinforcing Gaza; they now proposed to hold us on the Palestine front, while they concentrated their Yilderim Army for the recapture of Bagdad. In order to maintain the Gaza fortress, they began in May a branch railway from Tine (near Junction Station) to Gaza.

At the same time, the British, working for power to manœuvre, and to secure the upper line of the Wadi Ghuzzee, commenced a branch railway from Rafa to Shellal—where there was ample water—and also extended the pipe-line on to the plateau overlooking Shellal from the west.

Moreover, as it was evident that large reinforcements, especially in artillery, would be required for the reduction of Gaza, the double tracking of the railway from Kantara was decided on and commenced; and the 12-in. pipe was also to be duplicated between Rafa and Kantara.

Destruction of the Auja–Beersheba Railway.—The Turks had abandoned their Sinai railway extension at the end of January; but in May they began to pick up the rails and sleepers in order to use them on their new branch line from Tine to Gaza. Sir Philip Chetwode decided to stop this work, and to do so organized a large destructive raid by mounted troops. The Imperial Camel Corps at Rafa, one brigade of the Australian and New Zealand Mounted Division, two field squadrons, and R.H.A. were detailed for the operation. A large number of demolition parties were specially trained and drilled to rapid work. In order to confuse the enemy, the Gaza defences were subjected to severe bombardment and wire-cutting for three days prior to the enterprise; and on the day of the raid, the remainder of the mounted troops made a reconnaissance in force to the north-west of Beersheba, and destroyed the Irgeig railway viaduct by shell-fire.

The raiding brigades moved out on 22nd May, the Imperial Camel Corps from Rafa direct to Auja. The others moved from near Khan Yunus to Esani and Khalasa, where they watered, and thence went on to Asluj and Hadaj on the railway. They completely wrecked 13 miles of line. Every pair of rails was cut in the centre, all the points and crossings at Asluj Station, six bridges, and many valuable stores were destroyed. The troops then withdrew unhindered.

Comments.—The outstanding feature of the recovery of Sinai was the energetic offensive initiated by Sir A. Murray. As a result of his enterprise the Turk was wholly driven out of Egypt, east, west, and south, and his machinations for revolt brought to nought. Besides, with material British support, the Arabs had destroyed Turkish authority in the Hedjaz. After the defeat at Romani, the Turk had displayed no initiative whatever against us.

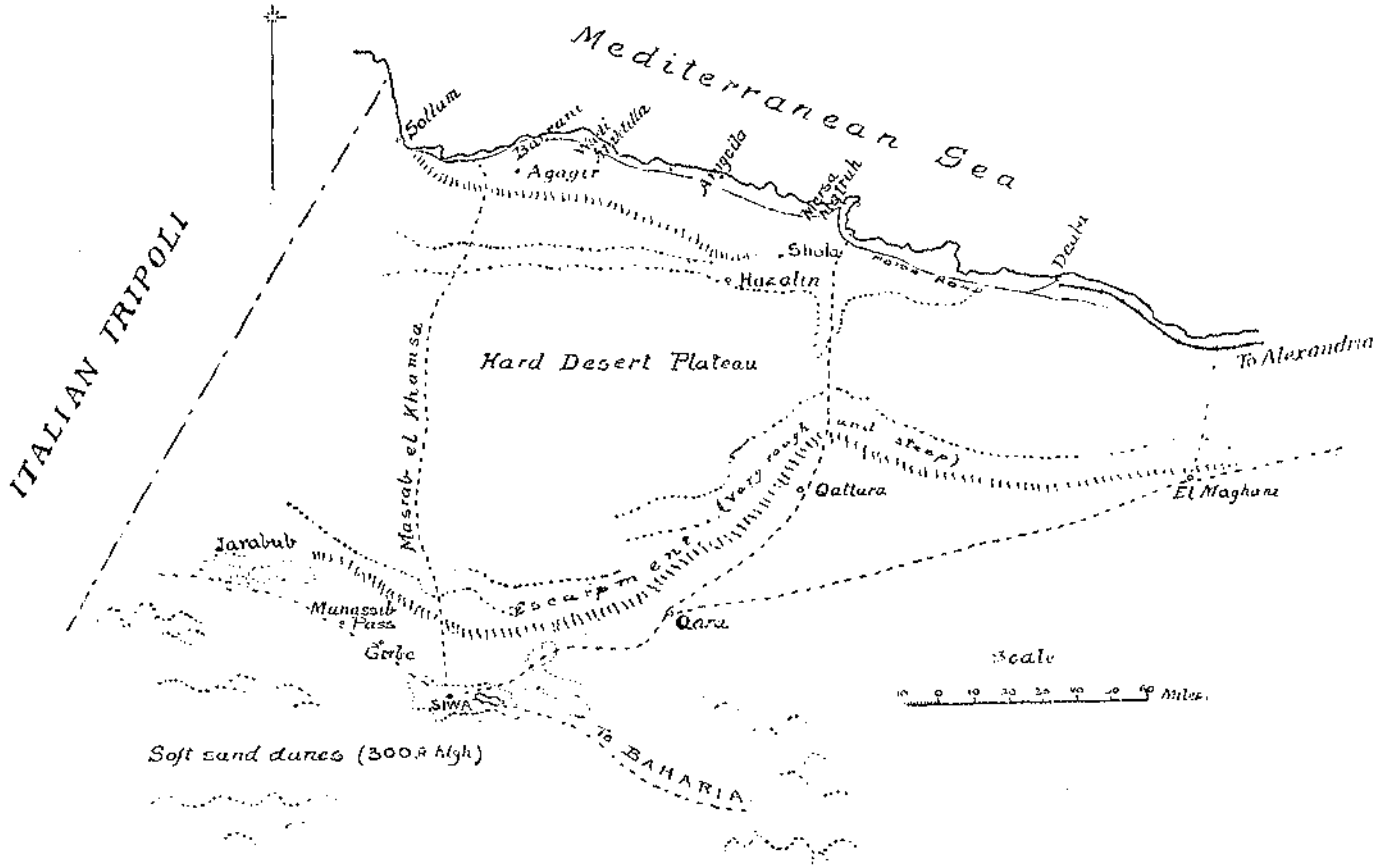
The success of this offensive—for success it was, notwithstanding the check at Gaza—may be attributed to the *mobility* given to the whole force, and to the development and able use of the mounted divisions—Yeomanry, Australian and New Zealand troops. The mounted arm was constantly employed, in spite of the difficulties of desert, sand, season and water. It was used in reconnaissances, in raids, as a screen, as a mobile reserve, in envelopment, and in pursuit. The Sinai Desert was the training-ground in which these mounted troops were schooled for their later exploits in Palestine and Syria.

The spring of 1917 had certainly been disappointing for the British, but the Turk had cold comfort, too. His prestige in the East was very low; he had been turned out of Sinai, and defeated in the west; two of the holy cities—Bagdad and Mecca, were lost, and he was blockaded in Medina. Nevertheless, he was gathering himself together for a great effort to recover Mesopotamia with German aid.

Just at this time General Sir Edmund Allenby, who had been in command of the 3rd Army of the B.E.F. in France, came out to succeed General Sir Archibald Murray, at the end of June.

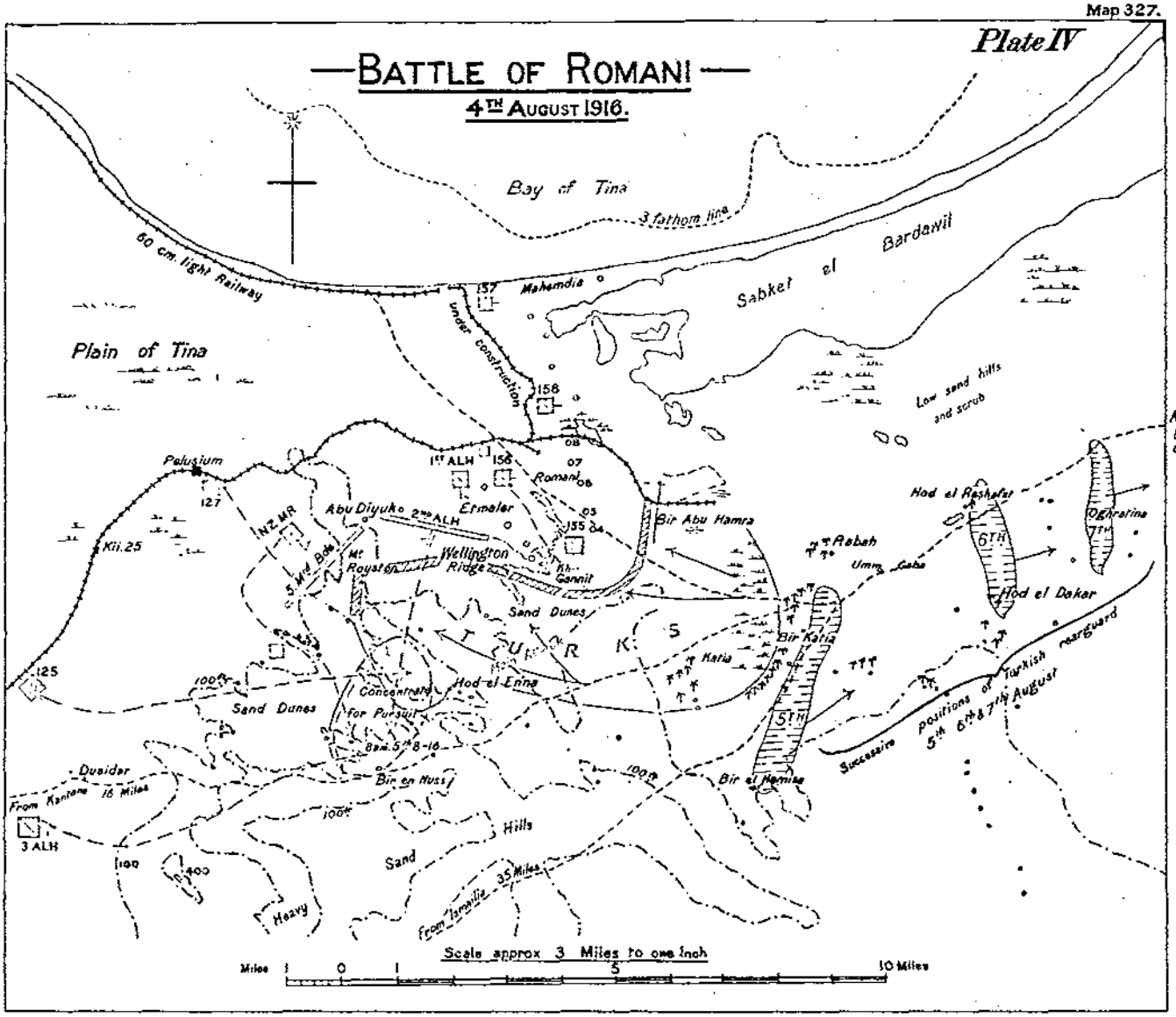
(To be continued.)

OPERATIONS AGAINST SENUSSI, 1915–1917.



SKETCH I.

Map 327.



Ordnance Survey, January 1921.

Legend

Turkish lines of advance .....

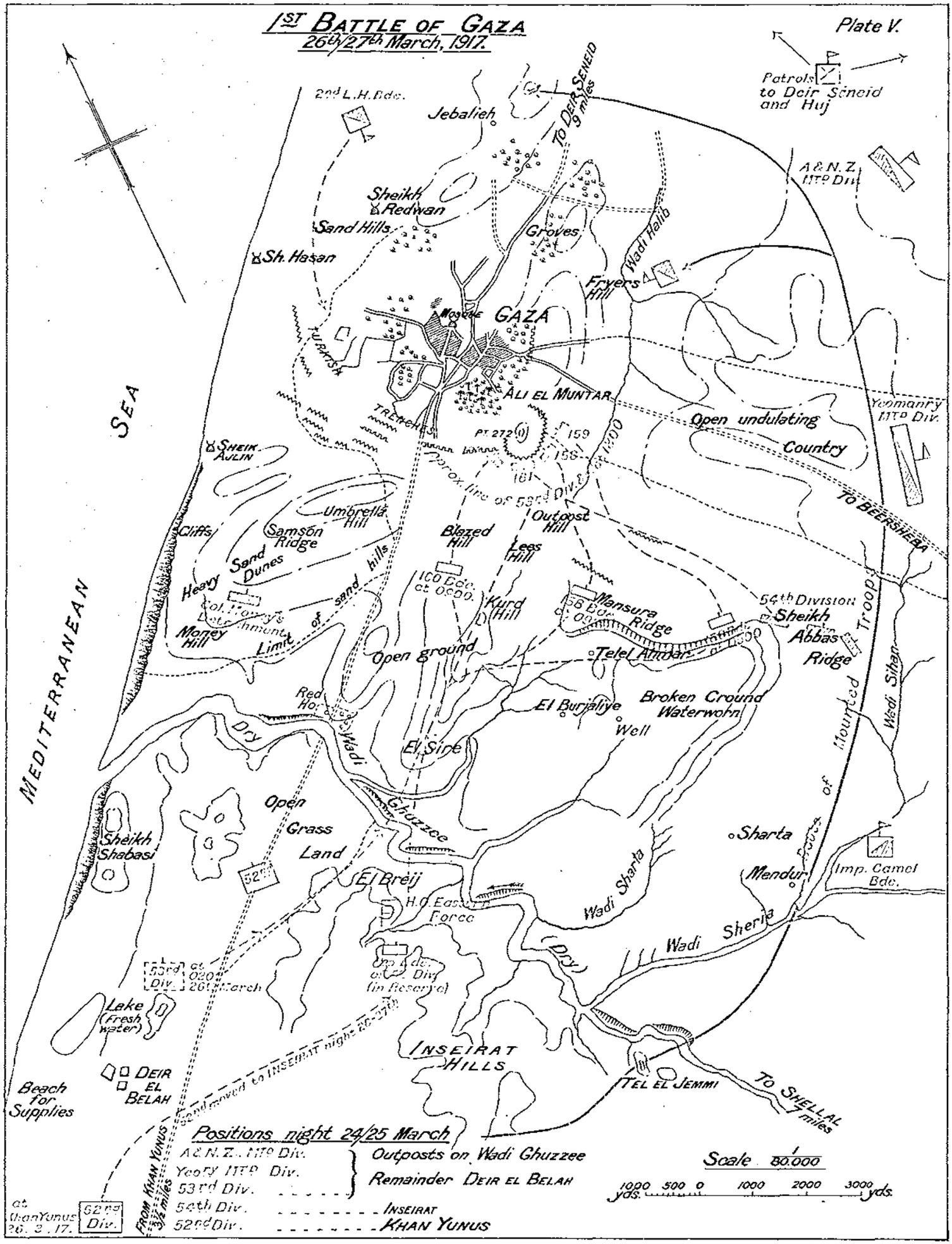
Further position reached by Turks .....

British posts .....

Camel Tracks .....

1st Battle of Gaza
26th/27th March, 1917.

Plate V.



Positions night 24/25 March

A & N.Z. Mtd Div.	Outposts on Wadi Ghuzzee
Yeomy Mtd Div.	
53rd Div.	Remainder Deir el Belah
54th Div.	Inseirat
52nd Div.	Khan Yunus

Scale 1/80,000

1000 500 0 1000 2000 3000 yds.

Ordnance Survey, January 1921.

NOTES ON REFRIGERATION.

By CAPTAIN J. H. DYER, M.C., R.E.

HAVING recently spent some weeks attached to a manufacturing company who have specialized in refrigerating machinery since its earliest commercial application, the writer is taking the opportunity of recording some of his impressions, especially in amplification of the article, *Notes on Refrigeration*, published in the *R.E. Journal* for November, 1921.

The statement that ammonia compressors are usually of the double-acting horizontal type, running at 70 to 90 r.p.m. is accurate only so far as it applies to the larger sizes. The manufacturers referred to have been building a regular line of machines up to eight tons ice-making per day, at speeds up to 200 r.p.m. for the last 15 years. The system is now being applied to larger machines, and machines of 75 tons daily ice capacity, to run at 250 r.p.m., are being made. The only real advantage of increased speed seems to be the possibility of direct coupling to motive power, oil, or gas engine or electric motor. It seems doubtful whether the compressor will be much cheaper, even if smaller, owing to its higher speed; but space occupied will be less, belt losses eliminated, and cost of foundations greatly reduced.

The statement that air will be drawn into the plant if the care of the rod is neglected is, of course, true, but necessarily only applies where the gauge suction pressure is something less than 0 lbs. per square inch (for NH_3 this corresponds to *minus* 28·5°F.), which it seldom is (*i.e.*, suction pressure is generally higher than atmospheric).

On the subject of "clearance," it should be noted that the oil-injection machines have not been manufactured for over 12 years, though many are still at work. The system is really a survival from a time when conditions were different to those existing now—ammonia very expensive, and good packing difficult to obtain.

In the observations as to running conditions, enough stress does not seem to be laid upon the absolute necessity of not running the compressor too cold, *i.e.*, with the returning gas too wet. If the gas is too wet, then, however small the clearance, re-expansion will occur, and a consequent great drop in the work done. It is suggested that rather more than hand-warm is the usual temperature of the discharge-pipe. Normally, it should feel really hot to the hand.

ICE-MAKING.

The Can System.—The normal thickness of ice in larger plants in this country is 12 in. The statement that 11-in. ice freezes in 60 hours requires amplifying. The time of freezing depends on the temperature of the brine. 60 hours for 11-in. ice is correct for 18° F. brine. A usual workshop rule is that the time (T) varies as thickness² (C) ÷ 2, or $T_1 = \frac{C^2}{2}$ for brine at 18° F. For other temperatures, say 11° F, to find the time (T_2), $T_2 = \frac{32-18}{32-11} = \frac{2T_1}{3} = 40$ hours.

By increasing the size of the compressors, therefore, so as to work at a lower temperature, the size of the ice-tank and the number of cans can be reduced for a given daily output, but the power costs per ton of ice are increased.

The Cell System.—Owing to its first cost this is hardly ever installed now, but it should be noted that there is no reason why cell-ice should take longer to form than can-ice at similar temperatures, and, in fact, it does not; and the only possible reason for a smaller output per compressor unit is the extra reduction losses owing to brine piping, and the heat lost in cooling the unfrozen water.

Direct Expansion Systems are referred to, and it is suggested that the "Empire" System referred to is in an experimental stage, no commercial plant being in operation; the "Pluperfect" System also appears to be only slightly beyond the experimental stage, few plants having been in use for many years and these largely for the crushed-ice trade, which is by no means the whole.

The only advantage which the direct freezing of ice, compared to the use of brine can possibly have is if the same or a higher evaporating temperature is used, thus obtaining a greater or the same temperature difference between the refrigerant and the water, with the same or more efficient temperature conditions for the compressor.

Theoretically this condition should always be obtainable, but practically, owing to the higher first cost of direct expansion plants as compared to Can plants of a similar tank capacity, there is a tendency to reduce the tank capacity of the direct-expansion plants and work with even a lower evaporating temperature than with brine plants. The practical effect of this is that a study of actual conditions almost always reveals a less efficient temperature condition with a direct expansion plant.

The peculiar form, also, of Pluperfect ice, producing, as it does, a block weighing perhaps 7 cwt., with rounded ends and central holes, makes it most difficult to handle and store, as it cannot be admitted that "in most cases ice is crushed before use."

The figures of ice produced per ton of coal, it is suggested, are

unintentionally misleading. The efficiency, on the lines given, is only important in so far as it is a function of the tons of ice per ton of coal.

A Pluperfect plant, equipped with an equally bad power-unit, as the Cell plant quoted, would give exactly similar unsatisfactory results.

The typical temperatures given suggest winter weather. It is seldom an ice manufacturer is lucky enough to have a condenser-pressure of only 107 lbs. The brine temperature also will usually be found to be much nearer 15°F. for both can and cell ice.

Selection of Plant.

(1) *Unit of Output:* 1 ton of Refrigeration=B.T.U. absorbed by 2,000 lbs. of ice at 32° F. melting to water at 32° F.=288,000 B.T.U.

(2) *Output Required:* (*a*) *Ice Making:* Allow 2 tons of refrigeration in 24 hours per ton of ice-making capacity in 24 hours required. [N.B.—Machines are rated to give so many "tons of refrigeration" in 24 hours for a standard suction pressure (generally 27 lbs. gauge for ammonia). The output of the machine is greater for a higher suction pressure and *vice versa*.]

(*b*) *Cold Storage:* Allow 1 ton of refrigeration in 24 hours per ton of meat to be stored at 32° F. and add 25% for maintaining the store at the low temperature in addition to extracting the original heat from the meat.

(3) *Type of Machine:* (*a*) *Ammonia Compressor:* most efficient. Little trouble with joints, as pressures are moderate and leaks easily detected.

(*b*) *CO_2 Compressor:* very compact and non-poisonous. Very inefficient in tropical climate where cooling water is above 80° F. Very high pressures.

(*c*) *Ammonia Absorption Plant:* only 35% of the efficiency of an NH_3 compressor. Only semi-skilled attention required. Use where a large quantity of low pressure steam is available.

(*d*) *Air-machines:* only 25% of the efficiency of an NH_3 compressor. Simple to use. For low temperatures snow collects in the air-ducts and requires frequent clearing. Use where only a moderate temperature is required in the store, *e.g.*, 50° F. for magazines in tropical countries.

A METHOD OF MILITARY SKETCHING FROM THE AIR.

By BT.-LIEUT.-COLONEL H. ST. J. L. WINTERBOTHAM, C.M.G., D.S.O.

IN the *R.E. Journal* of February, 1921, and in the *Journal of United Service Institution of India* for April, 1921, Lieut.-Colonel G. A. Beazeley, D.S.O., R.E., of the Survey of India, describes a method of military sketching from the air in articles entitled, "Topographical Air Survey." So much experience has been gained in surveying from air-photographs, and so much discussion has centred on it, that the thought of a topographer actually seated in an aeroplane and working on a plane-table comes with something of a shock. It is undoubtedly a possible method of field sketching, however, and must be considered on its methods.

Lieut.-Colonel Beazeley tells us that this method was attempted in Mesopotamia in order to provide a skeleton upon which to piece together large numbers of air-photographs taken in strips over such enemy territory as lay beyond the reach of triangulation. In the body of his text this underlying purpose is somewhat obscured, however, and his article is really a description of the instruments and methods advocated for making a sketch map of a large area, at some such scale as 1/125,000. Very briefly he developed his work on the following lines. The topographer was equipped with a plane-table which was kept constantly oriented (by compass or sun azimuth). Position at any moment was obtained by drawing a ray forward from a known back point (along an alidade aligned and pivoted on that point) and by measuring along this ray the distance travelled since the aeroplane passed over it. The distance was measured from that one of a number of time scales which corresponded to the calculated ground-speed of the aeroplane. No interpolation was possible, because the human observer cannot consult three trig. points simultaneously, but a certain amount of cutting in and rough intersection seems to have been possible. The bulk of the work was, of course, sketching, and the author recommends, as a preliminary measure, the sketching in of a grid of traverses which can be roughly adjusted and used as a control for area sketching. Form lines of the roughest nature were added. As a result we get a rough small-scale sketch map which should give a good general idea of the drainage and communications and a vague indication as to heights.

The author claims an accuracy of distance measurement of about 1/20. The errors of bearing would, I think, be of a larger order. One might consider, then, that the end of a 20-mile strip of traverse sketch might be anywhere on a circle of a 1-mile radius. These

errors would tend, under favourable flying conditions, to be of a systematic order, but it would be impossible to guarantee this. The result was, however, obtained very rapidly. The author claims, for example, to have sketched 500 square miles of difficult country in nine hours. But in order to obtain this result we must postulate two factors. We must have a really expert topographer, and complete local mastery of the air. No such survey would be possible if the aeroplane were compelled to dodge enemy aircraft or "archies."

However, it is not with a complete sketch that we are primarily concerned. The camera gives us a picture which is, occasionally, difficult to use, but which, even with our existing methods and appliances, supplies data out of all proportion more accurate than could be got by sketching at 60 miles an hour. The really important claim made for sketching is the orientation and fixing of photographs in their proper place. Now will this sketch control be wanted in future wars? It certainly will not be wanted where any fair topographical survey exists. We may say definitely that a sketch made in this fashion can never be expected to compete with ground survey. Generally speaking, then, it is very unlikely to be used in any European war, and the discussion can be narrowed to unsurveyed countries and, probably also, to small wars. In these cases a rough control pushed ahead of the triangulation will be of immense value. Is the method evolved in Mesopotamia the best way to secure it? I think that at this point we can eliminate another class of surveys, *i.e.*, those in which detail, natural or artificial, is sufficiently marked and close to allow of joining up air-photo traverses and thus securing a control. The arrangement of such air-photo traverses in rough triangles was a feature of the Palestine war surveys and recent experiments at Cambridge show how accurately and consistently such series of photographs can be taken. Naturally considerable differences of altitude introduce appreciable error, but these will not attain the order of 1/20 if reasonable overlaps are allowed for.

But we have still to consider the case of a desert area so deficient in detail as to afford no means of identifying the position of successive photographs. There are, however, photographic methods of fair precision which take into account differences of altitude and by which a subsidiary order of control may be established in such cases. No existing method of photographic survey can be relied upon to extend its own control far, but errors of a larger order than 1/200 can be avoided. In a very interesting French post-war survey in Morocco, described in *Cahiers du Service Géographique de l'Armée No.* 38," and briefly alluded to in the *R.E. Journal* for June, * 1921, the subsidiary orders of control points were secured by photographic intersection and interpolation. There is also the autocartograph of

* "The development and present possibilities of Air-photography for Mapping."

Professor Hugershoff, described by Major M. N. MacLeod, D.S.O., M.C., in the April, 1922, *Journal* of the Royal Geographical Society, and there are other methods at present in the experimental stage for attaining the same object.

We have at present little national experience in the use of obliques, but we know that, given well-trained pilots, we can maintain the camera within about 3° of the vertical, even without special apparatus, and therefore can photograph within the same limits at any desired inclination. Experiments now in progress may substantially reduce this error, and it seems certain that by photographing from above different known points or by interpolating from them we can plot points over a gap limited only by visibility. It is, in fact, only where a gap exists of, say, some 30 or 40 miles that one can see difficulty in pushing forward a photographic survey of a greater accuracy and in far greater detail than could be secured by sketching, and at such distances from known points it is probable that the observer would be as much at fault as the camera.

It may be maintained that no purely photographic method could be made so rapid as actual field sketching. No doubt, this is true. As the speed of the aeroplane is dictated by factors independent of either sketching or photography, it is probable that it will take as long to photograph as to sketch, and the time spent in developing printing and plotting will be additional. Our experience during the last war pointed to the need of a map at a scale at least as large as 1/40,000, and our ideas as to plotting and compiling are based on that fact. To compile from air-photographs a rough, but fairly accurate sketch map at the ½-in. scale would be nothing like so lengthy a process and would keep pace readily enough with any military requirements.

Even then, if photographic methods of pushing forward a control are still experimental, it is obvious that they will develop to much greater possibilities than can sketching and we should be ill-advised to waste time in pursuing the latter.

Military surveyors, and particularly those whose experience lay solely in the western theatres, will none the less find many ideas of value for the future in these article.

It is obviously sound for the map-maker to fly over the country he is to map, and Lieut.-Colonel Beazely's methods of locating position might be a most useful accessory on such a trip. His sun azimuth arrangement of a pin as vane, on a sun-dial drawn upon the plane-table to correspond with local mean time (or whatever time is actually in use) is simple and should be efficient. The "time" scale depending upon measurement of ground-speed carried out in both directions over a known base does not sound particularly satisfactory, but it is difficult to see how its use can be avoided, and lastly, the difficulties he met with and his methods of overcoming them are interesting and instructive.

REVIEWS.

LES CHEMINS DE FER FRANÇAIS ET LA GUERRE.

Colonel Le Hénaff et Capitaine Henri Bornecque. Préface du Général Gassouin. Paris. Librairie Chapelot, 1922. (At present rate of exchange, about 9s.)

THERE are probably less than a score of officers in the world who could write on the use of railways in war with the authority of Colonel Le Hénaff. Before the war, and for a short time at the beginning of it, he was Commissaire Militaire of the Est Railway of France, the staff officer responsible for the preparedness for war of the most important strategic railway in the country, and, on the outbreak of war, for the movements required for mobilization, for the concentration, and the subsequent maintenance and strategical moves by rail of the forces on the eastern frontier. Early in the war he became *Directeur des Chemins de Fer*, a post he retained until his health broke down. Thereafter, until the end of the war, his wide experience was made use of with the Inter-allied Transportation Council.

The book is the most valuable contribution to the literature on the use of railways in a European war which has yet appeared. The French system for the military use of railways has stood the test of war, and no great modifications in it are contemplated. The book, therefore, will well repay study by officers both of the Q.M.G.'s branch of the staff and of the technical railway service. The conditions of stabilized warfare and a very extensive and highly organized railway system are, of course, quite different to those to be met with in, say, Palestine, Mesopotamia or South Africa, but in war on a grand scale, in which railways play a great part, principles emerge which are really just as important, though less obvious, in a campaign conducted in a country where the railway facilities are strictly limited.

The great part played by the railways in Foch's strategic moves is shown clearly. Between the 18th of July and the end of August, 1918, over 80 Divisions were moved by rail. The summer campaign may be compared to a game of chess with the Allied and enemy G.H.Q.'s as players, Divisions the pawns, and the railways the hands that moved them. Such moves were mainly parallel to the front, and the urgent need of good lateral communications is obvious. The peace-time railways radiated from Paris like the spokes of a wheel, with the Ceinture railway round Paris as the hub; from the earliest days of the war the French were busy improving the cross-country lines north of Paris which connected the spokes. All the main routes by which the British and French forces were connected north of the Ceinture passed through Amiens, and when, in the spring of 1918, that great railway centre was threatened, a very extensive system of new main lines was constructed with remarkable rapidity north-west of Paris and the old lines to the south-west greatly improved. Not only by large works like these but by numerous other examples the book shows how much must be done to an existing railway laid out for civil traffic of particular kinds and quantities, and between particular points, before it can handle successfully the quite different traffic between other points which it is called upon to deal with in time of war.

The authors are not always quite accurate in what they say about the British railway service, but on the whole give a very fair account of it. The train discipline of the *poilu* was often held up to officers of the British railway service as a model; there is a refreshing admission that the *permissionnaire* equally with the leaveman did not always appreciate the seats in the *wagons amenagés* of the leave trains. It is interesting, too, to learn that the French *Commissaire de Gare* was sometimes as unpopular as his British cousin, the R.T.O.

Valuable particulars are given, showing what can be expected from railways of various gauges and from roads, and from other particulars given useful deductions can be drawn as to the relative time and labour required to construct a road or a railway system to deal with the same tonnage. The reconstruction of communications across the devastated zone was necessarily so slow that if the Germans could have retired to the Rhine, leaving all communications behind them destroyed on the same scale as in that zone, it would have been impossible to resume active operations against the enemy on a large scale for many months.

The book deals with many points of great interest both from the staff and from a technical point of view. No one interested in the use of railways in war should overlook it.

A.M.H.

THE LEINSTER REGIMENTAL ANNUAL, 1921-22.

THE Institution has received a copy of the *Annual* of The Prince of Wales's Leinster Regiment (Royal Canadians) for 1921–22, edited by Lieut.-Colonel F. E. Whitton, C.M.G. While deploring the necessity which has arisen for disbanding this famous old regiment, one cannot but admire the fine, light-hearted spirit in which it is making its exit from the scene on which it has played so many parts. The *Annual* shows nothing in keeping with the mournful interest which must be attached to its last appearance, and its contents fully justify its motto: "E'en in our ashes live their wonted fires."

F.E.G.S.

NOTICES OF MAGAZINES.

MILITÄR WOCHENBLATT.

No. 45.—Lieut.-General Balck contributes an article on the political position of Great Britain from the military point of view, in which he argues that our present position is more unfavourable than that obtaining after the Napoleonic wars. He declares that we are war-weary and on that account fail to stand up against French Policy. England, he says, has departed from her traditional policy in allowing the balance of power in Europe to be upset, whereby France has become possessed of the master voice in European affairs. Economically, too, England has lost ground, as the bulk of the European markets have become closed to her, owing to the depreciation in exchanges. Bolshevist Russia has openly declared its intention to destroy the British Empire by propaganda.

Referring to the results of the Conference in America on the subject

of naval armaments, he goes on to give it as his opinion that our policy is influenced by a desire to debarrass ourselves of our Japanese Allies, whom England suspects of working to effect a junction with China.

The *Entente Cordiale*, he thinks, is dead, whence the change of front on the part of England towards Germany. The former German menace has become a French menace, enhanced by the Franco-Belgian Alliance. French policy in the Near East is hostile to England.

The position in India is causing grave anxiety. Anglo-Indian politics, he points out, have not succeeded in Afghanistan. The nationalist movement in Egypt has not yet subsided. The British Parliament has renounced its full sovereignty over Ireland. Particulars follow concerning the strength of the British Army.

No. 46.—Lieut.-General von Cramon gives some interesting particulars concerning the strategy of the Central Powers in 1916. This officer was the plenipotentiary representative of the German High Command in the Austrian Royal Headquarters. He was, in consequence, present at the various negotiations and deliberations which took place. He was, moreover, repeatedly employed by Field-Marshal von Conrad to represent his views. He therefore considers himself specially qualified to throw light on the much debated question as to why the Central Powers did not either undertake a combined offensive against Italy or alternatively throw their full weight against the Western Front.

He commences his argument with a short appreciation of the situation at the end of 1915, which he describes as a specially fortunate year after the defeats sustained towards the close of 1914. Russia was *hors de combat*, at any rate for a long time to come, Serbia had been overpowered, the road to Constantinople opened, Roumania had been intimidated, and the possibility offered to Austria to deal with Montenegro.

The situation, therefore, called for a decisive blow to put an end to the war, which had already lasted too long, and to give victory to Germany and her Allies.

Conrad had, during the summer of 1915, repeatedly confided to him his plan of a combined offensive against Italy, after whose subjection France should be similarly dealt with. His intention of breaking through from South Tyrol was in accordance with the plan of operations elaborated in peace-time. He was confident of carrying through an attack on the rear of the main Italian Army and forcing them to lay down their arms in the field, in which view General Krauss concurred. The results would, in their opinion, have had an influence not to be over-estimated in bringing the war to an end.

Falkenhayn was not so optimistic on this score, in which view von Cramon thinks he was probably right. He was, consequently, unable to take the responsibility of displacing nine German divisions from the Western Front, which would have greatly enhanced the difficulties of defence against the French and English.

Krauss and Conrad were of the definite opinion that in the event of the overthrow of Italy the Western Powers would be compelled to come to the aid of their Ally, whereby the Western Front would be materially relieved.

In support of this contention he cites the events of 1917. On the other hand, he points out the dangers to the right flank of the Germans

on the Western Front. The difference of opinion of the two Staffs was further influenced by other considerations.

Conrad at first desired to conduct the attack on Italy with only Austro-Hungarian troops, and to reinforce them with divisions from the Eastern Front. These, he proposed, should be made free by German forces from the Western Front. It was only later that he asked for German troops for Italy. Falkenhayn could not be talked over to agree to either of these proposals, as he could not be convinced that the operation would materially conduce towards ending the war. Further, he would never agree to placing German troops under Austrian leadership, which Conrad assiduously maintained in Italy. Cramon declares that anyone having, as he had, personal knowledge of the difficulties which arose during the preparations for breaking through at Gorlice, and more especially later in the campaign against Serbia, on account of Falkenhayn's stipulations that the High Command must be German, must know that a combined offensive against Italy on the lines planned by Conrad was out of the question.

Why Falkenhayn did not accept the alleged proffered assistance of Austro-Hungarian troops in his attack on Verdun has not been satisfactorily explained to this day. Cramon tells us that Falkenhayn had always told him that this offer had now and then been casually mentioned in conversation, but had never been put forward seriously. Conrad asserts the contrary, and Cramon suggests that the solution of the riddle is probably that the offer was made only verbally. In point of fact, Conrad only agreed to giving Austrian support after the overthrow of Italy. He especially emphasizes this fact in his memorandum of 18. 5. 15 to Falkenhayn, wherein he states that Austro-Hungarian troops would not be available for participation in seeking a decision on the Western Front so long as Italy had not been placed *hors de combat*.

Cramon goes on to describe the incompatability of temperament of the two leaders, which was a stumbling-block to harmonious co-operation. His conclusion is that under any circumstances they should have agreed to a combined, as opposed to independent, action.

In his opinion the view accepted by many Germans that Austrian troops were not suitable for offensive action on the Western Front was true only in respect of certain formations. It was undoubtedly a great sin of omission on the part of the Germans not to have previously settled in peace-time the question of an uniform direction in war. That the views of the two Army leaders might differ could have been foreseen, and provision should have been made for a supreme authority —of German composition—able to issue orders without recourse to procrastinating negotiations. That this was not done affords, in Cramon's opinion, one of the many proofs that Germany was not responsible for the war.

H. DE C. TOOGOOD, *Captain, R.E.*

REVUE MILITAIRE GÉNÉRALE

April, 1922.

The Army We Require.—By General D'Urbal.—France may have to be ready for another war with Germany, in whose army certain Austrian

units may be incorporated. Russia may side with Germany, but Poland should be able to contain her, and the *Little Entente* should be able to hold Hungary and keep the East in order. France cannot count on active assistance from Great Britain or Belgium, at any rate at first, and Italy has her eyes on the Adriatic and Aegean. This leaves the troops of France, and of her colonies, provided control of the sea is assured, alone to face Germany, and only the home and North African troops will be available at the outbreak of hostilities. Germany will have the advantage of numbers, but her mobilization must be comparatively slow. France should be able to forestall her on the right bank of the Rhine, with Berlin and Munich as ultimate objectives. The line of resistance of the 1st echelon or outpost troops of the invading army, from Holland to Switzerland, should be roughly—Ahaus, Dortmund, Hanau on the Maine, Stuttgart, Donaueschingen, approximately 30 miles to the east of the Rhine, with that river to fall back on in case of need. With fully-trained troops this line could be held by ten infantry and six cavalry divisions on each front north and south of the Maine, and the Germans should be unable to concentrate on a single front, but be obliged to concentrate behind the Weser and Danube with precarious communications between the two bodies along the comparatively narrow corridor between the French and Bohemia. The mobility and equipment of the French cavalry must be such that there would be no hesitation in sending it as far forward as Osnabrück, Minden, Cassel, Fulda, Bamberg and Nuremberg. The 1st echelon should number about 300,000 of all arms, and would be followed by a 2nd echelon provided with all requisites for open warfare, and a 3rd echelon comprising material for position warfare, second line, and line of communication troops. The total of the 1st and 2nd echelon should not be less than 800,000 for the north and 600,000 for the south groups of armies, and 200,000 should be added for *liaison* between the two. The first echelon should all be troops of the active army, stationed as near to the frontier as possible, and there should be a permanent nucleus ready to embody the 1,300,000 troops of the 2nd echelon, say one-fifth, or 260,000 and 50,000 more for the embodiment of the 3rd echelon. This necessitates a permanent army 610,000 strong.

The Revision of the Regulations.—(A continuation of the article by "Lucius," fifth period, continued).—*The Defence of Positions* (1) *From the German side (continued).*—By defending not the first-line, but the first position, the Germans hoped to maintain an economical defensive, but the Allied attacks on limited objectives, during which the barrages were too intense for the counter-attack troops to face, brought their tactics to nought, and, in 1917, their defences were captured step by step. The IVth Army Commander tried concentrating closer to his front the infantry necessary to defend the first line and first position, but the result was the same except that casualties were heavier. From the beginning of the battle of Flanders, Ludendorff held more strongly than ever his opinion that the remedy was to dispose both positions and troops in great depth, and published a new regulation on 15. 8. 17. This directed that the battle should not be in lines, but in zones, consecutive battle zones, each several kilometres deep and separated from each other by not less than three kilometres, with the double object of ensuring to

the commander greater security in case his front was penetrated, and of forcing the adversary to prolong and repeat his preparations for attack. The first, or covering zone, was to be held by advanced posts to repel a surprise attack, give the alarm, and retard the enemy. The second, or principal zone of resistance should be able to stop even the most violent attacks and the main body, which was to hold it, would, by reason of its distance from the front, suffer less from the bombardment, and have plenty of time to occupy its defences. The third, or rear combat zone, would shelter reserves destined either to counter-attack in the second zone, or to stay the enemy should he have forced his way through the latter. Artillery would find its best protection in numerous alternative blinded emplacements, but, during the battle or for special missions, guns might have to fire in the open, and the same rules apply to *Minenwerfer*. The covering zone has the advantage of obliging the enemy to engage troops and appliances in considerable force which will then not be available for the main attack. As he progresses he will meet more numerous and unforeseen difficulties, and will have to elaborate several successive attacks to break through. These principles, first applied during the last days of the battle of Flanders, served as guides in the construction of the Siegfried, Brunhild, and Hunding positions.

The Defence of Positions (2). *From the French side.*—General Pétain collected all the ethics of the defence in two complementary Instructions —that of 20. 12. 17, on the defensive action of the larger formations, and that of 22. 8. 17, on the organization of the ground and employment of all arms. The former asserts the necessity for a strict combination of defensive with offensive action, the first to lead on to the second by its material and moral effect. The fundamental principle is organization in depth: successive positions, with the defending troops disposed in depth in each. There should be at least two positions separated by such a distance (six to eight kilometres) that both cannot be simultaneously bombarded by the same artillery preparation. Intermediate and switch positions may be prepared between each. A position comprises a number of centres of resistance formed by linking up supporting points, the elementary cell of the organization being the automatic gun detachment or *combat group*. "To make artillery fire and aerial reconnaissance ineffectual, it is indispensable to spread the essential elements of the defence over the ground, to separate them from the visible organizations and disguise them as far as possible. But this dispersion renders more necessary than ever a considered distribution of the means of defence, and a careful organization of command." While the artillery is distributed in depth, the infantry will be divided into guard troops to defend the covering position and principal parallel, garrisons for the supporting points and centres of resistance, support troops close in rear of the guard troops for immediate counter-attack, and a reserve further behind ready with artillery and tanks for a general counter-attack or counter-offensive. The defence must be active, not passive. The high command will fix the position of resistance, and here will be the principal parallel, defended by the guard troops, and the normal objectives of the counter-attacks of the supports or reserves. To avoid surprise, reconnaissance must be developed and the ground organized for manœuvre. Preparation for the active defence includes making

plans: for defences, for reinforcement, transport and retreat. The action of the different arms, especially aviation and measures of defence against aircraft and tanks, must be carefully studied for the principal cases which may present themselves.

Almost at the same time as the Instruction on defensive action appeared *Directive No.* 4, dated 22. 12. 17, from the General-in-Chief. In case of an extensive enemy offensive (1) the first position must be so held as to shatter, or at least break up the first dash of the enemy, (2) only sufficient troops and material must be assigned to the front lines to ensure of good use being made of the organizations, and to guarantee the distribution of the main body in good time in the second and switch positions, the impregnability of which must be assured, (3) to employ the reserves not only in direct counter-attack, but in counter-offensives against the enemy's flanks or on an adjacent part of the front. The general reserves will be employed either in reinforcing the troops attacked, or in attacking in any direction judged favourable. This made the second position the principal position of resistance, which was also the tendency of the Instruction of 20. 12. 17. On the other hand, now appears for the first time the idea of replying to the attack not only by an active resistance but also by attacks in neighbouring sectors or in any favourable direction, a conception of manœuvre which will be the richer in results as capable of producing surprise.

On 24. 1. 18 the General-in-Chief issued his Instruction on the application of *Directive No.* 4, substituting for successive positions the *field of battle of the army*. The latter is "the whole organized region on which the army has to stand and beat the enemy. The essential element of this battlefield is the position of resistance, chosen in such a manner that the enemy can only attack it after a series of contests of which the effect will have been the separation of his infantry from his original artillery position." If it is lost in whole or part, the army commander must do his very utmost to recapture it. The ground between the position of resistance and the enemy consequently constitutes the margin of safety which the army commander disposes of to bring his forces to battle. It is, therefore, essentially a covering task which must be accomplished by the divisions which happen to be in contact when the enemy opens his attack, hence each of them must be disposed in depth so as to develop to the maximum the defensive capabilities of the ground and organizations, to put to profit the distance separating the enemy's front from the position of resistance, and to guarantee the time necessary to assemble the reinforcements (infantry and artillery) destined to stop the enemy on the position of resistance. Thus the evolution of the French doctrine of defence followed the same course as the German, but six months later. It is the same conception as that of security when at rest in active warfare.

VI. *Conclusion.*—To sum up, the second half of the year 1917 shows a growing use of material means, notably (*a*) artillery, a large portion of the heavy guns are now quick-firing, and at Malmaison there was one gun per six metres of front, which is not likely to be exceeded; (*b*) aviation, which is now not only an organ of observation and *liaison*, but contains chasing and bombing squadrons; (*c*) tanks, now used in masses and allowing of the omission of the artillery preparation, as at

Cambrai, and making a tactical surprise almost certain; (*d*) the use of gas-shell for neutralizing the enemy's artillery personnel. This increased use of material means allowed of a diminution in the infantry engaged, and artillery tended to become the principal arm. Quick-firing heavy guns, tanks and gas-shell admitting of surprising the enemy, the efficiency of the defence appeared to be problematical and rupture of the front possible. The Germans were evidently very apprehensive on this point, and, in short, the conflict between arms and armour turned in favour of the former. But, in spite of this superiority on the side of the attacker, the result of the battle of the Aisne tended on the French side to a diminution of energy and lack of confidence in the success of large operations, and the tragic events of the spring of 1918 were to be required before courage was completely restored. The real reason why the Allied attacks in 1917 achieved only incomplete successes was that the material means were as a rule not quite sufficient, leading to failure at the critical moment to effect a practicable breach. Again, in 1917, Russia was not affording the assistance which was expected of her, and the Germans were able to transfer forces to France and relieve exhausted troops. It will be seen that the doubts of the Allies in regard to the possibilities of the attack were not shared by the Germans.

(To be continued.) A. R. REYNOLDS.

REVUE MILITAIRE SUISSE

No. 3.—*March*, 1922.

Search for a New Discipline.—The original article is the concluding part of one by Capt. Cingria begun in the number of the *Revue* for November, 1921 (see *R.E.J.*, April, 1922); in it an endeavour is made to meet some of the criticisms levelled against the views to which expression is given in the preceding parts of the original article. Capt. Cingria contends that the measures which he recommends will strengthen discipline and not destroy it, as some suggest would be the result if his views were carried into effect. He recognizes the force of the ethical doctrine which prompts a *free citizen* to render implicit obedience to a chief, and intends in no way to lend his support to those journalists, and others, who are for ever doing their best to lower the prestige of the officer class. Capt. Cingria is of opinion that the officer class must always constitute a distinct *caste*; indeed, that it should be regarded as a kind of aristocracy, consisting of men with a cultivation, which is higher, and an experience, which is wider, than are generally to be found in the men whom they are called upon to command. He does not believe in any greater democratization of the officer grades than exists at present. Again, he does not agree with those who think that discipline would be helped if officers lived the same lives as the rank and file, had their meals with their men and slept in the same dormitories. The adoption of such a course would, he feels, lead to the complete destruction of all real discipline. In a militia force particularly, it is, Capt. Cingria recognizes, essential that the officers should, when mobilized for training or service, be considered as being a class apart, but this does not, he argues, justify all the ceremonial with which the life of the officer is surrounded and which demands a sort of mechanical respect towards him from the rank and file. He is convinced in his own mind that

discipline can be fostered in an Army on lines exactly similar to those by which it is maintained in the Boy Scout Organization. Capt. Cingria fully recognizes that a reform of discipline so as to make it accord with his idealistic views, presents a most difficult problem, involving as it does adjustments of the springs of anarchy, of bureaucracy and of dictatorship in such a way that their resultant effect will be to produce a perfectly stable state of equilibrium. The subject under discussion is of great public importance, and much of the matter contained in the original articles of this series is of considerable interest.

The Army and the Suppression of Civil Disorder.—In the original article, the author of which is anonymous, is described an incident which deals with the difficult problem of the employment of soldiers in aid of the civil authorities. A strike of the workmen in the dyeing industry took place in Basle on July 29th, 1919. A Strikers' Committee incited the malcontents to bring about a general strike two days later: the mischievous advice was acted on. The *Conseil d'Etat* of Basle took measures to meet the situation and, on July 31st, put itself in communication with the Federal Council. The latter body at once arranged for troops to be withdrawn from the frontier and, on August 1st, the 20th Company of Observation Troops was drafted into Basle; on arrival there it was quartered in the barracks, where its commander explained to his men their duties when acting in aid of the Civil Power and called attention to the rules laid down in the Official Regulations in relation to the use of arms on occasions of the kind then existing. Almost as soon as the troops reached Basle they had to be sent into the public squares for the purpose of maintaining order. The soldiers were attacked by the strikers and retaliated by firing on the mob. A workman in the crowd was hit by a bullet and died within a few minutes. The military authorities wished to convey the dead man's body to the Gymnastic Hall near the barracks, but were prevented from doing so by the strikers, who took charge of the corpse. The occasion was made one for a socialist demonstration: some 200 to 300 persons collected, and, having formed a funeral procession with red flags, etc., marched to the Gymnastic Hall. The entrance to this building from the public street being closed, the crowd attempted to force its way into the barrack square, the entrance to which was guarded by a couple of sentries, one of whom, on seeing the mob, which was approaching the gateway, had put the gates to and fastened them. The pressure of the crowd on the gates caused the fastenings to give way and the gates flew open. Thereupon a man rushed forward from the crowd and advanced to the gateway as if intending to force the sentries; at the same time he bared his breast and shouted defiantly to the sentries to fire. A couple of shots rang out: it is not known by whom they were fired. The main guard now fell in at the entrance to the barracks and opened fire on the crowd. Shortly afterwards the Company Commander arrived on the scene and stopped the firing. The funeral procession dispersed; however, during the fusillade a woman was shot dead. Why this latter victim was present in the tumult has not been explained. The mother of the dead woman brought an action against the Government claiming 11,700 francs as damages in respect of the loss of her daughter; the Federal Courts non-suited her

on the ground that, according to the doctrine of the Swiss law, in such cases the responsibility for wrong-doing is placed directly on the tort-feasor, and then alone when the wrong-doing is an act in contravention of his duty. In this particular case it was shown that the troops had in no way violated the service instructions issued for the purpose of regulating their conduct in circumstances of the kind in which the unfortunate woman killed had met her death. In the original article the question is raised whether in certain circumstances there should not, on the grounds of justice and equity, be an obligation upon the State to pay compensation to third parties who suffer loss by an "Act of State." The author of the original article offers an answer to the question. He says that when the necessity arises for the State to defend itself or to take extraordinary steps to maintain public order within the realm, it becomes the duty of every loyal citizen to place his person and goods at the disposition of the community at large, and should one such in so acting suffer damage, he certainly makes a sacrifice, but in so doing he is but performing his duty to society.

NOTES AND NEWS.—*Switzerland.*—Attention is called to the paragraphs in the *Instructions du Service de l'Infanterie* for 1922, in which it is enjoined that the *pas cadencé*—the German Paradeschritt—shall form part of the drill training of recruits, N.C.O.'s and officers of the Swiss Army. This gymnastic step is to the Romand section of the Swiss Army like unto the proverbial red rag to a bull. The *Revue* takes the authorities to task for maintaining German traditions in the Swiss Army and points out that for the past fourteen years it has consistently objected to this essentially German parade trick: five grounds are given for the abolition of this particular kind of "goose-step."

France.—A Special Correspondent points out that the Provisional Instructions relating to the tactical handling of the larger formations approved by the French War Minister on October 6th, 1921, were published at the end of February, 1922. The volume opens with a declaration concerning poison-gas warfare, which it is thought will give rise to much criticism. The French military authorities, in effect, announce that if an enemy government, at the beginning of a future war, does not give a satisfactory undertaking not to bring into use those "weapons of war" which were proscribed at the Washington Conference, France will reserve to herself full liberty to take whatever action that the circumstances of the moment may then dictate. The general principles upon which the instructions have been built up are summarized in the original communication: the comments on them are too lengthy for reproduction here.

Attention is called to two volumes recently published in France: *Racolage et milice* (1701–1705) by G. Girard (published by Plon, Paris, 1922), and *Histoire militaire* by Lieut.-Colonel René Tournès (published by Charles Lavauzelle, Paris). The latter volume is recommended as a work which should be in the hands of all commanding officers, not only because therein it is shown how best they can utilize the men and materials placed at their command, but also by reason of the fact that the contents of the volume are of a nature tending to promote the general culture of the professional soldier.

W. A. J. O'MEARA.