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THE ROYAL ENGINEERS JOURNAL.

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CONTENTS.

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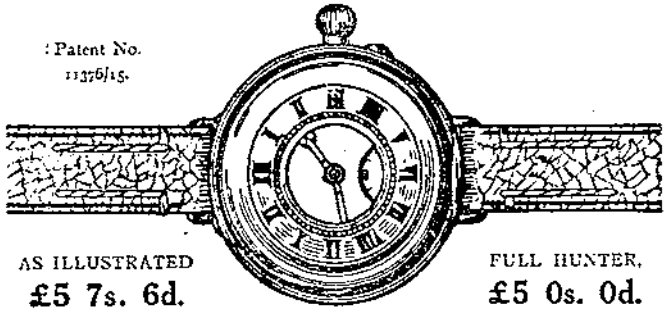

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CONTENTS.

LAUNCHING AN INGLIS BRIDGE.

By CAPT. A. TAYLOR, R.E.

THE following notes on launching a heavy triangular type Inglis Bridge on wire cables over a gap of 216 ft. without the aid of a carriage have been forwarded by a Chief Engineer.

Site.—The bridge had to span a river whose banks rose steeply to a height of 140 ft. above the water level on the north side, and 85 ft. on the south side.

Anchorage for Cables.—Four ¾-in. diam. cables were employed in pairs to support the bridge during launching and were anchored. On the south side two 12-in. × 12-in. timber baulks sunk into the ground behind a large boulder and on the north side four oak trees were utilized. The cables were made fast 13 ft. apart to the 12-in. × 12-in. baulks and the loose ends taken across the gap by means of an aerial ropeway previously erected. They were then passed round the rear two trees and hooked on to 3-ton differential tackles. The strain being taken on the cables, with the differential fastened on to the *near* trees. All seizings were by means of wrought-iron clamps. The distance between anchorages on north and south banks was 545 ft.

Bridge Seatings.—A plumb line dropped from the cables gave the exact line for the bridge seatings. These were raised to the required level on crib piers, M.S. cubes being employed.

Winches.—For hauling the bridge across the gap two 3-ton winches were placed in line between the cables on the north side and bedded down. One 3-ton winch was sited on the south bank to control the bridge from the rear.

Erecting and Launching.—As the Inglis Bridge was to be launched from the south side, a distance of 30 ft. from the front of the crib piers to the bank was required, which formed the shore bay and erecting platform. This was decked over with 9-in. × 4-in. and R.S.Js. Two bays of bridge were then erected. A false transom had meanwhile been made and fitted with a guide shoe at each end, so that the cables would clear the superstructure of the bridge. This transom was now secured under road transom No. 2, and the cables inserted under the guide shoes. By hauling on the differential tackles all slack was taken up on the cables. Two 1-in. diam. wire cables were made fast to No. 1 transom and passed through the

winches on the north bank, and 1½-in. diam. cable secured to No. 1 pyramid and passed back to the winch on the south bank. Side and back guys were also used to control the launching.

The bridge was then launched forward one bay. By adding a bay and launching a bay at a time the whole span was taken across the gap. One bay was always kept in hand on the launching platform.

After the fifth bay had been added it became necessary to lessen the dip of the bridge. This was done by pulling up on the differential tackles, and also using men and R.S.Js. as a counter-balance on the bay on the launching platform. When No. 1 transom of bridge reached the north abutment the bridge had a slope of 1·5°.

As it was impossible to raise the bridge on to its seating with the differential tackles, owing to the heavy strain on them, the top cubes of the crib piers were dismantled. The bridge was then jacked up and the crib piers reconstructed. After the bridge was properly seated, the cables that the bridge was launched on were slacked away, and placed under the false transom which had been inserted at the centre of bridge. This was No. 10 transom. The cables thus formed tension ties for the support of the bridge at the centre of the span, and after hauling up as tautly as possible with the differential tackle, they were made fast at the anchorage.

In carrying out the work above mentioned the following points were noted :—

(*a*). The two ¾-in. cables did not give a sufficient margin of safety. 1—1⅛-in. diam. cables on either side of bridge are necessary.

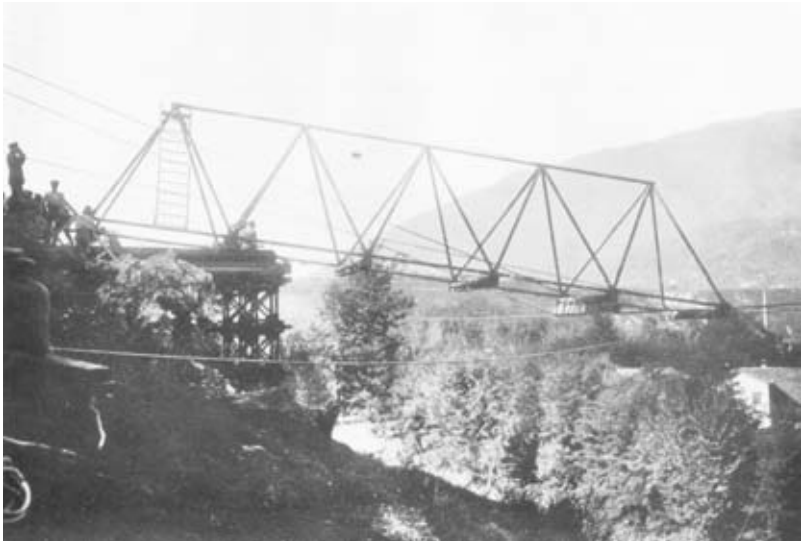
(*b*). 3-ton differential tackles are insufficient for adjusting the cables. Two 6-ton tackles are required, or larger.

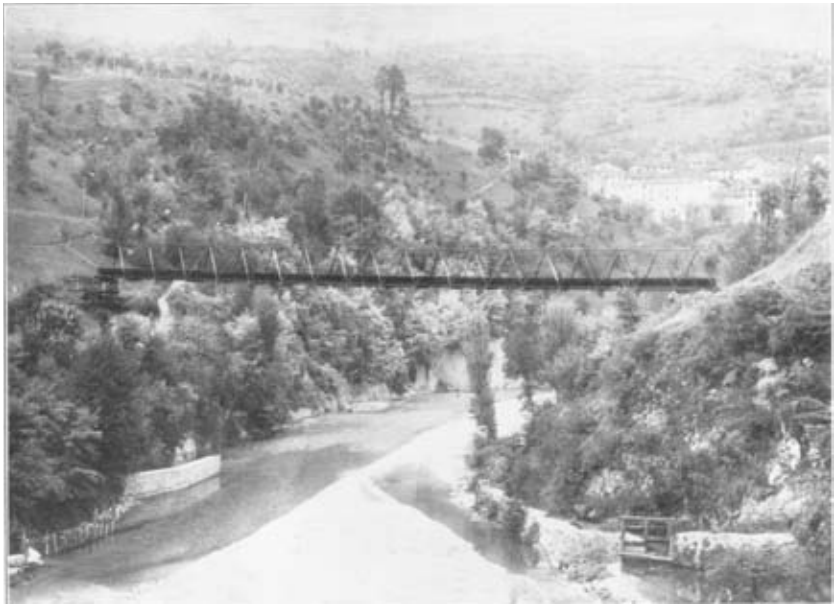
Remarks.—As the Inglis Bridge is capable of supporting its own structural load over a span of 200 ft. or more (without channel for roadway) it is possible by increasing the number and strength of the tension ties to render such a bridge suitable for the following traffic :—

Infantry in file.
Field guns.
First line transport.

For the launching and erection of the bridge, the man-hours worked were 4,000 employing a party of 50 men. One hundred and fifty men working in three shifts of eight hours should put in anchorage, erect crib piers, and launch and complete bridge in four days.

Launching of the Inglis Bridge





Launching of the Inglis Bridge

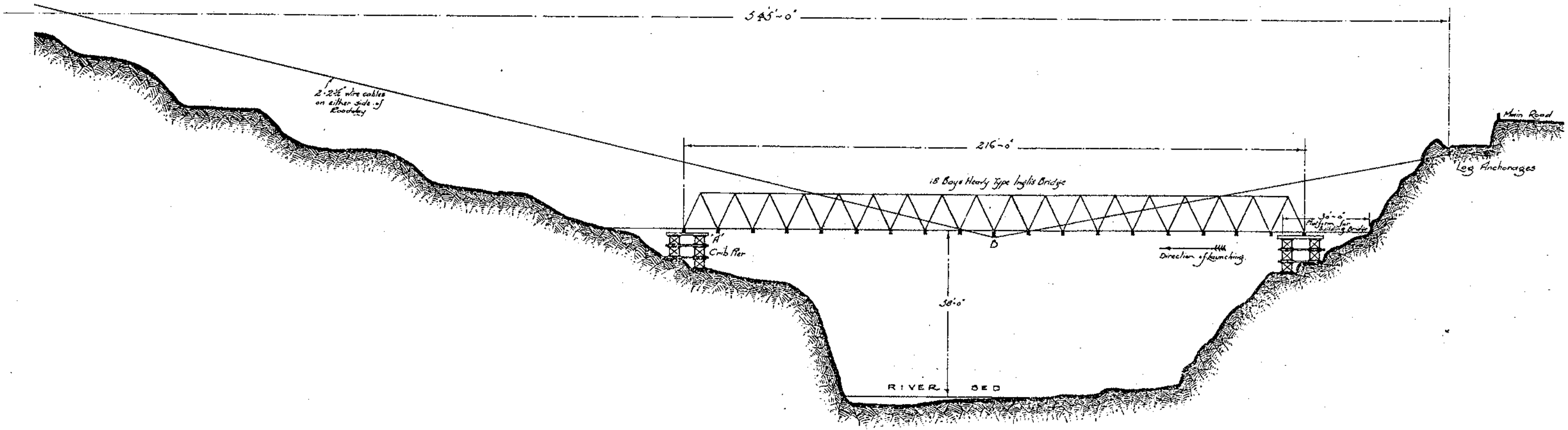
BRIDGE SPAN OF 216 FEET

SECTION OF GAP

Scale 1"-20'-0"

Note: Bridge was Launched on 2 Pairs of 2½" Wire Cables & Travelled on a false Transom at 'A'
The cables were then placed under Transom 'B' to form Supporting Ties

...orages.



WATER SUPPLIES TO A MOUNTAIN PLATEAU.

By CAPT. H. B. WARD, M.C., R.E., M.SC., M.ENG., A.M.I.C.E., P.A.S.I.

Topography and Geology of the Plateau.—The plateau under consideration lies at an elevation of 3,000 ft. above sea level, bounded on the north by steeply inclined hills rising to an elevation of 5,000 to 6,000 ft., and on the south by more gently sloping ones averaging some 4,000 ft. above the sea.

To the west and east, the plateau descends abruptly to the Valleys of the "A" and "B" respectively. Broadly speaking the Northern and Southern mountain boundaries are composed of a calcareous limestone of the lower Jurassic formation. This rock is light coloured, generally pale grey or yellow, and moderately hard. The important characteristic of this limestone is its extraordinary permeability, with a resulting absence of natural springs.

The basin forming the actual plateau is composed almost entirely of another variety of calcareous limestone belonging to the lower Cretaceous system. It is mostly concealed through a light covering of soil, and is very permeable. Both limestones are extensively fissured; fissures are known that are over 800 ft. deep by 20 ft. in breadth, and there are a great number of smaller ones.

As a direct result of its geological formation, the plateau is noted for an almost entire absence of springs; all the rain and melted snow is rapidly lost through the numerous fissures and hence special arrangements have to be made for the supply of water. There are a few small springs, whose existence however is of no assistance to the British Forces, since they are in enemy hands.

Sources of Supply.—Down on the plains on the foot of the mountains forming the Southern boundary of the plateau, several good springs emerge, and these appear to owe their origin to the percolation of rainwater and melted snow through the very permeable formations referred to. These springs vary throughout the year corresponding with the rainfall, but their variation is gradual with the changes of the seasons, and the larger ones are not liable to the rapid fluctuations that occur in mere surface springs. Owing to the highly fissured nature of the limestone, slight impurities gain access to the spring waters, and generally half a measure of chloride of lime is needed per 110 gallons to sterilize the water.

Delivery to the Plateau.—The question of supplying the plateau with water resolves itself then into a purely engineering problem, pumping plant being established at each of these main springs on the plains to lift water to the summits of the mountains, from where service reservoirs feed by gravity the Plateau Area.

Several pumping schemes were already in operation before the British Forces were in the line on the plateau, but as a portion of the area occupied was not sufficiently supplied, new work was commenced. The spring selected was one which delivered about 40,000 gallons an hour, the work being carried out by the Ufficio Idrico of the Italian Army concerned as far as delivering water to the mountain summit. Forward of this, British Army Troops Companies, R.E., assisted by Field Companies, laid the gravity main and constructed the water-points. Initial and relay pumping stations were erected, as it was desired to obtain as large a delivery as possible. Had the total lift been done by only one pumping plant, not more than half the quantity of water would have been delivered. The total lift was approximately 4,200 ft., divided into two lifts of 2,100 ft. each.

The plant at each pumping station consisted of a pair of reciprocating 3-throw ram pumps, specially designed for high-lift work; two were made at Milan and two at Turin. One pump at each of these stations had a duty of 1,600 gallons an hour and the other a duty of 2,400 gallons, so that when both worked simultaneously a total quantity of approximately 4,000 gallons per hour is delivered 4,200 ft. above the source of the spring. The pumps were designed to work against a head of 2,300 ft. in this case. The motive power at each pumping station consisted of four high-speed petrol motors, each about 45 h.p. Two motors were sufficient to drive both the pumps, and the other pair were in reserve.

As in all high-lift pumping schemes the piping required special attention, the usual 4-in. screw jointed pipes being quite inadequate. Instead steel tubing, 2½ in. diameter, by Messrs. M. was used, the joints formed of two heavy flanges brought together with bolts, which tightened on to a rubber ring circular in section held in a soft metal casing. These pipes stand a pressure of 4,500 ft. of water, and pumps are made by both the firms already mentioned to lift against a maximum head of 4,500 ft. Thus the piping and pumps available corresponded as to their ability to stand these maximum pressures, and installations are in existence where water is lifted 4,500 ft., at the rate of 800 gallons an hour.

Where greater deliveries are required, the lift is divided into two portions, and pumps are then available to deliver 2,400 gallons an hour against heads of about 2,500 ft. In the pumping plant established the rising main was 5,000 yards long, 4,000 yards being of steel tubing, the upper 500 yards on each section of the rising main being made

with the usual 4-in. screw jointed pipes. Work was commenced in the middle of March, and by the 25th of April, water was delivered to one of the important roads on the mountain slope, 3,500 ft. above the spring, and 10 days later water was pumped to the summit of the mountain, 4,200 ft. above the source. This particular mountain summit is 4,900 ft. above sea level.

The lower pumping station was close to a main road, and the transport of plant and materials was therefore simple. The only other road crossing the pipe-line was the one referred to, 3,500 ft. higher up, and much of the piping for the upper section of the rising main was delivered by lorry on this road, and carried down the steep mountain side by hand. The gradient of the piping averaged 1 in 3 from the spring to the summit.

Engines and pumps for the upper pumping station were pulled up rough mule tracks from the main road at the mountain foot by large parties of Italian civilian labour; one of the motors being drawn up by a party of 60 Italian girls; pumps being hauled up by parties 40 strong, and so on.

The rising main was laid on the surface of the mountain side to save time, and subsequently dropped into a trench about 2 ft. deep. Most of this trench had to be cut out of rock. Selection of a site for storage reservoirs on the summit was made with a view of their being out of direct vision from the mountains held by the enemy. Four 9,000 gallon tanks were erected, with timber floors and sides, lined with the usual tarred tarpaulins 30 ft. square.

Delivery by Gravity Forward of the Summit Reservoirs.—The first 2,000 yards forward from the summit reservoirs traversed rather difficult country for pipe laying. Broadly speaking the line of least resistance was followed, the pipe-line descending slowly at first below the summit, and then dipping steeply downwards to a valley leading towards the first water-point. The ground was reconnoitred when there was 3 ft. of snow on the upper slopes of the mountains, most of which had, however, melted by the time work was commenced.

Four-in. screw-jointed piping was laid on the surface, except where deep ravines and considerable irregularities were met with, when timber trestles were erected and the pipes supported on them. With a view to the avoidance of trouble in the winter, the whole main was laid with a continuous gradient forwards, so that it can be emptied as soon as a water-point has been filled without leaving any water to freeze in the pipes. The upper end of the main was left open just above the first intake from the reservoirs, to allow air to escape, and several air valves were put in at rapid changes in the gradient. Four expansion valves were also put in, in a length of 2,000 yards, to relieve strains at the joints due to the wide diurnal range of temperature. As soon as the pipes were covered, these valves practically went out of commission. At 2,000 yards from the reservoirs an im-

portant road was met, where the first water-point was established at a level of 750 ft. below the summit. The usual 30 ft. square tarred tarpaulin-lined tank was used throughout, raised sufficiently on short round timber piles to enable the floor to clear the irregularities of the ground.

All tanks supplying water-points were placed 20 to 30 ft. above road level, this greatly facilitating rapid re-filling of water-carts, an arrangement made easily possible by the fact that on one side of almost all the mountain roads the hillside rose steeply from the road level. Immediately below this first water-point, an automatic pressure reducing tank was installed. This tank was half-way as regards level between the mountain summit and the level of the plateau, and was a 400-gallon galvanized iron tank fitted with two 2-in. ball valves. The main from the mountain on reaching the tank divided into two branches, to each of which 4-in. to 2-in. reducers and 2-in. ball valves were fitted.

The piping was admittedly subjected to pressure in excess of what would be considered advisable, the lower end of each section of the gravity main sustaining a head of about 750 ft. Very few leaks or breaks occurred however, and the breaks were nearly all longitudinal splits, some pipes being found to be weak along a seam-line from end to end.

Some difficulty was found at first with the washers in the ball valves not being suitable for a high pressure; this was overcome, as also a tendency to bend in the arms between the balls and the valves. From this pressure reducing tank a 4-in. main continues through the forest to the front line, supplying several water-points en route. At two points branch mains of 2-in. piping, about 2,000 yards long, were taken off it; the 2-in. pipes being large enough considering that each of the subsidiary pipe-lines left the main where the head of water was fairly considerable. The ease and rapidity with which 2-in. mains can be laid in mountainous country as compared to 4-in., is to be noted, and the use of the smaller pipes is often possible when the head available is as great as it usually is in the mountains.

Horse-Watering.—The difficult problem of horse-watering on the plateau was greatly relieved by the existence of several large ponds possessed of clay bottoms, which were available until late in August. All ponds were fenced round with barbed wire, and animals prevented from walking into them. Lift and force pumps and troughs were fitted up, and it was not until late in August, and in some cases early in September, that piped supplies had to be drawn on to any extent.

To guard against any temporary shortage of horse-water, and to provide a reserve which would be required in the event of operations (since with a greatly increased number of horses and mules on the plateau the pumping plant could not then have coped adequately

with the demand) four horse-water storage points were established. These each contained 25,000 gallons and were kept full, being supplied from the piped systems. 100,000 gallons were thus kept in reserve. In addition to horse-water supplies from ponds, and from the mains, a good deal of very useful work was done by Divisions in the construction of tarpaulin-lined catchment pits. These were dug into the ground in carefully selected positions, to which surface water would run during heavy rain. Pumps and troughs were fitted up, and at the best of these pits a few hours' heavy rain was sufficient to accumulate 9,000 gallons of water for horse supplies.

Winter Precautions.—Precautions against frost have to be undertaken most thoroughly on the Plateau. The mean annual temperature for "A"——is only 7° Centigrade, the coldest month being March, whose mean temperature is 0·8° C. From November to April inclusive an almost continuous frost exists, with the thermometer at or below zero for 25 days or so per month. Generally on the Plateau it snows from November to the end of March, the mean annual depth of snow being 4 ft. With these conditions for six months of the year, the usual comparatively shallow burying of mains is of little or no protection, and to reach a safe depth the trenches would have to be cut out of solid rock, at the expense of an immense amount of time and labour. Pipe lines are generally covered over with 18 ins. to 2 ft. of earth, and the special precautions detailed below taken in addition.

(*a*) *Rising Mains up to the Mountains.*—Placed at the bottom of the rising main close to the pump is a washout valve, and this is opened at night once the cold weather sets in, the main being emptied. In certain cases the rising mains are not entirely emptied, but sufficiently so as to ensure the water being in motion during the night.

(*b*) *Gravity Mains.*—As already stated, these are graded so as to admit of them being emptied except when water is actually passing down the main to re-fill a water-point. Water should not be allowed to stand in mains at night (unless deeply buried) or in the daytime either during the more severe frosts. Where hollows in the line of the main are unavoidable, washout valves are put in, so that the whole main can be emptied.

(*c*) *Water-Points.*—Since the timber tarpaulin-lined tank is quite unsuitable in the winter, special ones have been prepared. These are built in masonry and concrete, and are rectangular in form with a 6-ft. depth of water in them. Excavations in every case had to be cleared by blasting, and when the sites were prepared, walls varying in thickness from 2 ft. to 3 ft. were put in on a 12-in. floor of concrete. The roofing was supported by rolled steel joists carrying a 6-in. layer of concrete with reinforcement of expanded metal. The roof was covered over with a 2-ft. layer of stones and earth and dry walling 2 ft. thick built up around the exposed portions of the walls.

The draw-off pipes from these winter tanks were fitted with the control valves placed immediately outside the masonry walls, so that as soon as a water-cart was filled and the valve closed, the delivery pipe emptied itself at once. Since the tanks were placed well above the roadway, the draw-off pipe had a continuous gradient to the water-cart or lorry being filled. The valves are worked by the Water Police at each water-point. The short length of piping to the dixie-filler was the only pipe filled with water during the daytime, and was buried deeply. The actual dixie-filler consisted of a length of 2-in. piping, with half a dozen 1-in. branches from it, to which latter were fitted $\frac{3}{4}$-in. bib-cocks. The 2-in. pipe was laid to a gradient, the lower end being plugged off, and the 1-in. branches were inclined backwards to the 2-in. main, so that on removing at night the plug referred to all water was withdrawn from the piping at the dixie-filler. The whole was built into a solid mass of masonry and concrete.

RELATION OF WEIGHT OF RAIL TO AXLE-LOAD.

By G. RICHARDS, M.INST.C.E., Chief Engineer with the Railway Board, Simla.

THE following, which is Technical Paper No. 188, has been kindly provided by the Chief Engineer with the Railway Board of India :—

During the last few months several Engineers have asked—

(*a*). Why the Railway Board have laid down different scales of axle-loads for the 5 ft. 6 in. gauge and for narrower gauges?

(*b*). To what extent the axle-load for any weight of rail may be increased with closer spacing of sleepers?

The scales of axle-loads are given in the "Schedules of Maximum, Minimum and Recommended Dimensions to be observed on all {5 ft. 6 in. / 2 ft. 6 in. / metre} gauge railways in India" which were distributed with the Railway Board's Circulars {No. 1820 R.C., dated 2nd July, 1913. / No. 1262 R.C., dated 8th May, 1913. / No. 1831 R.C., dated 3rd July, 1913.}

5 *ft.* 6 *in. Gauge.*—Item I (15) of the Schedule reads as follows :—

Minimum weight of rail per yard for each ton of weight on a pair of wheels :—

Axle-load, *i.e.*, weight on a pair of wheels including weight of wheels and axles.	Minimum weight of rail per yard.
12 tons 0 cwt.	60 lbs.
13 „ 10 „	65 „
15 „ 2 „	70 „
17 „ 0 „	75 „
18 „ 12 „	80 „
20 „ 8 „	85 „
22 „ 12 „	90 „
24 „ 14 „	95 „
26 „ 18 „	100 „

Metre Gauge.—Item I (15) and 2 *ft.* 6 *in. Gauge* Item I (18) read as follows :—

> Minimum weight of rail per yard for each ton of weight on a pair of wheels, 5 lbs.

Below these items in all three of the schedules, is the following note :—

> With closer spacing of sleepers a less weight of rail is permissible.

We know very little about the actual stresses in rails in an elastic road under a train, so opinions must differ about the relation of weight of rail to axle-load.

The following note, which I compiled a few months ago from the Railway Board's records, shows (*a*) reasons for the scales of axle-loads which are prescribed in the Schedules of 1913 and (*b*) the limitations of closer spacing of sleepers.

(*a*). *Scales of Axle-loads.*

1. The maximum axle-loads prescribed in 1913 were fixed after careful consideration of the remarks of the principal Railway Administrations which were received in response to Railway Board's Circular No. 2915 R.C., dated 2nd November, 1911. Only two railways objected to the scales of axle-loads circulated with that letter, viz., the Bombay, Baroda and Central India Railway whose Chief Engineer suggested that the *weights of rails* were decidedly too small and the South Indian railway whose Board of Directors appeared to prefer the old uniform scale of 5 lbs. weight of rail per ton of axle-load and whose Consulting Engineer wrote : " I have been unable to find out that the proposed altered weights are calculated according to any of the formulæ on the subject with which I am acquainted."

2. The old uniform scale of 5 lbs. weight of rail per ton of axle-load unduly restricted the axle-loads that could be carried on rails weighing over 60 lbs. per yard : for instance, only 15-ton axle-loads were allowed under the old scale to run on 75 lb. rails though it was known that 17-ton axle-loads could and did do so.

3. Long experience had shown that a 60 lb. rail is quite suitable for 12-ton axle-loads with the ordinary number of sleepers (say about 1,900 or 2,000) per mile.

4. The following table was prepared in the Railway Board's Office in 1911 to indicate the axle-loads which are probably suitable for various weights of rails on the assumption that 12 tons is the correct axle-load for a 60 lb. rail with regard to both stiffness and strength of the rail :—

Weight of rail in lbs. per yard. (w)	Old Government Rule. $W=\frac{w}{5}$.	Axle-load in tons (W). According to stiffness of rail.	Axle-load in tons (W). According to strength of rail.
20	4	1.5	2.5
25	5	2.2	3.0
30	6	3.0	3.66
35	7	4.1	4.6
40	8	5.4	6.0
45	9	6.9	7.3
50	10	8.4	8.7
55	11	10.1	10.3
60	12	12	12.0
65	13	—	13.5
70	14	—	15.1
75	15	—	17.0
80	16	—	18.6
85	17	—	20.4
90	18	—	22.6
95	19	—	24.7
100	20	—	26.9

Axle-loads were not calculated according to stiffness for rails weighing over 60 lbs. per yard because the stiffness of such rails (B.S. Section) is ample if their strength is sufficient.

5. The axle-loads based on calculations of strength were finally adopted for the 5 ft. 6 in. gauge, and inserted in the schedule of dimensions of 1913 for rails weighing over 60 lbs. per yard. No rails lighter than 70 lbs. per yard are likely to be used on 5 ft. 6 in. gauge railways in India, so no mention of such rails was made in the 5 ft. 6 in. gauge schedule.

6. The axle-loads calculated for rails weighing less than 60 lbs. per yard were much smaller than those permissible under the old uniform scale of 5 lbs. per ton. Experience on the Kohat-Thal and Nowshera-Durgai railways had indicated that the "5 lbs. per ton" rule gives axle-loads which are really too big for light rails but, in view of the low speed at which trains are usually run on light rails, it was decided to retain the old uniform scale for rails not exceeding 60 lbs. per yard. The heaviest rails used on metre gauge and 2 ft. 6 in. gauge railways in India do not weigh much more than 60 lbs. per yard: so the old "5 lbs. per ton" rule was retained in the schedules of 1913 for metre gauge and 2 ft. 6 in. gauge railways.

7. If a metre gauge railway is laid or relaid with new rails heavier than 60 lbs. per yard, the scale of axle-loads prescribed for the 5 ft. 6 in. gauge will no doubt be allowed for the metre gauge as far as the rails are concerned.

(b). Spacing of Sleepers.

8. Below the items of the schedules of dimensions which lay down the "minimum weight of rail per yard for each ton of weight on a pair of wheels" there is the following note:—"With closer spacing of sleepers a less weight per yard of rail is permissible."

9. No figures were given to show how much extra axle-load a rail may be permitted to carry by closer sleeper spacing. The omission was deliberate. This subject was carefully considered in 1902–03 when the following algebraical formula was proposed:—

Maximum axle-load=

$$\frac{\text{weight of rail per yard}}{5} \times \frac{30}{\text{sleeper spacing in inches}}.$$

The formula was never promulgated as a Government Rule, but the late Mr. C. W. Hodson suggested that Government Inspectors should bear it in mind when considering special cases.

10. In the present stage of development of rail joint in India it is doubtful if extra sleepers, spaced closer than about 30 inches, justify *any* excess over the axle-loads prescribed in the schedules of 1913.

11. The present general type of joint is a suspended joint with the sleepers on each side of it brought as close together as the fishplates or the practical requirements of packing will allow: it is believed that the joint is usually weaker than the rest of the rail.

12. So long as the rail joint (with sleepers laid as near to it as possible) is weaker than the rest of the rail with the minimum number of sleepers (1,906) per mile, it is obvious that the track cannot be strengthened by inserting additional sleepers, for the strength of the joint would not be increased thereby.

13. In the case of a road in which the joints are *stronger* than the rest of the rail, it is safe to increase the axle-load and to make it vary inversely with the sleeper spacing up to a certain limit which may possibly depend on the resistance of the rails to local crushing.

14. Even when the joints are stronger than the rest of the rail it will probably be found uneconomical to lay any new line with rails so light that they need sleepers spaced much closer than the ordinary 30 inches. It will, however, often be economical to strengthen an existing light track by inserting additional sleepers, instead of renewing the rails, on condition that the rail joint is still as strong as the rail with the reduced sleeper spacing.

Field Marshall Lord Nicholson GCB Colonel Commandant RE

MEMOIR.

FIELD MARSHAL LORD NICHOLSON, G.C.B., COLONEL COMMANDANT, R.E.

By the death, in London, on the 13th September, 1918, of Field Marshal Lord Nicholson, G.C.B., Knight of Grace of the Order of St. John of Jerusalem, and at one time A.D.C. General to H.M. King George V., there passed away one of the most remarkable men that ever belonged to the Corps of Royal Engineers. He never commanded even a small unit, in peace or war, yet he rose to be a field marshal; he never graduated at the Staff College, yet he rose to be the Chief of the Imperial General Staff; he had no Parliamentary or family interest or other influence, yet he became a peer of the realm and occupied a position of recognized authority among statesmen; the greater part of his army service was in India, yet when he came to serve at home his influence at once became felt, and he exercised power even in quarters where prejudice against Indian administrators, as such, still lingered. It was all due to sheer brain power and ability. He had in a most remarkable degree the gift of clear perception of the ultimate aim and relative importance of every subject he handled, and the consummate skill with which he expressed his views, and the strength with which he insisted on their adoption, were the means whereby he rose to power and commanded the respect of those associated with him in his life's work.

William Gustavus Nicholson was the son of William N. Nicholson, J.P., D.L., of Roundhay Park, Leeds, and was born on 2nd March, 1845, at the Mansion House, Roundhay. He was educated at Leeds Grammar School under Dr. (afterwards Bishop) Barry, one of the distinguished sons of Sir Charles Barry, the architect of the Houses of Parliament. Among his schoolfellows were Mr. Robert Elliott-Cooper, President of the Institution of Civil Engineers in 1912 and now Chairman of the War Office Committee of the I.C.E. on Hutted Camps, etc., and several others who attained distinction in civil engineering (as well as others who attained high position in other professions). Yet the school was not one which specially devoted attention to engineering, on the contrary a classical curriculum obtained at that time there, as in all schools, to the exclusion of everything else. In Nicholson's case it resulted in his being, to an extraordinary extent, a polished student of classical authors, and an accomplished writer of felicitous expressions and incisive phraseology

in his own language. The fact, however, of so many pupils becoming leaders in various walks of life and especially in engineering shows how Dr. Barry must have been able to educate them, not only in what Carlyle calls "gerund grinding," but in the far harder task of grasping the broad essentials of life and the practical purposes to which to apply their knowledge.

In 1863 Nicholson passed for the R.M.A. at Woolwich and obtained his first commission in the Royal Engineers in March, 1865. One who served with him as a cadet speaks gratefully of his kindness and consideration to a forlorn "snooker," at a time when discipline at the R.M.A. among cadets themselves was certainly lacking in these qualities. After the usual course at Chatham, and some regimental duty at that station, Nicholson was ordered to the West Indies, and served in Barbados from March, 1868, until 1871. The work he had to do there was probably not very arduous. At all events it seems to have left his vigour and energy quite unimpaired by the climate. Possibly the experience he gained of the essential features of coast fortification, as exemplified in the defence of the islands, was of service to him in taking up the work later of the Defence Committee in India.

After completion of his three years tour in the West Indies he returned to duty again at home but appears to have volunteered for service in India, to which country he was sent in October, 1871. He had married in that year Victorie, daughter of D. Dillon, Esq., a lady who now survives him.

In India, where he was destined to rise to very high position and where for the next thirty years, more or less, his service was spent, he was employed first in the Public Works Department at Hyderabad and subsequently in the Punjab Irrigation Branch. This was then a very favourite employment for R.E. officers, and continued to be so until departmental changes of a drastic nature took place in 1880. At the head of the department were various capable R.E. officers, Gulliver, Crofton, Brownlow, and others, men of the very best stamp of the old East Indian Corps of Engineers, and all imbued with the highest ideals. The work too was on a large scale and well worthy of the best energies of any man. But the life was a severe one and exacting for a young married couple and possibly for this reason, possibly because he found himself departmentally junior to his contemporaries in the Corps, Nicholson left it for Military Works. He was employed at Rawal Pindi and Peshawar on the usual barrack and road work, but at the latter station he carried out the new waterworks scheme, designed by the late Colonel T. C. Manderson, R.E., one of the first of the important waterworks projects which have done so much to improve the sanitary conditions of life in our Indian cantonments. The supply in this case was obtained from the Bara river at the foot of the hills about 10 miles from Peshawar,

whence after passing through an ingenious arrangement of settling tanks and filters, the water is conveyed by a concrete aqueduct to the cantonments. Concrete in those days was a very different thing from what it is now, for Portland cement was far too costly to be used, and engineers had to make the best use they could of local resources. The work Nicholson did was admirable and has stood the test of years. Moreover, he there learnt something of frontier conditions and of the tribesmen. His regimental promotion was slow. He was thirteen years a subaltern, and during that period had no chance of showing the great qualities that he possessed, but, as in the case of his great contemporary Lord Kitchener, his chance came to him soon after his promotion to captain.

In the autumn of 1878 the Afghan War broke out. Three columns invaded Afghanistan: furthest north, in the Khyber, the central one in the Kurram, and the third through the Bolan Pass. To the last of these Capt. Nicholson was appointed as Field Engineer. The route was an exceptionally difficult one. There was then no bridge at Sukkur over the Indus, the nearest point on the railway was Jacobabad in Sind, then over 100 miles of absolute desert had to be crossed before reaching the sterile and difficult Bolan Pass leading to Quetta. Thence the route traversed the uplands of Peshin, crossed the Khojak Pass, and then, but not until then, reached fairly open country to Kandahar. Nicholson's work was mainly making roads and smoothing away difficulties in the way of water supply for the main columns. He was with the advanced troops that entered Kandahar, and his services were recognized by his being mentioned in despatches. He there came for the first time into contact with another famous R.E. officer, with whom in after years he was much associated, "Buster" Browne (afterwards Major-General Sir James Browne, K.C.S.I., C.B.), who accompanied the Kandahar Column as political officer and specially distinguished himself by the bold capture of Khelat i Ghilzai.

Early in 1879 it was decided to send a column from Kandahar back to India to the Punjab by an unknown route through the Thal Chotiali country due east from Kandahar. The troops composing this column were under the command of General Sir Michael Biddulph, Colonel Browne being the chief political officer and Capt. Nicholson being field engineer. The difficulties of guiding a column of all arms through an unsurveyed barren mountainous country swarming with hostile tribemen were great, but the march was accomplished with success, due to a considerable extent to the energy and ability of the two R.E. officers. Apart from the military value of the exploration, much valuable geographical and other knowledge was obtained. This march came to an end in April, 1879, and Nicholson returned to duty at Simla, believing, as everyone else did, that the Afghan War was ended.

But the massacre of Sir Louis Cavagnari and his ill-fated companions at Kabul in September, 1879, changed the whole aspect of affairs. Sir Frederick Roberts was ordered to take command of the troops still occupying the Kurram Valley and proceed at once over the Shutargardan Pass to Kabul. He started at once with such officers as were appointed to the Staff of the newly-formed force, among whom were the C.R.E., Colonel Æneas Perkins, and Capt. Nicholson who was to be field engineer of the force. They proceeded with all haste to the front, crossed the Shutargardan, and, at the battle of Charasia, on the 5th October, Sir F. Roberts with his mere handful of troops defeated the strongly-entrenched and superior force of Afghans. This was followed at once by the occupation of Kabul.

One of the first steps to be taken was the establishment of communications at once with India by the Khyber route, as the Shutargardan Pass was sure to be soon blocked with snow. An army was advancing by the Khyber line and the road by this route had already been complete, for all arms, as far as Gandamak, about 70 miles from Kabul, in the earlier part of the war. To complete the remainder, through a wild and difficult country, it was decided that the Khyber column as it advanced should make the road as far as the Lataband Pass about 20 miles from Kabul, and that the remaining portion should be carried out by Sir F. Roberts' small force. This task was entrusted to Nicholson.

The road, some 3 miles from Kabul, crossed the Logar river by a brick bridge of several arches which the enemy had not destroyed, then it traversed a swamp about a mile wide, which was fairly passable in summer but in winter had some four feet of water over the path in parts. For the next 6 or 7 miles the route was easy, passing by the village of Butkhak, noted as being at the mouth of the Khurd Kabul defile of infamous memory in the 1842 campaign. Then followed a series of tangled ravines and stony uplands, culminating in the difficult mountain pass of Lataband.

Nicholson at once perceived that the two crucial points were the Logar swamp and the Lataband Pass. For the former he obtained, somehow, the services, as contractor, of an influential native of Kabul, a man who had been *Kotwal* (head of police) in that city, and who, though probably not immaculate in his dealings with his fellow citizens (or else his looks and reputation belied him), was able to lay his hands on materials and labour and to apply both with skill and energy. Him Nicholson placed under the orders of his subaltern at Butkhak, while he himself proceeded with his other subaltern to Lataband.* The garrison at this isolated mountain pass consisted of one battalion of infantry, two mountain guns, and

* The reasons for adopting the Lataband Pass rather than the Khurd Kabul used in 1841-42 are given in Lord Roberts' *Forty-One Years in India*, vol. ii., pp. 253-54.

a small detachment of cavalry, under Lieut.-Colonel Hudson, 21st N.I. (afterwards General Sir John Hudson, K.C.B., Commander-in-Chief of the Bombay Army). The force at Butkhak was one company of infantry and a regiment of native cavalry. The R.E. officer there had a fair amount of transport for sending forward such engineering stores as could be obtained locally, to the work at Lataband.

Everything went on well for about a month after work started. Labour came in freely, and supplies of timber, iron, etc., were obtainable. The drainage of the swamp was skilfully and successfully tackled, the materials for the many bridges were being brought to the various sites, the winding tracks up the pass were rapidly assuming shape, when suddenly the storm burst.

The little British army near Kabul suddenly found itself attacked by vast hordes of Afghans, and after some three days' fighting was obliged to retreat under the shelter of the walls of Sherpur cantonments. The little garrison of Butkhak was withdrawn to Sherpur under cover of night, but that at Lataband was too far off and it was left in a position of perilous isolation.

This was Nicholson's opportunity. He had some idea of the possible abandonment, for as soon as the fighting began, he sent orders to his subaltern at Butkhak to load up all his transport animals with food and send them on at once to Lataband, under strong escort. This secured a considerable addition to the supplies of the little garrison. He was indefatigable also in the defence arrangements, and indeed in all matters connected with the safety and well-being of the garrison, and a sufficiently powerful counter-offensive against the enemy.

During the two weeks that the little force was thus "on its own," he was, though nominally only a Sapper captain, really the chief staff officer, and Colonel Hudson was far too honourable a man to take all the credit to himself and to conceal the fact that Nicholson was the main prop on which he leaned in the successful defence which was maintained, until the arrival of the relieving army under Sir Charles Gough on the 22nd December. The relief of Sherpur took place the next day.

This was the first real step in Nicholson's military career. Up to that time he had been an engineer officer pure and simple. From then onwards he became more and more a staff officer, reliable, cool, far-seeing and capable.

The early months of 1880 were passed by him in Kabul, building the permanent defences. But meantime his road to Lataband, which even in December was good enough to take the traffic of the relief force, had now been finished, and was the subject of a special report from Sir F. Roberts, eliciting from the Commander-in-Chief a letter of thanks to Nicholson and his two subalterns.*

* Colonel Hon. M. G. Talbot, C.B., and the writer of this memorial sketch.

Negotiations for peace and withdrawal were proceeding during the summer months, when suddenly the news of Ayub Khan's victory at Maiwand changed the whole arrangement of affairs, and a force of 10,000 men under Sir F. Roberts was detailed to march to Kandahar.

In that famous march Nicholson was attached to the 2nd Brigade, ultimately taking part, with the 72nd Highlanders, 5th Goorkhas and two frontier regiments, in the battle of Kandahar, where his previous knowledge of the ground was very valuable.

This closed the campaign. Nicholson got the medal and three clasps, bronze star and brevet majority. His reputation as a man of capacity, resource and knowledge was now established. After a period of short leave he returned to Simla as Secretary of the Defence Committee, which had been constituted shortly before to consider all the problems connected both with coast defence, frontier defence and internal arrangements for the safety of India. As Lord Roberts points out in his book, this involved not merely questions of fortification, but of roads and railways, and of the distribution of troops. It was influenced too by considerations of a political nature, *e.g.*, the advance of Russia in Central Asia, and the obligations of the Government of India to the Amir of Afghanistan.

Before Nicholson, however, had progressed very far in his new duties he was again summoned to active service. In the Egyptian campaign of 1882 a contingent under the command of General Sir H. Macpherson was ordered from India. The C.R.E. was "Buster" Browne, and the field engineers Nicholson and Capt. J. Armstrong, with Lieuts. Burn-Murdoch and Mason as assistants. The final orders for this force, however, reduced the numbers, and the orders to Capt. Armstrong and Lieut. Mason were cancelled, with somewhat curious results as we shall see. Browne and Nicholson, though in many important respects unlike, were both men of independence and energy, both full of resource, and gifted with a keen sense of humour. It was a strong combination, and they had in Lieut. Burn-Murdoch a young officer who had already in the Afghan War distinguished himself by great gallantry and ability. They had four companies of native sappers with them.

Reaching Suez on the 20th August, 1882, they set to work to put in a state of defence the principal local buildings and works, as well as construct landing stages, piers, etc., and the railways to the north. Shortly afterwards the whole contingent moved to Ismailia, where they were soon hard at work, repairing roads and canals, and making accessory railway lines. Here they were part of the main force of R.E. that had come from England under General Nugent. On the 10th September the Indian Contingent started for the front and on the 13th took part in the battle of Tel el Kebir and the subsequent advance on Cairo. The Indian Contingent had to make a

flanking movement on the left of the army, being however fortunate in working along a fair road on the Canal bank, thus gaining both time in the darkness, and ease in progress as compared with the main force which operated on the desert sands. The attack delivered there was a surprise and a complete success. Macpherson at once pushed on to Zagazig. Browne, Nicholson and Burn-Murdoch pressed on with the cavalry (the last-named officer had performed a very gallant action that day already in the attack of a battery for which he was recommended for the V.C.). Nicholson captured four trains under steam, one of which was sent back to help the infantry in their exhausting march. It was a splendid conclusion to the day's success for it cut the enemy's railway system in two, and opened the way next day to the capture of Cairo.

This practically ended Nicholson's share in the war. A ludicrous result, however, followed. In the long list of honours and rewards, there appeared among the list of brevets, the name of Capt. Armstrong, who, as noted above, had been on the original list of R.E. officers ordered to Egypt, but who owing to reduction of establishment, had never been there at all. This inexcusable blunder tickled Nicholson's sense of the ridiculous, and, as he enjoyed nothing more than a practical joke, he applied officially for the brevet, alleging that it was evidently a clerical error, and really meant for him. The application was refused, whereupon Nicholson appealed to the Queen under Sec. 42 of the Army Act. The flutter in official dovecots caused by this audacious act was exactly what he desired. When asked about the success of his appeal, he would reply with much laughter that the highest authorities at the War Office "were very peevish."

Back again to his Defence Committee work at Simla, he was after a while appointed A.A.G., R.E., in India.

Later on, in 1885, Lord Roberts was appointed Commander-in-Chief in India, and took much personal interest in the very important work of the Defence Committee. He has left on record that "it was in a great measure due to Colonel Nicholson's clear-sighted judgment on the many knotty points which came before us, and to his technical knowledge that the schemes for the defence of the frontier, and for the ports of Bombay, Karachi, Calcutta, Rangoon, and Madras were carried out so rapidly, thoroughly and economically, as they were."* This high opinion of Nicholson's ability resulted in his being selected, in 1890, to become Lord Roberts' military secretary, and as "Buster" Browne was then Q.M.G. in India they were again associated in very important work.

Prior to this, however, Nicholson had again work in the field. The operations in Burma which had resulted in the overthrow of the organized forces of King Theebaw, left a legacy of long guerilla

* *Forty-One Years in India*, vol. ii., p. 423.

warfare of a troublesome nature. Nicholson was employed as A.A.G. on the headquarter staff in 1886–87; he was mentioned in despatches and was given the brevet of lieut.-colonel. It does not appear that he had in this campaign any opportunities of special work, but it was the first in which he was employed on the General Staff (as it would now be called) on which ever afterwards he served in the field.

His work on Lord Roberts' staff is naturally merged in the great work of his illustrious chief, who found in him a most reliable and brilliant adviser. The period was one of many frontier expeditions and of much development. Anyone who knows what the N.W. Frontier was 30 years ago, will recognize that the improvements wrought in the interval are stupendous. At the close of the Afghan War there was not even a metalled road in the whole country between Peshawar and Quetta, with the solitary exception of the Grand Trunk Road between Rawal Pindi and Peshawar. There were no railways beyond Rawal Pindi. The fortified posts all along the frontier were for the most part very antiquated, being those built in the very early years of British occupation.

With a strong combination of experts in the persons of Lord Roberts, Browne and Nicholson, improvements at once came into being. The great frontier road from Dera Ismail Khan to Kohat—a monumental work—was carried out under Colonel Perkins' able superintendence. The railway was pushed on to Peshawar, the Indus bridged at Attock and Sukkur, and the Mari-Attock railway planned. Sir James Browne also strongly advocated a line from Dera Ismail Khan to Quetta through the Gomal; this was surveyed, but rejected on account of the expense. But if it had been carried out, we should have been saved at least two frontier expeditions.

Nicholson's intimate knowledge of frontier conditions was further utilized when, after about two years' duty with the Military Works Branch, as chief engineer (at headquarters), he was made D.A.G. of the Punjab Army in 1895. It will be remembered that, as the General Staff did not come into existence for some 10 years after this date, the A.G.'s branch were then responsible for all training, military policy and operations. Nicholson was therefore Chief Staff Officer to the Lieutenant-General Commanding the Punjab Army Corps, who at that time was Sir William Lockhart, subsequently Commander-in-Chief in India. At the time Nicholson took over the appointment, the Chitral campaign was in full swing, and the strain on the command organization must have been great. Hardly had the effects of this passed away when in 1897 the whole frontier was in a blaze, and the principal part of the campaign was that directed by Sir W. Lockhart himself against the Afridis in Tirah. This was by far the most formidable of any of the frontier tribes, both from their fighting strength, natural qualities and from their central

position between the Kohat-Kurram country and the Kabul river basin. It was their proud boast that from Tirah "the purdah had never been lifted." But it was to be no longer inviolate.

Sir William Lockhart was by no means the sort of general to be "run by his staff," but he was far too wise a man to try and be chief of the staff as well as general. He had the highest opinion of Nicholson, and like Lord Roberts, trusted his sound judgment and clear grasp of affairs. So in this campaign Nicholson occupied a position of the greatest influence. His knowledge of frontier warfare was now far-reaching and he had studied the problem with the best experts. He was present at the action of the Chagru Kotal, and at the subsequent capture of the Sampagha and Arhanga Passes, with their fierce fighting on most difficult ground. Later on he was at the reconnaissance of the Sarun Sar and the operations at and around Dwatoi in November, 1897. Operations against the Chani Khel Chamkanis, a tribe distinct from, but allied to the Afridis, followed immediately afterwards, and in these he played a prominent part. In December followed operations in the Bara valley and in the Bazar valley, in the mountainous country south of the Khyber, until at the end of the year the whole Afridi country had been swept from end to end. For this campaign he was awarded the frontier medal with two clasps and made a K.C.B.

He returned for a short time to his duties at the headquarters of the Punjab Command, but later in 1898 was promoted to be Adjutant General in India, at that time the highest appointment on the staff.

The experience of an important campaign always results in much revision of methods and organization, and a busy task was before him. He had, however, barely settled down to its accomplishment when the initial disasters in South Africa called him again to active service. Lord Roberts was summoned to take command of our armies in the field, and he sent for Kitchener from the Sudan and Nicholson from India, to assist him in his great task. To both of these distinguished officers of our Corps, but to the latter especially, was committed the duty of organizing the transport. The entire system had to be recast. Transport had been, up to the time of Lord Roberts' arrival, based on a regimental system, which had certain advantages, but it was extravagant and wanting in mobility for general purposes. The whole demanded reorganization. The regimental transport was formed into transport companies, and concentrated for redistribution in proportion to the wants of the service as a whole, and in accordance with the needs of actual operations. Nicholson had been summoned from India to be Military Secretary, and he was one of the very few officers to whom Lord Roberts' plan of campaign was made known, and he was subsequently largely employed by his chief in his personal capacity for a variety of responsible and confidential duties, but it was as Director

of Transport that he exercised, at first, the most important influence on the progress of the campaign. He was present at Paardeberg, and, in the advance later, at the actions at Poplar Grove, Drei Fontein, Vet and Zand Rivers, in the operations near Johannesberg, Pretoria and Diamond Hill, and in the operations in the Transvaal, east of Pretoria during the latter half of 1900. During part of this time he was employed on Intelligence Work, in addition to other duties. In October, 1900, he returned to India. For his services in the S. African War he was promoted Major-General.

In the spring of 1901 he was appointed Director-General of Mobilization and Military Intelligence at Headquarters, and for the first time since he was a junior subaltern he served in England. The position he now held was one of the greatest importance, and it was one in which his great experience of war and wide grasp of affairs was specially valuable. He succeeded another very gifted R.E. officer, the late Major-General Sir John Ardagh, K.C.M.G., K.C.I.E., C.B., who had been Private Secretary to Lord Lansdowne when that nobleman was Viceroy of India at the same time that Lord Roberts, as Commander-in-Chief, had Nicholson as his military secretary. Ardagh had worked up the Intelligence Branch to a high pitch of efficiency, and Nicholson now took up the work in such a way as to make it the nucleus of that General Staff Bureau of Information which it now has become. In those days the Intelligence Department was a branch of the Q.M.G.'s office, and supplied information as and when required. But Nicholson held that it should be a controlling and governing power, that on its reports and information the policy of our army, its training, its whole being, should be based. This was not the War Office tradition, which at that time held that policy and training should be governed by the Adjutant-General. Nicholson was not imbued with any War Office traditions. He held that the military policy of the country must be settled in its broad outlines by the Cabinet, under the authority of the Sovereign, and that it was the business of the Director of Intelligence so to furnish the Cabinet with such information of what was going on in the world, as would enable them to decide what their policy should be, and then when that policy was determined, it was the business of the Army Staff to work out all details of training, organization, etc., in such a way as to give effect to the policy within the necessary limitations of expense, recruiting and other concomitants of our national life. To carry his views in the teeth of much opposition was Nicholson's task, and although he laid the foundation of his great plans then, it was not until he became Chief of the General Staff at a later stage that he was able to carry them out in their entirety. Even then, however, he was making his mark as a powerful administrator.

Meantime he was again called to the East on active service,

early in 1904, as Chief Military Attaché to the Japanese Army in Manchuria, where he remained for a little more than a year. To a man of his wide experience and keen intellect it was an experience of the greatest value, for the operations which he witnessed were of war on a far larger scale than anything he had witnessed before, and the army to which he was attached was not only imbued with the highest courage and patriotism but it had been eagerly assimilating from all European sources every possible lesson that was of value. Nicholson was granted the Japanese war medal and the Grand Cordon of the Rising Sun.

In 1905 on return from the Far East, he was offered a command in the Mediterranean, but this he declined, preferring to go on half-pay until something more in accordance with his experience and capacity presented itself. He had not long to wait, for at the end of that year, when Sir Herbert Plumer vacated the appointment of Q.M.G. at Headquarters, Nicholson was appointed to succeed him. He was now a member of the Army Council, and in a position to exercise direct influence on the policy of administration. In this appointment he continued for some two years.

From this appointment, in 1908, he was promoted to be Chief of the General Staff, succeeding Sir Neville Lyttelton. This was subsequently made "Chief of the *Imperial* General Staff," as it embraced all the staff operations of the Colonial and Indian armies as well as those of the Mother Country.

It need hardly be said that in such a position the talents of a great student of war and of public affairs have a wonderful opportunity. The General Staff of the Army was in 1908 a more or less amorphous body, composed of many brilliant and capable men it is true, all of whom, with very few exceptions, had been through an admirable course of training at the Staff College, and a still more searching test of capacity in actual war. But they lacked the power and influence that united action gives, and this Nicholson largely supplied. He had a great knowledge of character, and power of selecting good men, and he wielded that power with vigour and impartiality. Men might fear him, or dislike him, but all were imbued with the respect that is commanded by capacity, decision and impartiality. During those years of welding together the various personal elements of the General Staff, he was collating information from abroad, organizing units into divisions and other commands, supervising training, and all the time keeping in close touch with the civil power so as to subordinate the military weapon to its recognized policy. For it will be remembered that those years were ones of anxious endeavour on the part of our Government to maintain peace in Europe, and the shadow of the Great War was beginning to overcast the political sky. Whether Nicholson gave the wisest advice to the Cabinet on the subject, or whether the

Cabinet was to blame for not accepting his suggestions, no one can now say who is not in the secrets of the late Government. But this at least may be said that when a definite policy was fixed, that a certain Expeditionary Force should be maintained for overseas, and a Territorial Force should be organized for home service, it became the duty of the Chief of the Staff to see that each and every component part was ready for such eventualities as might arise. How far this was done can best be answered by the achievements of the Old Army in 1914–15, in the speed, secrecy and celerity with which it crossed to France in the early days of the war, in the splendid victories of the autumn and the bitter winter of that year, and in the readiness and devotion of the Territorial Force in the early days of 1915 and ever since. The "Old Army" was, as we all know, far too few in numbers, and Nicholson's old chief, Lord Roberts, had pleaded in vain for a fuller recognition of our national danger, and for a more adequate provision against it, but, within the limits that the politicians had laid down, there was no question of inefficiency. The General Staff, under Nicholson's supervision, had made the weapon at their disposal as keen and polished as human skill could make it.

Nicholson transferred his great responsibilities as Chief of the Staff in the spring of 1912 to Sir John French. He had been promoted to the rank of Field Marshal in the previous year and had been made A.D.C. General to the King, when His Majesty came to the throne in 1910. On retirement from the Army Council in 1912 Sir William Nicholson was raised to the peerage as Baron Nicholson of Roundhay, Yorks.

This was the culminating point of his career, but he still had opportunities of useful service. In 1912 he was appointed head of a Commission, consisting of Sir William Meyer (of Mesopotamian notoriety later), Sir Percy Lake and Sir Robert Scallon, to enquire into the expenditure of the Indian Army. Nicholson therefore returned to India, for a final visit, in the summer of 1912, remaining there for about a year. The recommendations of that Committee, whatever they may have been, were overshadowed by the Great War, and were not carried into effect.

He continued to be a member of the Committee of Imperial Defence and during the war he was a member of the Committees which investigated the conduct of operations in Gallipoli and Mesopotamia. He was also chairman of the Territorial Force Association for London. In 1916 he was appointed Colonel Commandant, R.E.

Lord Nicholson was essentially a man who did not bid for popular applause. He was a brilliant speaker; on the few occasions when he was obliged to make a speech he could do so with the most amusing wit and charming humour, but he rarely spoke in public. He wrote with admirable point and perspicacity, but his name never appeared

in any periodical or public letter. As a member of a mess, in the old days, he was an intensely amusing comrade, full of humour and unexpected jokes, but he was apparently quite indifferent to the opinion of his brother officers. He was not interested in the internal matters of the Corps, seldom came to the Corps dinner or to any of the Corps meetings, and admitted few of his brother officers to intimate friendship. Yet to the few that did know him well, he was full of sympathy and kindness, and one cannot help feeling that if in his early years he had been in touch with the admirable comradeship which exists between officers and men in the R.E. units (with whom he never served) it would have elicited more of that sympathy and would have added to his own happiness. As an executive engineer he was admirable in his dealings with his assistants, giving them clear and precise instructions, and then leaving them a free hand in carrying these out, without petty interference or worrying over details. And the distinguished officers under whom he served, Sir James Browne, Lord Roberts and Sir William Lockhart, not only admired his talents but had the warmest appreciation of his personal characteristics. The good opinion of such men was doubtless what he prized, and as regards others he was indifferent.

G. K. SCOTT-MONCRIEFF.

NOTICE OF MAGAZINE.

REVUE MILITAIRE SUISSE.

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MILITARY TRAINING AND MORALE OF THE SWISS SOLDIER.

The author of the original article quotes an extract from the order issued by General Wille to the Swiss Army in August, 1914; therein the General stated:—"Neither improved armaments, nor numerical superiority, nor the dispositions of troops made by the Higher Command can, as a primary cause, ensure success in war. Success, depends above all things, upon *the spirit that animates an army*. This spirit springs from the strong desire of each and every one to bear with pleasure his share of the burden for the security and independence of the Fatherland."

It is, of course, universally admitted that the *morale* of an army is the true measure of its value. This historical truth, says the author of the original article, cannot be repeated too often. The great Corsican has declared that in war the *morale* is to the physical of an army in the proportion of three to one. Again, in our own day, Marshal Foch has expressed himself in terms which show that the moral qualities of a soldier still count for far more than do all his other qualities.

The author of the original article having shown that there are not two opinions on this important matter boldly asks the question: Are we (*i.e.*, the Swiss) ready?

He enquires, indeed, whether in the event of the Swiss Army being compelled to take the field on the morrow, it would be found ready for the task in hand, from the material point of view as well as that of *morale*. He does not further pursue the question relating to the material and technical aspects of the preparations made in Switzerland to cope with a war, but with regard to the question whether the Swiss Army is ready as regards its *morale*, he thinks that hardened optimists might reply: Perhaps! His own opinion, however, is that the person in Switzerland, whether he be civilian or soldier, who can honestly say, in view of all the outward signs of discontent, distrust, disgust with military service, etc., existing in the country, that the *morale* of the Swiss Army is satisfactory, must be both deaf and blind. It is no use crying over spilt milk, in effect, continues the author of the original article; the best thing to do, he suggests, is to combat the unfortunate state of affairs known to exist and to adopt energetic preventive measures lest worse calamities befall the Republic.

It is stated that numerous articles have appeared in the Press and many pamphlets have been published, which bear on the unsatisfactory state of the *morale* of the Swiss Army; and in this connection, a reference is made to Dr. Bürke's *Volk und Armée* (Fehr, St. Gallen) and to Captain

Vallière's Article published in the *Revue* for January, 1918 (*vide R.E. Journal* for March, 1918).

The causes responsible for the state of affairs complained of are said to be as follows:—The monotonous and irksome character of Army routine; *false* drill; disregard of regulations and conduct contrary to discipline on the part of officers; abuses of authority by certain C.O.s., etc. Although the grievances enumerated in the original article are numerous, the statement is made that they could be added to.

It is pointed out that the Swiss soldier, when comparing his lot with that of his civilian friends, finds that he is being penalized in many ways by giving up a part of his time to the service of the State; whilst his family experience difficulty in making both ends meet, the civilian is able to earn good wages and can, in other ways also, get the better of the man in uniform. The author of the original article admits that the problem under discussion is one the solution whereof is most difficult; the increase already granted in the soldier's pay has not been sufficient, he thinks, to adjust the inequalities complained of. Attention is called to this matter, he continues, in order that those who are in a position to deal with the difficulty and provide remedies may take the question in hand and do what is equitable.

The question of improving the *morale* of the Swiss Army is, it is admitted, primarily a matter for the officers to deal with; a great deal can be done, it is pointed out, by military training conducted on proper lines.

An examination is made, in the original article, of the course of military training through which Swiss soldiers are put, and the opinion is expressed that too much attention is given to mechanical details in the instruction of the soldier, whilst essential matters of importance are largely lost sight of during the training period. The instructors in the Swiss Army, it is hinted, do not employ the most suitable methods in the training of their men; this seems to be due in part to the faulty instruction which they themselves have received. (*To be continued*).

The Re-organization of the Swiss Aviation Service.

It is stated in the original article that for some months past the Swiss Press has been directing attention to the Swiss Air Force. The hope is expressed that these persistent attacks may result in the introduction of the necessary reforms in the Fifth Arm. Regret is expressed that no spontaneous effort has been made within the Service to effect the improvements so badly needed.

The author of the original article states that in Switzerland, as has been the case in other countries, many faults have been committed in relation to military aviation. However, other countries have shown that past errors in this field, as in others, can be amended, and it is suggested that the time has arrived for Switzerland to follow the example of others.

The principal mistake made in Switzerland has been that the Air Force has never had a supreme chief. All those who have wished to and could have organized an Air Force have come up against and been held up by Commissions with ill-defined powers and offices possessing no

authority. The situation has not been improved by the fact that aviation has been directly under the General Staff, and, in consequence, without any one in particular to take up the cudgels on its behalf.

Four years ago, those in high places in the Swiss Army were, it is stated, still sceptical as to the military value of aviation. The fear of seeing the Army Estimates increased seems to have clouded the reasoning powers of those in authority. M. Hoffmann, who was responsible for the Military Department, held the purse strings very tightly when it was a question of providing the needful for the Air Force. It was in consequence of his attitude that private initiative came to the rescue of military aviation in Switzerland.

Thanks to the efforts of the Committee over which Colonel Audeoud presided with conspicuous zeal and ability, the public subscriptions to the Aviation Fund amounted at the end of 1913 to 1¾ million francs. The donors intended this sum to be spent in the purchase of aeroplanes. The Aviation Commission had, in 1914, placed orders for six biplanes with the *Luft-Verkehrs Gesellschaft* of Johannisthal (near Berlin); deliveries thereof were due when the war broke out.

On the outbreak of hostilities the Swiss Government immediately commandeered all the aeroplanes at the Exhibition at Berne and those belonging to private aviators; 7 machines were thus obtained.

Captain T. Real, of the Swiss Cavalry, was placed in command of the Aviation detachment; he was one of the pioneers amongst Swiss pilots. About a dozen aviators volunteered for service in the Air Force and were accepted. Apparently only three of them alone remain in the Service to-day. The author of the original article states that he would prefer those who have left the service personally to give the reasons why they severed their connection with the Force.

In 1915, it was announced that the Air Force had been placed under the Aviation Commission. The headquarters of the force were established at Dübendorf at the beginning of the year mentioned and three months later it issued pilots certificates to the first four of the flying men trained there. About the same time, deliveries of the first batch of aeroplanes manufactured in Switzerland were made to the Aviation Commission; these machines were biplanes of the *Aviatik* type. At this time the question of the proper position for the propeller of military machines was being hotly debated in Switzerland; the Aviation Commission decided to adopt the propulsive position for the propeller in the machines ordered to be built at the military workshops.

In the opinion of many Dübendorf was considered an unsuitable place, from the point of view of defence, for aerodromes. In April, 1915, the cantonal authorities and private persons were appealed to to assist in the provision of landing grounds. Only in Lausanne was there a response to this appeal. A Federal Decree was signed on the 13th August, 1915, to deal with the Air Force, whose numbers had by that date increased sufficiently to justify such a step being taken. Shortly afterwards difficulties arose in connection with the Air Force; the situation at the time that the original article was written was still unsatisfactory. Colonel Audeoud had already resigned his position some time previously for reasons which are not stated, but can be guessed.

The state of affairs finally became such as to necessitate the appointment of a Commission to enquire into matters connected with the Aviation Service; the Commission was still sitting when the original article was sent to press.

It is thought in some quarters that the existing difficulty in connection with the Swiss Air Force may be met by the appointment of an officer to take charge of all the executive work in connection with the Aviation Service. In this event the present Chief will have to confine his attention to administrative details. The author of the original article points out that timid half measures will not cure the defects complained of.

A great part of the present trouble has arisen owing to acute differences of opinion on the question of the design of machines; and the machine is thus being made the scape-goat for all the defects in the Aviation Service.

It is pointed out that since the beginning of the war, the French have standardized their machines, so also have the British, and the Germans are on the point of doing so.

The French have, it is stated, six categories of machines, each containing several types or models. These categories are:—

1. The single-seater chasing machine—extra high speed.
2. The two-seater chasing machine—extra high speed.
3. The three-seater (double-motor) machine for photographic reconnaissance work.
4. The two or three-seater contact machine.
5. The two-seater day bombing machine.
6. The two or three-seater night bombing machine.

The author of the original article expresses the opinion that the Swiss Air Force requires machines of three categories only at the present time, viz.:—

1. A two-seater machine which can be used for all purposes.
2. A single or two-seater chasing machine possessing extra high speed.
3. Instructional machines with duplicate controls.

In many quarters of Switzerland, it is being urged that the construction of aeroplanes should no longer be carried out in Government workshops, and that the whole of this work should be transferred to private firms. The author of the original article is of opinion that the time for so drastic a change has not yet arrived in Switzerland; the situation in that country is not comparable with the conditions prevailing in Great Britain and in France, so that the practice in these countries would not necessarily give similar results if adopted in Switzerland.

The statement is made that what the Swiss Air Force most wants is a strong disciplinarian to command it and to keep in check the *individualisme à outrance* prevailing in the youngest arm of the Helvetic Army.

Divisional Training Centres.

The article which appeared in the number of the *Revue* for August, 1918, on the "Training Centre of the Swiss 1st Division" (*vide R.E. Journal* for October, 1918) appears to have attracted a considerable amount of attention in Switzerland. The observations of Major F. Badoux on Divisional Training Centres were published in the number of the *Revue* for September, 1918 (*vide R.E. Journal* for November, 1918);

a further contribution on the same subject, from the pen of Captain Decollogny, is published in the number of the *Revue* now under notice.

Capt. Decollogny is of opinion that the anonymous author of the first article of the series was too severe in his criticisms of the infantry of the Swiss 1st Division; he himself is satisfied that during the period of its mobilization the Swiss infantry has improved immensely in military efficiency. The controversy now in progress is of domestic rather than general interest. The Swiss Army has special difficulties of its own to contend with in connection with training matters, and close acquaintanceship with the conditions prevailing in Switzerland is necessary for a proper understanding of the points at issue in the correspondence to which reference is made here.

Captain Decollogny points out that specialization is a necessary feature in the preparation of a modern army in war; he is in favour of decentralization and recommends that battalion training centres shall be created in addition to divisional training centres. Frequent inspections of the battalion training centres by the instructors of the divisional training centres is also recommended by him, as a means for providing that the instruction given thereat shall be on uniform lines throughout the formation.

MEDICAL SERVICES OF THE FRENCH ARMY DURING THE RECENT OPERATIONS.

The author of the original article states that, a "war of movement" having taken the place of trench-warfare on the Western Front, a reorganization of the Medical Services of the French Army became necessary; in consequence, radical alterations have been made therein.

Trench-warfare permitted the surgical treatment of the wounded to be carried out under perfect conditions; the formula "early operations, rapid evacuations" sums up in a few words the methods which were in vogue.

One of the results of the "war of movement" has been that the splendid Evacuation Hospitals, a great number of which had been established at distances of from 6 to 9 miles behind the front line of the trench system, can no longer be utilized for the purpose for which they were designed.

When the "war of movement" began in April last, a new programme was drawn up for the treatment of the wounded; it came into operation at the beginning of June last.

Under the new scheme only men who had been so dangerously wounded that it would have been unsafe to subject them to a long journey were operated upon at the advanced or primary Evacuation Hospitals. Every other wounded man was sent back to a secondary Evacuation Hospital—situated from 30 to 120 miles behind the front. A system of inspection was established so that in the event of the condition of a patient having taken a turn for the worse whilst on the journey between the primary and secondary Evacuation Centres an operation could, if necessary, be at once performed. Trains were halted at medical Regulating Centres to enable this inspection to be carried out and in order to detrain those whose condition was such as to render an immediate operation necessary.

The lightly wounded, those who had been gassed and the sick were sent back by stages to hospital zones in rear of the fighting line or in the interior of France.

This scheme involved the creation of immense surgical centres, containing 2,000, 3,000 and even 4,000 beds apiece.

The beds were, in such cases, housed in temporary structures, erected in open country, and in proximity to suitable railway communications. A conspicuous feature of the organization was the special transport service consisting of vehicles of various kinds for the conveyance of men and materials. Multiple hospital trains were also prepared, so as to carry back the wounded in as short a time as possible from the primary to the secondary or rearward Evacuation Centres. On an average these trains were arranged to carry 300 cases apiece. The rivers and canals were also utilized as far as possible for the evacuation of the wounded. It is estimated that under this scheme, on an average, operations were carried out within 20 to 30 hours after the wounds had been received. As a rule the conditions of wounds is such that even after an elapse of 48 or even 50 hours operations can be carried out in safety and with every prospect of success.

Notes and News.

Switzerland.—Satisfaction is expressed at the fact that the end of the war was in sight. It is suggested that when peace reigns once more the political and military authorities will have leisure to look into that which is amiss in the Swiss Army and to put things right.

It is pointed out that the advantages of "unity of command" have been abundantly proved in the great war. The Central Powers provided for it almost from the opening days of the campaign; the Western Powers were converted to the idea at the eleventh hour. The twelfth hour is striking; yet Switzerland, with its small Army of six divisions, it is said, is still without "unity of command"!

An extract from a letter sent to the newspapers by a staff officer, on the 22nd August last, is published in the *Revue*; therein the writer attributes the troubles existing in the Swiss Aviation Services and in other branches of the army to the "mischievous dualism" created by the Swiss laws in matters connected with the command of the Army and the Territorial Force.

The writer of the original communication to the *Revue* considers that the time has arrived to mend or end the defects in the Swiss military laws and in the vices of the Swiss Administrative system. He says that it is widely known as a fact that the Swiss Army is under the direction of an association of officials who are at loggerheads with one another. Further, he blames the Helvetic Parliament for its interference in Army affairs.

Matters in connection with the Swiss Air Force are touched upon; it is recognized that the members of this Force, as of the Army, as a whole, are sound at heart, all that is wanted is that the valuable material of which it consists shall be properly exploited.

The discovery that the German military attaché had a finger in the explosives affair at Zurich, and the incident connected with the killing of a Swiss airman, by a German airman, whilst the former was flying

over Swiss territory, have naturally caused indignation and excitement in Switzerland. It is suggested that the time has arrived for the Swiss to take a firm line in connection with the ever-recurring scandals of these kinds.

Portugal.—A special correspondent furnishes a detailed account of the happenings of the 9th April last, when the Sector on the Western Front held by the Portuguese was rushed by the Germans; it is based on the Portuguese official despatches. The Portuguese troops suffered particularly heavy casualties on this occasion.

International News.—A brief account is given of the second Battle of the Marne (15—25th July, 1918) under this heading.

INFORMATION.

Switzerland.—A contribution by Lieut.-Colonel Arthur Foujallaz is published under the title "Fausse route." There is considerable difficulty in estimating the true value of the military organization of a country, writes Colonel Foujallaz, when for many decades one method, and one alone, has been held worthy of imitation as has been the case in Switzerland. He makes a satirical reference to the exaggerated attention which has been paid in the Swiss Army to the practising of the German "ceremonial step," the *paradeschritt*; the noise made by troops in "marching past" have, in the opinion of some, he thinks, been taken as an outward and visible sign of their true fighting value.

Matters connected with the training of the Swiss Army have been, it is asserted, in a state of hopeless muddle since the Great War began. Part of this muddle is attributed to the fact that the difference in the conditions of training existing in peace time as compared with those of war time have not been properly appreciated. The desire for reform caused the authorities to attempt changes in so many directions that everything was turned topsy turvy; this was even the case with institutions which had been brought into existence after careful consideration by competent minds.

Complaint is made that a great variety of methods have been introduced in the carrying out of the instructions contained in the Swiss Training Manuals, etc., *e.g.*, in the matter of sa'uting, of the manual exercise, of the firing exercise, of gymnastic training, etc. Even in the matter of the uniform little regard is paid by officers to the orders on the subject; instead of wearing garments cut according to sealed patterns, many officers provide themselves with uniforms fashioned on *chic* models of Paris or of Berlin.

Colonel Foujallaz points out that the theory of "*laisser-faire*" and of the "*pourvu pas d'histoire*" is out of place in a military organization, and he feels strongly that the time has arrived for wheeling the Swiss Army into line and for exacting a strict obedience to the Regulations. He considers that it would be an act of cowardice on his part, and prejudicial to discipline, if he did not publicly declare that the Swiss Army was on a "wrong road."

Bibliography.—A notice of the following work by a Swiss eye-witness is published *Somme und Oise: Die verwüsteten Gegend.* Orell Fussli, Zurich, 1918.

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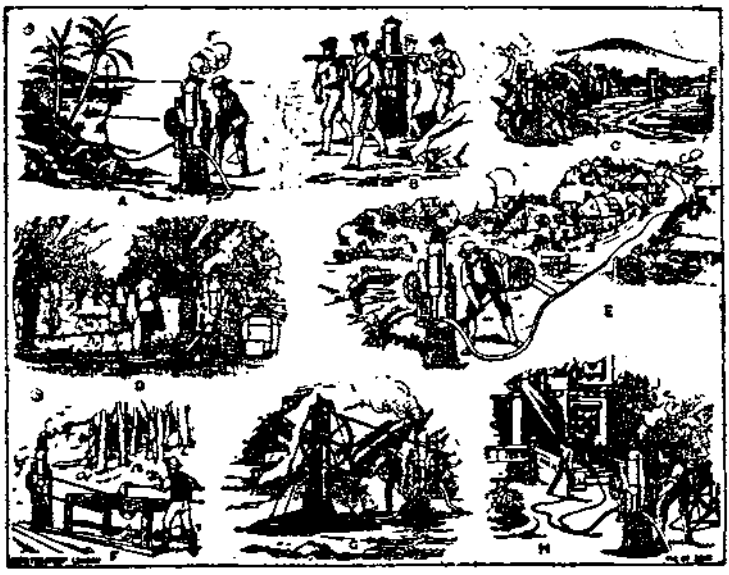

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