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Authors alone are responsible for the statements made and the opinions expressed in their papers. [2150-1, 3. 20].

MONTGOMERIE PRIZE.

ATTENTION is invited to the conditions under which this prize, in value about \pounds_{10} , is offered for competition each year.

1. The Prize shall be awarded by the R.E. Institute Council in the manner considered best for the encouragement of contributions on professional subjects, by R.E. Officers, to the Corps publications. From the beginning of 1920 it has been decided that the Prize shall be confined to Officers on the Active List not above the rank of Substantive Major.

2. The Prize shall consist of (a) a book on Survey, Exploration, Travel, Geography, Topography, or Astronomy; the book to be wholebound in leather, and to have the Montgomerie book-plate with inscription inside; (b) the remainder of the year's income of the Fund in cash.

3. The name of the recipient of the Prize shall be notified in the Corps publications; and copies of the contribution for which the Prize was awarded shall be presented to the representatives of the donors.

The following are suggested as subjects for contributions :--

- (a). Descriptions of works actually carried out in peace or war.
- (b). Inventions.
- (c). Design (excluding works of defence).
- (d). Labour organization on work.
- (e). Scientific investigations generally.
- (f). Accounts of exploration work and surveys.

EXPERIMENTS IN GRENADE BALLISTICS.

By MAJOR C. H. LEY, O.B.E., LATE R.E.

THE advent of the discharger-cup as a means for firing grenades from the rifle rendered advisable an investigation into interior ballistics.

The advantages the cup promised forced its adoption in advance of knowledge gained by experiment, and military requirements demanded the adaptation of the existing Mills grenade to its use, and laid down a range of 200 yards at 45° elevation as indispensable. Now with an available shot-travel of 4 inches only this meant trouble, for neither had the Service rifle been designed for any such feat nor did any means exist for determining in such a case certain elementary ballistic data such as pressures and velocities occurring in the discharger, the best size of its expansion chamber, or the intrinsic nature of stresses set up during_recoil.

Rough preliminary experiments were carried out with the means available which well illustrate the nature of some of the design problems presented, the solution of which was one of the objects of the investigation to be described later.

The $2\frac{1}{2}$ inch discharger, known to effect a certain kind of damage to the S.M.L.E. rifle, was utterly destructive to the one-piece stock of the 1914 pattern rifle, and neither shock-absorbers fitted to the butts, nor reasonable reduction of range by reducing the charges of propellant, were found of use as remedies.

The idea that the stresses set up between parts of the recoiling structure were, apart from external resistance, governed solely by the momentum (*i.e.* velocity) of recoil, seemed inadequate, as it took no account either of vibration, blast effect. or of the time taken in arriving at that momentum.

The time taken is a matter of acceleration or shape of the velocity curve, and with the comparatively few and light parts concerned it seemed possible that a relationship existed between this shape and the variations of the acting force or effective pressure in the discharger, which in its turn must be largely dependent upon the initial volume available for expansion of the gases behind the projectile.

Experiments to test the effect on damage to the rifle of varying the expansion-chamber in the discharger were therefore carried out, and incomplete and rough as they were, they did indicate much reduction of damage with larger chambers without corresponding reduction of muzzle velocities, but they of course threw no light on the part played by other phenomena. Table I. is an extract from a report on these experiments.

					TA	BLE I.		_
Discharger, No.		Cham - ber c i.	Stroke ins.	Cart- ridge grains.	Mean Range, Yards,	Rounds.	Damage.	
Service	•••	I	3.3	4	č 30	200	Few	All rifles stocks split.
.,		,,		,,	25	172	974	Do. Do. Do. (4 rifles)
,,	• • •		,,		23	160	2130	Two split out of 4.
5-inch	•••	2	6.9	4.3	30	192	2020	I out of 2, split at Sooth round.
6-inch	•••	3	12.8	· 4	30	177	3800	x out of 4, split at 48th round.
,,	•••	,,	7.8	5	30	207	30	No damage.
,,	•••		5.7	5.4	30	215	30	No damage.

Notes.—1914 rifles and ballistite charges used throughout. Any visible split or bending of pins counted as damage. In the case of the damaged rifle with Mo. 2 discharger a large number of further rounds were fired from it without further development of the small split in the stock.

In this table the muzzle velocities had not been determined. They were not essential for the preliminary object, as the range was a sufficient guide for this, but it was clear that for further progress proper instrumental means for obtaining velocity and other data of interior ballistics was essential.

Not however until the spring of last year, was opportunity afforded and apparatus found which appeared suitable for the purpose.

After some enquiries and correspondence Capt. Adams and myself were fortunate enough to be able to visit Prof. Bull of the Institut Marey, Boulogne sur Seine, whose work in developing Sound-Ranging and in the kinematography of rapidly moving objects, such as revolver bullets, the wing-motions of flying insects, etc. is wellknown. We had brought dischargers etc. with us, and by the extreme kindness of Mr. Bull, who spent most of his time during three days taking and developing the photographs, we were able to come away with some very interesting films.

MR. BULL'S APPARATUS.

The apparatus was contained in a shed in the garden of the Institut Marey, and, owing to the enormously superior intensity of the light of the electric spark over that of sunlight, and to the brevity of the interval during which the film is exposed, the photos are taken in ordinary daylight.

The general arrangement as rigged up for the grenade experiments



is shown in the diagram, Fig. (1), and the parts will be referred to according to their lettering on the diagram.

(A).—A camera with electrically-controlled shutter and motordriven disc to which the film is screwed, and a resistance box in the motor-circuit for regulating the speed.

The circumference of the disc was 108 cm.

- (B).—A harmonium for ascertaining the speed. The film-disc had a 20 toothed wheel attached against which the edge of a piece of paper or film would give out a note according to the number of revolutions per second. The speed could thus be "tuned up" to any given note on the harmonium by altering the resistance. Mr. Bull informed me the error by this method was less than 2 per cent. Such an error would affect the time-scale and all the photos of one film equally, but would not affect the shape of a velocity curve.
- (C).—A sparking apparatus consisting of an induction coil and condensers working up to 15,000 volts, about 20 ft. from the camera. A voltmeter, a variable water-resistance to govern the frequency of the spark, and an air-jet (supplied from a small cylinder of compressed air) under the sparkgap to prevent formation of an arc, were attached.
- (D).—A parabolic mirror with 15 inch field around the sparkgap.
- (E).—A 15 inch lens at a point between spark-gap and camera to suit the desired size of image.
- (F).—A screen in front of the rifle carrying the stretched wires of the independent shutter and spark circuits, so placed that these circuits will be broken by passage of the projectile.
- (G).—A cardboard screen, having a slot about $15 \times 4\frac{1}{4}$ in. cut in it, placed across the field of light in front of the sparkgap to limit the field of the photos.

A wire was fixed across the slot to form a datum-line for measurement on each photo.

- (H).—The rifle with contact-maker, supporting trestle, and sand-box for the butt, placed so that the muzzle of the discharger is opposite the slot in the cardboard screen.
- (I).--Stuffed sacks suspended from the roof-truss, to receive the shots.

As regards the high-tension spark circuit one pole was connected with the contact-maker on the rifle. This consisted of a light brass arm attached to the cocking-piece, and a brass spring contact on an ebonite plate screwed to the fore-end, the two being adjusted so that the current passed just as the striker hit the cartridge.

The current travelled through the high-resistance wire stretched across the screen F, and so to the spark-gap, and the shadow photograph is taken in the infinitesimal time taken by the spark to jump the gap. The shutter-circuit formed part of the ordinary electric light circuit. It had been intended to connect this also through the contact-maker on the rifle, but too big a shutter delay was found, and separate hand contact was arranged for.

It was found that owing to damp only about 12,000 volts could be got out of the condensers, and the water resistance was adjusted to give a spark frequency of 3000 per second with this voltage. This adjustment is of importance to the success of the measurements, for if the frequency is too high consecutive photos will overlap at their sides and cause difficulty and confusion, if too low the photos may be too far apart for satisfactory measurement and points may be too few on the velocity curves. The speed of the projectile, the speed of the disc, and the size of the image, all enter into this consideration, and some trial shots are advisable. I understood that beyond these limiting conditions there is practically no limit to the frequency.

But the necessary first condition is that the whole time of sparking should be less than that of one revolution of the disc, and a suitable speed for the disc has therefore to be roughly calculated from what is known of the mean velocity of the projectile in the first instance.

As regards the rifle it has to be placed at an angle of elevation, and 30° was arranged for, the slot in the cardboard screen being also across the field of the mirror at the same angle. Thus the photos appear slanting across the film, This makes no difference to measurement, since all velocities have in any case to be brought to correct scale by a factor, but, with a limited travel of the stage of the microscope used in measuring the developed film, it has the drawback of causing more frequent resettings.

It was found best to strap the fore-end of the rifle loosely on the trestle so as to allow free recoil backwards while restricting the jump. Firing is safest by lanyard otherwise there is an off chance of receiving a 12,000 volt shock, a serious matter.

The general procedure was as follows :---

The electrical connections were fixed up, the camera prepared with the film and the focus adjusted, the rifle adjusted for position and loaded, and the voltage and connections of the condensers tested. The motor was then started and tuned up to speed by the harmonium, 30 revolutions per second (giving a note of 600 vibrations per sec.), being that actually used. The current through the coil was then started, and on the voltage rising to 11,000 the air-jet valve was opened on the word "one!" On the word "two!" the shutter was opened, and on the word "three!" the rifle was fired, these three operations taking about 2 seconds in all.

THE PHOTOGRAPHS,

Figs. 2, 3, 4 (see *Plate* facing page 136), are reproductions of films, each with a different discharger. They show the positions in shadow of the grenade and discharger with respect to the fixed wire at each spark, until the grenade has passed out of the field. The stick-like projection beyond the end of the grenade was a short grenade-rod fixed in the striker-hole to give a definite central point for measurement which would always appear beyond the discharger, and the transverse thin dark line near the muzzle is the fixed wire.

The progress of the shot can be divided into 4 distinct stages as follows;

(i). The ignition period, during which there is no motion, and which, beginning after the first spark, ends with the photo preceding the first issue of windage-gas.

The time represented by the length of this portion of film, must, if the adjustment of the contact-maker is correct, always somewhat exceed that for initial combustion up to the moment of highest pressure. It was found to be variable but appears on the average to be about 'ooz second.

(ii). The relative shot-travel in the bore, or "stroke," marked by the issue of windage-gas, and terminating when the gas-check at the base of the grenade leaves the discharger cup.

It will be observed that the gas-cloud proceeds faster than the grenade and has a drift across the photos which is always upwards. The cloud has an initial velocity in the trajectory of the order 500 f.s., and an upward velocity of the order 250 f.s.

The dark object on the shoulder of the grenade is a piece of matchwood which was used to wedge up the grenade to an even seating. Its proceedings are of interest.

(iii). The "blast" period prior to the issue of smoke, marked by gas and burning ballistite beneath the gas-check.

A feature of interest here is the "pressure-ring" or block of incandescent gas with very defined and straight lower edge immediately below the gas-check on first appearance of the latter. A straight and narrow dark band, often crosses the field just below and parallel to it. They both disappear almost at once, showing extremely rapid outward expansion. No satisfactory explanation of the band phenomena has however so far as I know yet been furnished. The granular appearance of the gas-cloud in this stage is sometimes very marked, and may be attributed to unburnt or partially burnt flakes of ballistite.

(iv). The smoke period then begins and continues for a comparatively long time, calling for no particular comment.

It appears possible that the strong upward rush of gas past a low-velocity projectile leaving the nuzzle may account for the deflection of its axis from the line of trajectory which is usually noticed. In the case of a large-headed rifle grenade with short rod the first part of the flight is with the head up and rod pointing down at a considerable angle with the trajectory, so much so that it never hits nose-first at short range.

THE METHOD OF MEASUREMENT.

It was found that the value of the results depends mainly upon the means and method of measurement, and upon the sharpness of the photos. Mr. Bull informed me that he could probably improve the sharpness of definition considerably in any future experiments. As regards the instrumental means, after many trials, I found a student's microscope, with a travelling double glass slide holding the film and operated by longitudinal and transverse rack-and-pinion attachments, with good fine scales and verniers, to be all that is practically necessary. No lantern enlargements are accurate enough.

Care is necessary that the glass slides hold the film evenly between them so that parallel motion is obtained and only slight adjustments of focus with the fine-motion focussing screw are necessary. Crosshairs marking the centre of the field are advisable, although with practice a point on the image can be placed in the centre of the field with a fairly high degree of accuracy by estimation. A portion of the errors of measurement were undoubtedly due to absence of such cross-hairs.

The scale and vernier reading the transverse spatial distances needs to be accurate, and one was constructed for me of bone by Capt. Adams which was divided to 'o2 inch, with vernier reading 'oo2 inch, and by rough estimation to 'oo02 inch. The lines were fine and the readings were by lens. Though a considerable improvement upon the coarse millimetre scale originally fitted, further increase in accuracy could doubtless be obtained with a special scale by a good maker.

But a cause of error which seriously entered into the measurement

of recoil was indefinition of the edges of the discharger due to the issuing gas, and some of the large variations of velocity of recoil of short period observed may be attributed to this cause. I would strongly recommend that in any future experiments a number of points be fixed to the discharger well below the muzzle which will be available for measurement. The mean of the measurements to

be available for measurement. The mean of the measurements to these would be more reliable, and the use of two datum wires instead of one would greatly decrease the probable error.

The system of microscope readings employed is illustrated in Fig. (5), and computations were made from the means of two readings in the cases of the datum-line and discharger.



FIG. 5.-1 Fixed Wire, 1 Grenade Point, 2 Discharger Points.

NOTES.—Readings taken in the order shown, resetting at *Photo* 12. Readings on both scales of 1, 4, or 6, 9, and on the space-scale only of 2, 3, 5, or 7, 8, 10. The factor for reduction of the spatial readings is determined by taking readings of points 3, A, B, *Photo* 12, and equating the resulting measure of the total length of the grenade with its actual length.

Fig. (6) shows suggested modifications, which involve two datum wires, two points on the grenade at its top end, and a sharp-edged band fixed around the discharger below the muzzle. Together with better definition, cross-hairs, better scales and verniers, and a proper buffer in lieu of a sand-box behind the butt, these should secure a great advance in accuracy, and render possible a reliable analysis in detail of the motions of both grenades and rifle.

It was found advisable to enter the readings on forms made out for the purpose, and to use special forms for the computations. The slide-rule was used for obtaining velocities.

PROGRAMME OF EXPERIMENTS.

In the brief time available in Paris it was impossible to secure a complete series of films, and although Mr. Bull has since kindly filled

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FIG. 6.—2 Fixed Wires, 2 Grenade Points, 4 Discharger Points.

NOTES.—Readings on each scale of 13, 14, 17, 18, and on the space-scale only of 13, 12, 15, 16, 19, 20, to be taken.

up some of the gaps, the whole programme was of a preliminary nature.

Three dischargers, selected for having even bores of approximately the same diameter, viz. 2 517 in., but having different lengths of chamber and "stroke," were used, and three shots were fired from each with Service grenades having gas-checks machined to 2 510 in. diameter. An additional group of 3 was also fired from one of these dischargers (No. III) with gas-checks machined to 2 490 in., in order to test the effect of windage.

No. I discharger was the service pattern having an expansion chamber of 3'3 cubic inches and a stroke of 4 in. (see No. 1 Table I).

No. II was the same pattern but with stops screwed in so as to increase the chamber to 7 o c.i. and reduce the stroke to 3.2 in. It corresponded with No. 2 discharger of Table I except for a stroke shorter by I inch.

No. III was the discharger No. 3 of Table I, having 12.8 c.i. expansion chamber and 4 in. stroke.

In all cases the service 30-grain ballistite cartridge was used.

PLOTTING THE CURVES.

The calculated velocities were plotted for each film on squared paper against the measured time-intervals, so that 3 graphs of velocity with respect to time were obtained for each group.

Fig. (7) shows a pair of graphs from No. II discharger, selected to show the magnitude of the variations from the mean of each graph and from the smoothed mean of the three, also because of some marked oscillations referred to below. Fig. (8) shows recoil graphs only for Nos. I and III.







The smoothed mean curves of each of these groups were then drawn, resulting in the 4 mean velocity-time curves of Fig. (9).



Now the acting force behind the grenade is by a law of motion proportional to the acceleration, and since this is the differential coefficient of the velocity, and is proportional to the tangent of the slope of the curve at any instant, a curve of natural tangents of the angles of slope at selected instants will represent a curve of pressures with respect to time on a scale to be determined.

To determine the scales of these curves the mean pressure of each was obtained by measuring the area enclosed up to the instant of leaving the muzzle dividing by the time up to that instant, multiplying by the space travelled through by the grenade and equating with the calculated kinetic energy at the same instant. The result gives the scale of total effective force, and dividing by the cross-section area the pressure per sq. inch is obtained.

But it is desirable to study the interior ballistics from velocityspace and pressure-space curves, and since the discharger is moving back while the grenade moves forward the sum of the spaces moved through by each at each instant were marked off on an abscissa line

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and the pressures plotted as ordinates against these. Figs. 10, 11 show the velocity-space and pressure-space curves derived from the time-curves in the above manner. These curves show the velocities and pressures with respect to the "expansion volumes," or "stroke,"

using the latter term to denote the shot-travel relative to the discharger, as distinct from the shot-travel in space.



It should be noted that this method does not give very accurate values for the maximum pressure or pressures very near the commencement of motion, since the velocity-time curves slope steeply here, and the tangent of an angle increases very rapidly as the angle increases if the latter is large. But as the first measurements are usually very near the origin, so that the work done is small over a minute indeterminate initial period, the scale for subsequent pressures cannot be seriously affected by assuming that the velocity curve continues smoothly up to the origin itself, *i.c.* that the maximum pressure occurs at that point, prior to motion. The evidence certainly seems to warrant that procedure.

APPARENT VELOCITY OSCILLATIONS.

Oscillations of the velocity of recoil of the rifle bedded in sand would be expected, but oscillations of grenade velocity would not. All the grenade velocity graphs show oscillations on either side of the mean up to 10 per cent of the mean velocity, many of these



FIG. 11. - Pressure-Space Curves (Smoothed Means).

appear periodic, and most show the chief oscillation to take place as the grenade leaves the muzzle.

Either these are real, or due to errors of observation, or to instrumental errors; and in a given case a combination of two or more of these causes probably produces the phenomenon.

Fig. (7) shows well-marked oscillations both of the grenade and rifle, having amplitudes of about 15 f.s. and periods of about one-thousandth of a second. In the one case (thick-lined graph) the oscillations are of opposite sign, which if not real might indicate an oscillation of the datum-wire. In the other (thin-lined graph) the oscillations are of the same sign, which might indicate a large periodic error in the time-scale or in the speed of the film, or, what is equivalent, that the film is uneven or slightly ridged on the disc.

Examination shows no evidence of a scale-error nor does one of the required magnitude appear possible, and it is difficult to believe that the radius of the film on the disc or the speed of rotation can vary by such an amount. If the datum wire oscillated owing to blast it would normally appear in all the films, but only after the grenade had left the muzzle.

Periodic friction between grenade and discharger might account

for oscillations of velocity during the stroke, as the grenade would probably wobble, and any jump of the rifle is across its trajectory, but there is little evidence of this in the photos.

That the oscillations appear as damped vibrations is very evident on the thin-lined graph of Fig. 7, where both the period and amplitude show regular decrease beyond the muzzle.

RECOIL OSCILLATIONS.

As regards the oscillations of the velocity of recoil, these appear much the largest during the "blast" period.

The recoil graphs of Figs. 7, 8, show the nature of these, and in Fig. 8 it appears that the mean graphs for Cups I and III are of similar nature and that III might be produced by flattening I, as by squeezing it out under a weight. While there are differences of phase in the graphs for Cup II of Fig. (7) the "blast oscillation" is apparent in all three Cups, and is essentially different from the normal oscillations during the "stroke", period, which might reasonably be attributed to errors.

I have endeavoured to trace connection between these large oscillations and both the "pressure-rings" appearing on the photographs, and small transverse movements or "wobble" of the discharger during recoil, but without definite result; doubtless improvements in accuracy and a more complete series of films would decide these points.

It is difficult however to avoid the surmise that the blast oscillations are in the main real, and that, if that is the case, that they are the principal sources of danger to the rifle. Their relationship to the initial chamber-volume and to the pressure curves would then form an interesting study, especially in connection with practical experiments on the lines of Table I.

Smoothed Mean Curves.

There can be little doubt however that the smoothed mean velocity and pressure curves are fairly accurate and representative.

As regards the velocity it is seen that the space-curves are nearly parabolic, and that less than 5 per cent. of the actual velocities at the muzzle is added during the subsequent blast period, though the blast of Cup II with the short stroke adds rather more than the others, as would be expected.

As regards pressure, this appears to be a maximum at, or within o'I inch of, the starting point. The maximum does not appear to be any simple inverse function of the chamber-volume, for approximately, the figures are as in Table II.

	TABLE	II.

II. 7.0 ,, 9.2 ,, 0.4 ,, ,, ,,	Cup. I.	Exp. Chamber. 3·3 c.i.	Total Chamber. 5 [.] 5 c.i.	Mcan Max. Pressure. 0.5 tons in.	Windage. '007 in.
111 10.8	11.	7.0 ,,	9.2 ,,	0'4 ,, ,,	,,
$111.$ 120 μ 15 μ 037 μ μ	III.	12.8 ,,	15 ,,	0.37 ,, ,,	,,
111. ,, ,, ,, ,, ,, 0.28 ,, ,, 0.27	111.	27 F2	13 13	0.58 '' ''	·027

Thus, with a given windage, increase of chamber effects a decrease of initial pressure in a smaller degree up to a certain point only, beyond which there is scarcely any decrease. Probably this point is in the neighbourhood of 7 c.i.

But the effect on shape of the pressure-curve is of more importance, and the advantage apparently possessed by Cup II (7 c.i. chamber) is marked, see Fig. (II), by a much smoother and more regularly sustained curve.

The effect of windage is important since gas-checks have hitherto been punched without machining, and rather wide limits have had to be allowed. This of course has been necessary to meet enormous and pressing demands, but it accounts for much variation of range. From the muzzle velocity curves IIIa, *Figs.* (10, 11), it appears that an increase of '020 inch windage, obtained by decreasing the diameter of the gas-check that amount, effects decreases of about 12 per cent in muzzle velocity and 25 per cent in initial pressure.

The reduction in range would roughly speaking and for small variations be 6 per cent. per '005 increase in windage at medium ranges, but, owing to more rapid falling off of range at higher velocities, less than this at extreme ranges.

Windage itself however, appears to affect the shape of the pressure-curve but slightly, see Fig. 11, with the same discharger.

Although it would be necessary for accuracy to use accurately machined gas-checks, Cups of accurate even bore are also essential for reliable results; but beyond these considerations arises the question of whether an increase in expansion-chamber or an increase in windage presents most advantage.

So far as these experiments go I believe it best to select a chamber giving the most efficient shape of pressure-curve, to use a 'stroke' which will give a sufficiently effective maximum range with minimum windage, and only to increase the latter if reduction is found essential.

FUTURE DEVELOPMENT.

I have ventured to describe the method and results of the preliminary experiments in some detail with a view to indicating particular aspects of an interesting field for future research rather than to advocate any particular theories, and I can only regret that circumstances prevented me from carrying the enquiry further, until more complete and reliable data had been obtained.

The apparatus required is not very expensive and if any R.E. Officers are interested in developing a branch of military science which of old belonged to them, and the token of which is still worn on the uniform of the Corps, they cannot do better than take the matter up with Professor Bull, whose extraordinary genius and readiness to help solve a thousand difficulties.

That further research in the subject is called for, and that it should be in such hands, suggests itself.



GRENADE BALLISTICS

THE BATTLE OF THE SOMME.

THE 41ST DIVISIONAL ENGINEERS AT FLERS ON 15TH, 16TH AND 17TH SEPTEMBER, 1916.

From the report of the C.R.E. 41st Division.

On the night of the 14th-15th September the Field Companies of the 41st Division were disposed as follows :---

In bivouac near Montauban, having left camp at Fricourt at 7.15, with only section transport :---

H.Q. and three sections 228th Fd. Company, R.E., under Captain E. C. Baker.

H.Q. and three sections 233rd Fd. Company, R.E., under Captain H. F. D. Thwaites.

H.Q. and three sections 237th Fd. Company, R.E., under Captain C. L. T. Matheson.

One section 228th Fd. Company under Lieut. E. T. G. Carter was detached under orders of the G.O.C. 122nd Infantry Brigade, and reported to him at York Trench at 7.0 p.m. This section taped out assembly trenches for the Brigade between the Longueval-Flers Road and the left boundary of the Divisional area, behind and parallel to the front line, in three lines, about 480 yards lay and 70 vards spacing. The section then returned to Brigade Headquarters at Green Dump. No further orders were received by this section till 8.0 a.m. on the 15th when it was told to get into touch with the O.C. front line of troops and assist in consolidating strong points round Flers. The section proceeded to a point just south of the village and constructed a strong point without infantry assistance. At about 2.0 p.m. the Brigade Major ordered Lieut. Carter to assemble all the scattered parties of infantry and take them with his Sappers round the right of Flers village, saying that he himself was taking a party round the left and would meet him on the other side. Lieut. Carter again met the B.M. at a point west of the north end of the village, and received instructions to occupy "Cox." This he did and proceeded to consolidate the position without infantry assistance. No covering party was provided. At about 5.0 p.m. word was passed down from the right to stand to. Lieut. Carter went along to the right to find the source of this order and found that the supporting infantry had retired and were going away out of sight up the valley. Being thus left in the air Lieut. Carter decided to

withdraw his section and moved back and reported to the Brigade at York Trench, his section of 32 men having suffered 14 casualties. After remaining the night at Green Dump he received orders to return to the company bivouac.

One section of the 237th Fd. Company was detached under the orders of the G.O.C. 124th Infantry Brigade and reported to him at York Trench at 8.0 p.m. on the 14th. It was subdivided by Brigade orders into two half-sections, one half-section, under Lieut. Hunter, was ordered to report to the O.C. 26th Royal Fusiliers, the other half-section, under Sergeant Mossman, to the O.C. 32nd Royal Fusiliers, both in Edge Trench. The section then proceeded to Edge Trench, and finding no one there went on to Green Trench, where they waited till 5.0 a.m. on the 15th when the infantry arrived. The first battalion to come up was the 26th Royal Fusiliers and Lieut. Hunter accompanied them with 14 men.

Sergeant Mossman was left in Green Trench with the remaining 14 men and accompanied a party of the 15th Hants. Regt., who appeared in Green Trench, in accordance with the order of the officer with the party, as far as Switch Trench, where he reported to the O.C. 15th Hants. Regt., who told him to put two machine-gun emplacements and a fire step in the trench. This was done with infantry assistance. On reporting completion of the work to the Colonel he was ordered to return and report to his company. This he did at 1.30 p.m. on the 15th.

Lieut. Hunter in the meantime reported to the O.C. 26th Royal Fusiliers and assisted the infantry in consolidating in Switch Trench. On completion the O.C. ordered him to return, and he reported to the Brigade Headquarters in York Trench, who said that they had no further orders for him. He accordingly reported to the O.C. 237th Fd. Company at 4.0 p.m. on the 15th.

One Section 233rd Fd. Company R.E. was ordered to report at Pommiers Redoubt at 8.0 p.m. on 14th to the G.O.C. 123rd Infantry Brigade, and Lieut. Langdale, who was in command, received orders to report to the O.C. roth Royal West Kent Regt. The section bivouacked with the R.W.K.'s till 12.30 a.m., when the party moved to York Trench, arriving there at 3.30 a.m. on 15th. No further instructions were received till 12.15 p.m., when the Battalion moved to the junction of Milk Lane and Carlton Trench, where they waited till 2.30 p.m., when the section received orders to advance between B and C Companies, and consolidate in Switch Trench. The section advanced among the various parties of the R.W.K.'s and on reaching Tea Trench, Lieut. Langdale carried out a reconnaissance with the Section Sergeant as far as Switch Trench, and sent back the Section Sergeant as a guide to the O.C. Battalion, who then brought up his Battalion and the Sappers to Switch Trench.

Here the Colonel, who had given instructions to a part of his

Battalion to move about 800 yards to the right and was about to recall parties who had straggled further off towards High Wood, was wounded, and Lieut. Langdale assisted in binding him up and in reporting the casualty at the forward dressing station in the northwest corner of Delville Wood. He then turned up towards Switch Trench and rendezvoused his Sappers at the junction of Milk Lane and Carlton Trench, reporting to Captain Thwaites, R.E., on his arrival at about 7.0 p.m. on the 15th, who then took charge of the half-section with the other two sections that he was taking up for consolidating work in rear of Flers. In the meantime Corporal Rice with half of the section had moved with the right column of the 10th R.W.K.'s, and assisted the Infantry in the consolidation of a portion of Switch Trench on the west of the Longueval-Flers road. At about 9.0 p.m. the work in hand was completed and no officer being present Corpl. Rice returned with his Sappers to the Company Headquarters and reported himself.

The remainder of the R.E. acted under Divisional orders, conveyed through the C.R.E., on the night of the 15th—16th. Captain Baker was ordered to proceed with the remaining three sections of his company, two sections of the 237th and one section of the 233rd, to consolidate the Box-Cox-Hogshead line in front of Flers.

In front of Longueval Captain Baker and Lieut. Berry were severely wounded and Captain Matheson took command of the six sections.

Information being received that no line in front of Flers was held. Captain Matheson reconnoitred to ascertain where the front line was. Finding that the Infantry had fallen back from Hogshead and that a front line was being held on the right of Flers, he consolidated this line, making strong points on each flank and one central one, with also a machine-gun emplacement on the right return flank. The work being completed at about 1.0 p.m., one section of 237th Fd. Company and one section of 233rd Fd. Company were left to consolidate the Brown line in accordance with instructions.

Two sections 233rd Fd. Company under command of Captain Thwaites were employed at the same time consolidating behind the line of Flers Trench, behind the village, in continuation of the work carried out by Lieut. Carter in the day-time, using the old wire of Flers Trench as an obstacle.

On the 16th the two sections who had not yet been employed worked on the improvements of the Montauban Quarry road, which was being used for evacuation of the wounded from the advanced Dressing Station.

On the night of 16th—17th, four sections under command of Captain Thwaites were ordered to proceed to Flers to report to the Commandant of Flers, and consolidate the line Box-Cox-Hogshead. Finding Box occupied by troops of the New Zealand Division, work was concentrated on Cox and Hogshead, and on completing the

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gaps in a connecting trench which the infantry had dug, also in making a short length of C.T. back to the sunken road. The two sections at work in the Brown line were ordered to be relieved, and one additional section was sent to the Green line to work till 4.0 a.m. On the 17th these sections were again employed on the Montauban Quarry road.

On the afternoon of the 17th all the Companies of the Division were withdrawn to Fricourt.

The lessons learnt as regards R.E. work were :---

I. That R.E. should as far as possible be employed under the direct orders of the Division on definite work of tactical value. The sections given to the Brigades were left almost entirely on their own initiative without definite instructions.

2. No party of R.E. of less size than a section under an officer should be employed, except perhaps a few guides who would be very useful to show the Infantry the way, and avoid the confusion which occurred through lack of knowledge of the trenches and of the direction of the attack. These should rejoin their sections at once.

3. A preliminary engineer reconnaissance of the positions to be consolidated, before the night parties of R.E. are sent out, would be very helpful in deciding what numbers of men, tools and materials are likely to be required.

4. One stretcher per R.E. section should be carried, the regimental stretcher bearer system is very apt to leave out the R.E. who have no stretcher bearers of their own. If two stretcher bearers per section could be added supernumerary to the strength they would be very useful in other ways.

5. For tool transport the pack cobs were found very useful, the conditions were impossible for getting tool-carts forward. It is suggested that a second pack saddle per section should be carried for use on a spare horse or cob. This would enable one pick and shovel for each man to be carried so that the Sappers could each carry up 25 sand bags for consolidation work.

In only one case was an infantry carrying party provided and so the Sappers had to rely on what they could bring or find for themselves.

6. Generally the Infantry did not yet appear to appreciate the tactical value of the Sappers; and except where they were employed directly under Division orders, with a Company Commander in charge, their work was apt to be misdirected. Probably therefore in working with the New Army, especially as the Officers themselves were lacking in experience, it would be advisable to work the Field Companies as far as possible as complete units.

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THE WORKS DIRECTORATE, MESOPOTAMIA EXPEDITIONARY FORCE.

PART II.-BAGHDAD AND FORWARD AREA.

ON the capture of Baghdad on 11th March 1917 it was decided to form a separate Works Organisation working directly under G.H.Q. to carry out works north of the Diala River, with Colonel H. L. Pearson R.E. as Deputy Director.

Although the Turks had done a large amount of damage to buildings and machinery in Baghdad, there were several large well-built buildings remaining which were taken over for conversion into hospitals. Of these, the Jews' Hospital was used as an isolation hospital, the Turkish Military Hospital as a British, and the Turkish Military School as an Indian Hospital. These buildings required little alteration beyond petty repairs and the addition of sanitary annexes and cook houses.

The Turkish Infantry Barracks taken over as a British Hospital and the Cavalry Barracks as an Indian Hospital, although not seriously damaged, were found to be in such an indescribably filthy condition that they had to be thoroughly disinfected and cleaned before they could be brought into use, and the usual offices had also to be added to these buildings.

In addition, three houses belonging to Kasim Pasha, on the right bank of the Tigris, were converted into an Officers' hospital, and a row of private houses, known as Fenareh Houses, on the left bank about two miles below Baghdad, were made into the Officers' Convalescent Depot. Both of these groups required considerable alterations and repairs before they could be made suitable for these purposes.

In order to increase the hospital accommodation it was decided to construct a hutted Indian hospital of 1000 beds near the Cavalry Barracks, north of the city.

Before the fall of Baghdad the British Consulate had been used as a Turkish hospital, but on the arrival of the British the patients were moved to the old Turkish Military Hospital and the building was taken over as G.H.Q., the *personnel* of Headquarters with the Directors and their staffs being billeted in houses near the consulate. Considerable work was necessary to adapt the houses to make them suitable for offices and quarters.

The G.O.C. Baghdad garrison and his staff were billeted near the north gate of the city, and the garrison lay under canvas to the north of the city and in the German barracks in the citadel.

The citadel was put to its former use as an ammunition dump and Ordnance depot, as, in spite of numerous fires and explosions, the majority of the buildings, except the workshop and main bakery, were undamaged. The bakery and workshop had been demolished and it was necessary to rebuild them, but many machines were salved from the debris of the workshop and were put to useful employment by the A.O.D.

A second bakery in Hospital Street had also suffered considerable damage, but was repaired in the early days of the British occupation.

Other important buildings damaged by the Turks before evacuation were :---

1. The flour mill, north of Baghdad, completely destroyed and machinery blown up, the chimney alone remaining ;

2. The German Wireless Station, masts blown down, machinery destroyed and buildings damaged ;

3. The Turkish Government Clothing Factory, all machinery destroyed and buildings damaged ;

4. The Turkish Magazine at the East gate, blown up; and

5. Messrs. Lynch Bros. premises, building damaged.

Many of the charges in these and other buildings had failed to explode, and in some cases the fuses had not even been lighted, due no doubt to the hurried exit of the Turk.

During the night of the 10th—11th March the Kurds in Baghdad started looting the bazaar, but the damage they did was of no military importance.

With the advance of the troops beyond Baghdad, an Advanced Base was established about five miles below the city. The headquarters were accommodated in two buildings on the left bank of the Tigris at Karradah, and other buildings on the river front were taken over as offices and billets. The main depots and the restcamp were on the right bank.

Four casualty clearing stations were also installed at the Advanced Base, and convalescent depots, each for 1000 beds, were sited on each bank of the river.

During the hot weather of 1917 it was decided that all units at Advanced Base should remain under canvas, but in spite of this a large amount of work had to be carried out in this area, building incinerators, latrines and cook houses, laying out and maintaining roads, providing dug-outs for shelter from the heat, etc.

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After the capture of Baghdad there were three lines of advance, the easternmost up the Diala, the centre one up the Tigris and the western up the Euphrates. The existing Baghdad-Samarrah Railway ran on the right bank of the Tigris, but it was decided that the Baghdad-Kut line should be on the left bank. It therefore became necessary to form new dumps on the left bank, and the Hinaidi peninsula was selected as the advanced base for troops and supplies intended for formations on the left bank. Work was carried out at Hinaidi similar to that at the other Advanced Base.

The city of Baghdad contained few streets capable of taking wheeled traffic, most of the so-called streets being narrow passageways between the houses, twisting and turning in all directions. During the war however the Turks had cut a main street, which they had called Khalil Pasha Street, through the city from the north to the south gate. The demolition of the houses for the construction of this street had been carried out only a short time before the British captured the city, and as soon as labour became available the completion of the work was undertaken, holes being filled up and the surface levelled. The street was renamed New Street.

Further demolition of buildings was carried out on both banks of the river, for the construction of roads leading to bridges over the river.

In addition to the roads within the areas of Baghdad city, Advanced Base and Hinaidi, trunk roads were built connecting the city with the two latter. In each case the system, which had been successful in the Field Army before Sunnaiyat, of building two roads, one of which was reserved for motor traffic, was followed.

Before the British occupation most of the houses in the city were provided with a piped water supply, and the installations were not damaged by the Turks. These consisted of oil engines driving centrifugal pumps which lifted the water from the river into troughs about ten feet above the ground, from whence it ran by gravity through the pipe lines. The pipes were cast-iron spigot and socket pipes, the joints having been mostly made with mud. The tracing of the pipe lines, of which no plans existed, was a work of some difficulty. It was also frequently necessary to clean out pipes which had become blocked with silt, and it was not uncommon to find lengths of small diameter in a line which was understood to be of larger diameter throughout. Considerable improvements and additions were carried out to the water supply, and among other works stand-pipes were placed on all the roads for street-watering gangs.

The water supply at Advanced Base was provided by pumping from the river by an Arab-owned engine and pump, the water being distributed through the camps and depots in open channels, running along the roads. This water was at first used both for drinking and road-watering, but in June the two supplies were divided and three miles of piping were laid to distribute the drinking water.

Electrical supply was practically unknown in Baghdad before the British occupation, there being only two Cinematograph sets and a supply at the Turkish Military Hospital, but it was understood that a scheme for supply of electrical power and the provision of a tram service were under consideration by a British company before the outbreak of war. The installation in the Turkish Military Hospital was a small set, sufficient to supply one light in each ward and one on each verandah, and this did good service until more powerful plant could be installed.

On the occupation it was decided that electric light and fans should be provided for G.H.Q., and all hospitals in Baghdad city, while the tented casualty clearing stations and convalescent depots at Advanced Base should be provided with punkahs if necessary. Owing to the limited time available before the advent of the hot weather, it was not possible to erect any heavy plant in time to provide power for the fans, and it was therefore decided to erect five local power stations to deal with the loads in their immediate vicinity. The question of concentrating the supply of power was not lost sight of, and proposals were put forward for the erection of a Central Power Station with plant which was already available at Busra. In May 1917 a scheme was put forward and received approval. The site selected for the Power Station was in the Turkish Military Clothing Factory, the buildings of which had escaped without serious damage, and provided accommodation for a small workshop and quarters for the British *personnel* of the E and M Section.

The provision of the temporary plants for the hot weather of 1917 did not make the progress hoped for owing to shipping delays, but by the end of July both British hospitals, the Officers' hospital and convalescent home, and G.H.Q. were receiving a limited supply of electric power during the hot hours of the day and during the evenings. Owing to shortage of plant the supply was not as reliable as could have been wished.

Baghdad contained several locally-owned ice-plants which it was estimated would provide enough ice during the hot weather of 1917 for the needs of the force. It was therefore decided not to erect any government plant that year, but to rely on the local plants, assisting the owners by providing stores to keep them going, and regularly inspecting their plants. Two barges fitted with ice-plants were sent up from Busra, one of which was sent to Chaldari to supply the troops in camp there, and the other was moored at Karradah to meet the requirements in that area. At Baqubah a municipalowned ice-plant was found, and arrangements were made for this to be worked for the benefit of the troops stationed there. Towards the end of June the erection of a one-ton ice-plant was begun at Advanced Base, but it was not ready in time to do useful work during the hot weather of 1917.

The Engineer Field Park was originally established at Advanced Base, the materials in stock at Sheikh Saad being transferred there, but on the inauguration of the Works Directorate at Baghdad a second Park was established in that city, the site selected for it being the old Turkish Customs House, which had a small wharf with two hand-operated cranes, and vards and houses with cellars affording ample storage accommodation. Large consignments of stores soon began to arrive and in the meanwhile the officer in charge was fully occupied in searching for and buying up the engineering materials which were to be found in the bazaar. The Baghdad Park took over as wood-working shops the Turkish aeroplane repair shops, which contained power-operated wood-working machines, the property of a Baghdad merchant, and a considerable amount of useful work was done there. It was soon decided that, as the system of having two Parks was unsatisfactory, the Advanced Base Park should become the Expeditionary Field Park and Baghdad City Park should be a works dump issuing stores to works units only.

In July 1917 the Army Commander decided that the Baghdad Works Directorate should cease to be a separate organization, and the Director of Works, Brigadier General Stokes-Roberts, took it over in addition to the L. of C. Works Directorate. Shortly after this the work was organised with two Assistant Directors, one at Advanced Base and the other in Baghdad, but this division of the work was not found to be satisfactory, owing to the difficulties of river transport, and at the end of 1917 their responsibilities were changed to the charge of the Right Bank and Left Bank of the Tigris, respectively.

With the extension of the Lines of Communication the road work of the Directorate was largely increased, and in spite of many difficulties, mostly connected with transport, all roads were greatly improved. A new hutted hospital, No 65 B.G.H., for 1000 beds, was also completed at Karradali in these early days of the occupation.

In the spring of 1918 the Works Directorate had large responsibilities in the building and upkeep of the bunds which had to be erected round Baghdad and Hinaidi to protect the city and camping areas from floods on the rise of the river. The area was successfully protected, but some anxiety was caused by the river washing away its banks in the neighbourhood of Hinaidi and exposing the foundations of several houses employed as billets. The billets had to be evacuated, but the houses stood and the bank was repaired as the

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river fell. In July 1918 the bunds were handed over to the Irrigation Directorate.

Considerable improvements to the water-supply in and around Baghdad were carried out during this year. Three water filtration plants were erected, one to supply the camps at Hinaidi, another the hospital area to the north of the city and the third the Advanced Base on the right bank The erection was commenced in February 1918 and the second started to pump filtered water in July.

An improvement in the supply to Baghdad city was also designed and carried out. A pumping station with settling tanks was erected to the north of the city, but owing to difficulties in connection with the tanks it was not possible to provide the city with settled water before the close of the year. It was at first intended to provide the whole city on both banks with water from this pumping station, the right bank being served by a pipe line to be taken across the river on a railway bridge which it was proposed to erect. But during the hot weather of 1918 it was found that the consumption of water by the civil population had risen so largely, owing to the improvements in the supply, that all calculations were falsified, and the new pumping station, far from supplying the whole city, could only provide for a portion of it on the left bank, and that the old Turkish pumping stations were still required. Additional overhead steel-plate storage tanks were also erected in Baghdad to improve the supply.

A large refugee camp was ordered to be prepared at Baqubah in August 1918, and finally provided accommodation for about 50,000 refugees who had come down from North-west Persia to put themselves under British protection. The Works Directorate provided many camp structures and a water-supply and roads throughout the camp.

During the cold weather of 1917-18 a Central Power Station was erected in Baghdad. Power mains were run through the streets and the local electrical installations were dismantled. High-tension lines were run to the hospital area north of the city and to Karradali and Hinaidi, the electrical loads at these places being connected to the main supply. The station itself consisted of four Babcocks and Wilcox boilers, complete with apparatus for oil-fuel firing, two D.C. 250 Kilowatt sets, one 200 K.W. and one small A.C. set, a rotary converter and the usual switchgear, balances, etc.

It was decided not to connect Advanced Base to the supply, and the Station there was enlarged to take the additional load in that area.

The right bank portion of the city was to have been connected to the Central Power Station, but, owing to the delay in the arrival of the cable, it was not possible to do this before October 1918. A temporary cable across the river was tried, but the experiment was not a success, and the local plants at the Officers' hospital continued working throughout the hot weather of 1918, additional plant being also installed at I Corps Headquarters and at the Railway Station and yards.

Electrical plants and filtration water-supplies were also installed at Hilla and Ramadie, and small electrical installations were provided for Divisional Headquarters during the hot weather of 1918.

For the ice-supply during 1918 it was decided to erect a main Government Ice Factory at the old Turkish Clothing Factory, and to become independent of the somewhat expensive method of purchasing from local factories. A ten ton, a six ton and a four ton plant were crected, and a reserve supply of 150 tons of ice was collected in an ice-store which was also built at the Clothing Factory. As a main supply for the right bank a private ice-factory with an out-turn of about ten tons a day was hired, completely overhauled and improved, and worked by government during the hot weather.

For the first time it was possible, during the hot weather of 1918, to make provision for the supply of ice to the Field Army, and iceplants were erected at Abu Saida, Qizil Robat and Kifri, to the northeast of Baghdad, Samarra on the Tigris, and as far north as Ramadie and Hit on the Euphrates. 1800 tons of ice were turned out from these plants during this hot weather.

In the spring of 1918 it was decided that the E and M Section of the Directorate should do all mechanical work required for the agricultural development of the country, and all engines and pumps, flour-mills, etc., the property of Arabs, were inspected and put in order. The repairing of many of these placed a heavy burden on the workshop staff, and the workshops had to be considerably enlarged and additional tools and machines ordered to keep pace with the work.

With the extension of the railways north of Baghdad and opening up of the country a certain amount of building material could be brought in from the north, bitumen and lime being obtainable from Hit, gravel from Feluja, and gravel and lime-stone from Table Mountain. With the gravel thus obtained it was possible to metal a considerable portion of New Street.

Among other works carried out towards the end of the war there may be mentioned the rebuilding of the retaining walls along the river bank in Baghdad City, and the erection of a cold-store at Advanced Base with a manufacturing capacity of 3 tons of ice and storage for 60 tons of frozen meat from the local stocks. The watersupply of Nejef was placed in order after that city had surrendered to the British, and a start was made on the crection of a large flourmill which had been despatched by the War Office to deal with the local harvest.

On the signing of the armistice preparations were made for the erection of a large military cantonment outside Baghdad city.

[NOTE.—An excellent map of Lower Mesopotamia between Baghdad and the Persian Gulf, with railways revised to November, 1919, is supplied with Sir John Hewett's Report to the Army Council on Mesopotamia, published by H.M. Stationery Office at the price of 15. 6d.—EDITOR, R.E.J.]

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THE WORK OF THE ROYAL ENGINEERS IN THE EUROPEAN WAR, 1914-1919.

CHAPTER V.

BRIDGING.

MISCELLANEOUS.

1,---DISMANTLING STEEL BRIDGES.

Soon after the Armistice instructions were issued from G.H.Q. for a number of steel bridges in the neighbourhood of Amiens and St. Omer to be dismantled, and returned to the base.

This work was organised by the Chief Engineer of the VII. Corps, and was carried out by the 227th Field Company in the Amiens area, and the 556th Army Troops Company in the St. Omer area.

Instructions were issued by the E. in C. as follows :---

"(a) Bridges taken down will have all parts clearly marked and packed in accordance with the Tables given in 'Portable Road Bridges' (I.I.S. War Office, March 1916, and additions issued from time to time).

(b) Bolts and nuts are short, and great care must be taken that they are undamaged, greased and packed in boxes, which will be carefully packed.

(c) Each Bridge will be packed complete with decking, etc., and a notification of any deficiencies will be sent to the Engineer in Chief's Office, in order that they may be replaced from the Base.

(d) Disposal of Bridges.—A notification will be sent to E. in C.'s office at least three days before the Bridge is ready for despatch, when a destination for the Bridge will be given, and truckage arranged for.

The Bridge will be put on rail and will be conveyed to its destination by a suitable escort.

Duplicate way-bills will be made out and a copy signed by the Officer in Charge at the Receiving Dump or Store will be forwarded to the E. in C.

(e) Slab approaches will be taken up and delivered at nearest Railhead, and loaded on trucks.

Notification will be sent to E. in C's Office of the number of trucks of slabs which will be delivered at each Railhead, and the date when they will be ready for loading.

E. in C. will arrange truckage and give destination."
Nineteen Bridges of various types were dismantled in the Amiens area, and eight in the St. Omer area. A large number of slabs and sleepers were also lifted and despatched from the approach roads. Labour was supplied by companies of prisoners of war, and was very satisfactory. No difficulties were found in the technical work of dismantling spans.

Generally speaking the lessons learnt were similar to those in the erection of steel bridges, that is to say that the most important work was that connected with the transport and packing of material.

Designation.				Unit.	Quantity.			
Bag, Sand			•••	No.	500			
Bars, Pinching		•••		No.	24			
Brushes, Paint	***	•••	•••	No.	6			
Cordage, 3 in. (130	oil)	Coils.	2					
Cranes, Loading, 1	ton			No.	2			
Crow-bars 5ft. 6 in			•••	No.	24			
Cutters, Wire	•••		• • •	No.	6			
Derricks, Lattice,	(with	2 sets	of					
blocks for each, I treble, I double,								
and 1 snatch)	•••		• • •	No.	2			
Grease (28 lb drur	ns)	•••	• • •	Drums.	2			
Hammers, (5 lb.)	•••			No.	24			
,, (2½ lb.)		•••		No.	48			
" Sledge () lb.)	•••	•••	No.	12			
Handles, Hammer	, assort	ed		No.	6			
Heads, Pick	•••	•••	•••	No.	12			
Helves, Pick	•••	•••		No.	12			
Jacks, Derrick (5 1	on)			No.	+			
Jacks, Derrick (6 f	on)			No,	10			
Oil, lubricating, M	ineral	•••	•••	Drums.	2			
Paint, Black	•••		•••	Drums.	I			
,, White	•••	•••		Drums.	I			
Rollers, launching,	specia	1		No.	8			
Shovels, R.E.				No.	12			
Spanners, ½ in.	•••		• • •	No.	24			
,, § in.	•••	•••		No.	24			
,, 🐴 in.		•••		No.	24			
,, Box	•••			No.	2			
Wire, plain, No. 1.	4 gauge		•••	Coils.	6			
Wire Rope, 2 in.		•••		Coils.	2			
Winches, 2 ton	•••	•••		No.	4			

The above stores were additional to the ordinary tools in possession of a Field Company, or obtainable from an Advanced R.E. Park. Transport from bridge sites to rail in the Amiens district had to be chiefly done by 3-ton lorries, which caused a good deal of delay and difficulty in loading long girders and timbers.

In the St. Omer district, all material was loaded direct on to barge, and taken to the base by canal.

2.—CLEARING AND REGULATING OPERATIONS ON CANALS.

During their retreat the Germans not only destroyed most of the road and railway bridges, but also succeeded in making considerable water obstacles by damming sections of the French and Belgian canals and cutting gaps through the banks up stream of the dams. They also carried out a large amount of wanton destruction of locks on the main canals.

The actual responsibility for clearing and repairing navigable canals lay with the Inland Water Transport, who were, however, quite unable to keep pace with the rate of advance, and the amount of destruction. The preliminary work of clearing waterways for flood water, and reduction of water level in the inundated areas, thus fell to the Chief Engineers of British Armies. The canal system of France and Belgium is a very complex one, and control of all water removal schemes had necessarily to be centralized. All possible information had been collected in the Office of the E. in C., and instructions were issued to all the Armies concerned as to the best means, and channels through which to let out flood water.

The biggest inundations and most extensive damage were on the Scarpe and the Escaut, and the clearance of these waterways, and surrounding areas, was entrusted shortly after the Armistice to the Chief Engineer of the VII. Corps, and was by him divided into a Northern and Southern Sector, each under a Lieutenant-Colonel R.E.

Description of Locks.—The locks on these canals are from 38.50 metres to 38.70 metres in length, and from 5.10 metres to 5.20 metres in width, with 2 metres draught. In the masonry walls up stream, lock gates, slots or chases approximately 20 to 25 cm. square in cross section existed to take wooden stop-logs, or *poutrelles*, by which the waterway could be completely closed.

Similar arrangements are also provided on the bye-pass channels. Description of Blocks or Dams made by the Germans.—The methods of blocking adopted by the Germans were :—

(a) Dams made of fascines and earth on the down stream side of a row of rough piling, and built up to the level of the canal banks.

(b) Block formed by filling in at a lock with bricks, fascines, mud and rubbish, between the *poutrelles* and the lock gates.

In some cases barges partially filled with bricks were also sunk in the locks.

The work of clearing some of these locks was made most unpleasant by the putrifying remains of dead horses which had apparently been cut up by the Germans, and mixed in with the débris between the *poutrelles* and the lock gates. Cut up dead horses were also found in the small bye-passes by which the locks are normally emptied.

Demolitions by Germans.—In some cases both ends of a lock were thus blocked. In other cases the up stream end only was blocked, the down stream end being entirely demolished.

The explosives used by the Germans were generally groups of large calibre H.E. shells, four on each side of the lock sunk about 2 metres deep, and I to 2 metres behind the brick backing of the masonry walls of the locks. The resultant craters were approximately 4 metres deep, and 8 to 9 metres diameter.

The work had evidently been very carefully planned to do the maximum damage to the canals consistent with retaining a head of water at those places where inundations were intended; for example, locks 8 at Denain, and 9 at Haulchin were completely demolished, craters being formed on either side of both up and down stream gates, whereas lock 10 at Trith St. Leger was blocked at both ends, and a steel barge sunk in it.

Clearing the Locks.—Where the locks were totally destroyed, all that could be done was to take out the larger débris, and so allow a free passage for storm water.

Where locks were dammed and contained sunk barges, an efficient water-lock was made by sinking a tarpaulin on the up stream of the *poulrelles*, so closing off the water.

Débris between *poutrelles* and lock gates was then removed : dead horses piled on the banks and burnt, and barges cut into sections by the use of explosives, and then pulled out by means of a caterpillar tractor.

Other Obstructions.—Through Valenciennes there are three main water channels:—

- (a) Canal de l'Escaut (The navigable Canal).
- (b) Canal de Charge | To take all water except
- (c) Old bed of the Escaut River | lock water.

A side channel controlled by *poutrelles* connects (a) and (b).

This channel is some 300 yards long, and had been blocked, as well as part of the Canal de Charge, by felling some 20 large trees, and dropping them into the channel. A steel barge was also sunk into the channel.

Work of clearing was first started by cutting the trees up into sections by the use of German stick grenades. A 2 ft. 6 in. diameter tree could be broken in half by four of these grenades lashed round it, and fired simultaneously. The tree sections were then hauled out by winches found in the neighbouring mills or workshops. After a few days a caterpillar tractor was obtained by means of which whole trees 40 ft. to 50 ft. long easily pulled out.

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Dams.—Dams were cleared by explosives, usually groups of 5'9 German shell in twos and threes, with one gun cotton primer fired electrically, the shells being dug down 4 to 5 feet into the dams, thus clearing a waterway, and as the water fell, smaller charges were used to cut down stumps of piles still remaining.

Demolished Bridges.—Practically every bridge across these canals had been totally or seriously damaged. These included Pont Levis, Pont Tournant, steel lattice and plate girders, masonry arches, and reinforced concrete arch bridges (road and railway).

The débris from these demolitions caused formidable obstructions, which generally had to be removed by the continual use of small charges of explosives.

At Antoing divers had to be employed for five or six weeks to remove débris of masonry, steel-work, etc., also at several locks to examine and assist in removing damaged lock gates where it was not possible to release the lock water.

Regulation and Control of Water in Canals.—The comparatively dry weather in November and beginning of December assisted the clearing operations greatly.

All the worst obstructions were removed, and the levels of the various reaches of the Escaut and Scarpe canals reduced to below normal before the heavy rains began. This enabled the inundated portions of the country in the Escaut valley to be drained.

At all locks and bye-passes not totally destroyed steps were taken to recover control of the water in the reaches, either by means of stop-logs or undamaged gates, so that the level of reaches could be raised or lowered. This largely helped to protect the canal banks.

In all this work the greatest care was taken to do nothing which should interfere with the future work of permanent re-construction.

Units employed .- The following R.E. Units were employed :--

411th and 550th Field Companies.

172, 175, 176, 251 and 253 Tunnelling Companies,

196 Land Drainage Company,

Detachment of 8th Canadian Engineer Battalion,

Detachment of 3rd Australian Tunnelling Company, and Detachment of I.W.T. (Divers, etc.).

[Previous articles under the heading of "The Work of the Royal Engineers during the European War, 1914—19" appeared in the R.E. *Journals* of September, 1919 (Introduction p. 105; Anti-Aircraft Searchlights, France, p. 106; Postal Section—Army Postal Services, p. 114), October (Bridging, Chapter I., p. 162), November (Bridging, Chapter II., p. 200), December (Bridging, Chapter III., p. 261), January 1920 (Bridging, Chapter III., *(continued)*, p. 13), and February (Bridging, Chapter IV., p. 61; Organization of Engineer Intelligence and Information, p. 79). Copies of these Journals may be obtained through the usual channels.]

MEMOIR.

COLONEL SIR HENRY EDWARD McCALLUM, G,C.M.G.

THE death of Sir Henry McCallum, which occurred at Camberley after a long illness on November 24th, 1919, removes a distinguished Royal Engineer Officer and a servant of the Crown who, in a civil capacity, held high office in various dependencies of the Empire.

The eldest son of Major H. A. McCallum, R.M.L.I., Sir Henry was born in 1852. Entering the Royal Military Academy at the age of 16, he passed out in 1871, first among a batch of 52 cadets with the Pollock Medal, and in due course received a Commission in the Royal Engineers. After two years spent in practical training at the School of Military Engineering, Chatham, where his ability in constructional work gained him the Fowke Medal, he was appointed in 1874 Superintendent of Telegraphs for the Southern District. A few months later he was transferred to the Office of the Inspector-General of Fortifications, remaining there until the following year when his long association with the East began.

In 1875, Sir Henry, who was then 23 years of age, accompanied Sir William Jervois, the Governor of the Straits Settlements and himself a Royal Engineer Officer, to Singapore as Private Secretary, thus making his first acquaintance with Crown Colony Government. To a young man, capable, industrious and energetic, the opportunity so afforded of familiarizing himself with the methods of Colonial administration and the association with problems attending the government of native races, furnished an invaluable training. Of this training Sir Henry took the fullest advantage, and the insight into affairs gained in these early days, the knowledge acquired and the lessons learned, coupled with the industry and high sense of duty which distinguished him throughout his life, fostered his natural talents and laid the foundation of the political wisdom which in later life was employed to so great advantage in the service of the During his two years of service as Private Secretary Sir Crown. Henry accompanied the Governor on various missions to the native states of the Malay Peninsula. He took part in the Perak war of 1876, receiving the medal and clasp, and was several times mentioned in despatches for services both in the campaign and in connection with the Commission of Enquiry which followed. In 1877 he



Col. Sir Henry Edward McCallum, G.C.M.G.

Col Sir Henry Edward McCallum GCMG

returned to his Corps, and after spending a short time at Hong Kong as Superintending Engineer of the Admiralty Works he returned in the following year to Singapore, where he had been chosen to devise measures for the defence of the port. Thereafter, he was attached to the Office of the Inspector of Works at the Royal Arsenal, Woolwich, until in 1880 he took service under the Government of the Straits Settlements as Deputy Colonial Engineer.

For the next seventeen years his lot was cast with the Colony. In 1884 he was appointed Colonial Engineer and Surveyor-General, and from this time onward until he left the Straits Settlements thirteen years later, he was intimately associated in a number of important capacities with the administrative and social life of the Colony. A member of both the Legislative and Executive Councils, he was also for a time Commandant of the Singapore Volunteer Artillery. For some years he was President of the Singapore Municipality and in this capacity his frank and kindly nature did much to encourage and preserve the good relations existing between all sections of the community. But although in the service of the Colonial Office, he retained his connection with his Corps. He was promoted to Captain in 1883; in 1890 he became a Major on the reserve list, and he was made a Lieut-Colonel in 1897. Three years later he was promoted to Colonel, and it was not until 1909 that he was placed on the retired list. In 1885 when, following the Panjdeh affair, Great Britain appeared to be within measurable distance of war with Russia, Sir Henry's professional knowledge was again requisitioned by the War Office who entrusted to him the important task of constructing new fortifications at Singapore. This duty he performed with great skill and thoroughness and on the completion of the work his services were acknowledged by the award of a C.M.G. A few years later, in 1891, when native disturbances broke out at Pahang in the Malay Peninsula, the Straits Settlements Government appointed him Special Commissioner for the disaffected area. Here he displayed ability and firmness in dealing with the situation and his success in suppressing the outbreak earned him the thanks of His Majesty's Government.

It was not to be expected that an officer of Sir Henry's administrative capacity would remain indefinitely in a subordinate position. His exceptional gifts of mind and character singled him out for promotion, and his opportunity came in 1897 when he was appointed to the vacant Governorship of Lagos. In directing the destinies of a young and undeveloped Colony Sir Henry found many matters to tax his strength and test his judgment, and in the execution of his task the apprenticeship which he had already served stood him in good stead. But beyond the normal administrative duties of a Governor, there existed in British West Africa at that time exceptional circumstances demanding judgment, watchfulness

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and resource. The boundary between French and British territory was undefined and on the inland borders the French for some time had been displaying unusual activity. Shortly after his arrival Sir Henry was sent on a special mission to the hinterland in connection with the situation which had arisen, and there he handled a delicate and troublesome business with distinction to himself and advantage to his country. In the following year, when the boundary questions at issue were settled by the Anglo-French Convention, Sir Henry received the thanks of His Majesty's Government for his services, and the assistance which he had rendered was further recognised by his promotion to K.C.M.G.

But the long months of hard and anxious work and the unhealthy climate of West Africa overtaxed even his strong constitution. His health broke down, serious illness followed, and in 1898, within two vears of his appointment to the Colony, he was invalided home. Later in the year, when his health had somewhat improved, he was transferred as Governor to the more bracing climate of Newfoundland where he made acquaintance for the first time with a Colony enjoying responsible Government. He remained in Newfoundland for two and a half years, co-operating whole-heartedly with his Ministers in the tasks of Government and devoting himself with characteristic energy to all that affected the welfare of the island and, the amelioration of the lot of its inhabitants. His services in Newfoundland received official recognition in 1900 by his appointment as an Aide-de-Camp to the Sovereign, and when, in the following year, he was promoted to the important Governorship of Natal his departure called forth universal expressions of gratitude and regret.

Soon after his arrival in Natal Sir Henry had the honour of entertaining their Majesties the King and Queen, at that time Duke and Duchess of York, who visited the Colony in August 1901 in the course of their progress through the Empire. In South Africa, the Boer war was still in progress, and the first year of Sir Henry's administration was occupied in dealing with a number of difficult problems incidental to the existence of a state of warfare in the neighbouring territories. By this time Natal itself had been freed of the Boer forces, and with the exception of a second and short-lived invasion at the end of the year, the Colony was not again called upon to defend itself or to experience a renewal of military operations within its borders. But in many ways the new Governor could render valuable assistance both to the central Government at Johannesburg and to the Commander-in-Chief, and until peace was signed in 1902 Sir Henry was indefatigable in the support which he gave to Lord Milner and to the Military authorities. Beyond the general supervision of the affairs of the Colony, he undertook, at the request of Lord Kitchener and with the concurrence of his Ministers, the personal control of the working

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of the Boer concentration camps which had been formed in the Colony, and his practical common-sense and grasp of detail soon proved their value in increased efficiency of administration and in the improvement of the conditions of life of the occupants.

The return of peace in 1902, which found Natal with some 7000 square miles added to its territory, was followed by a period of industrial and economic depression. The next few years were 'a time of reconstruction during which the energies of the Government were devoted to the extension of communications and the development of the natural resources of the Colony. The harbour works at Durban were improved and railways were pushed out in various directions. A line to the Zululand coalfields was opened by the Governor in 1903, and in the same year the railway to Vryheid and the recently incorporated territories was completed. Railways were also built to the eastern portion of the Orange Free State, affording in this way new outlets for the Colony's exports and increased facilities for its transit trade.

But the clouds were soon to gather again, and a year or so before his departure from Natal Sir Henry was called upon to deal with. an internal situation of grave danger to the Colony. Rumours of native unrest, both in Natal proper and in Zululand, had been rife for some time. Dinizulu himself, a son of the last of the Zulu Kings, was believed by many to be disaffected, and although he remained ostensibly loyal, a change of attitude on the part of the natives towards the European population which had been discernible since the conclusion of the Boer war was becoming more and more apparent. Of this changed attitude Sir Henry had personal experience on one occasion when, in the course of a tour on the Zululand border, two tribes which he had summoned to an indaba showed deliberate disrespect by appearing before him with fighting shields and in full war paint. The immediate sequel to this incident was unexpected. Not until the weapons had been withdrawn to the foot of a neighbouring hill would Sir Henry receive the chiefs, and he then interviewed the tribes separately. At the close of the audience, the first of the two tribes to be dismissed. succumbing to temptation, collected not only their own but their neighbours' weapons as well and so made off, leaving their indignant friends to discover the loss later on, and to plan measures of revenge which resolved themselves the same night in a faction fight between the two tribes.

The causes of unrest were many and deep seated. There were admittedly serious defects in the machinery of native administration, more particularly as affecting taxation, compulsory labour and debt. Further, the growth of the Ethiopian movement which, religious in origin, had assumed in its development many of the characteristics of a secret political organisation, itself furnished evidence of the

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growing sense of union among the natives of South Africa and provided in some quarters a convenient cloak to cover seditious teaching. To these and other causes must be added a general loosening of control for which the Boer war was to some extent responsible, and the damaging effect on European prestige occasioned by the success with which, on at least one occasion, a native force had retaliated on a cattle raiding Boer Commando. The taunts, too, of their women-folk directed against a generation of natives which had not " blooded its assegais " furnished a further incitement to violence, which soon manifested itself in the killing of pigs, white goats and other animals, and in the ominous organisation of hunting expeditions serving as a mask for military training. The passing of an Act by the Natal Government in 1905 imposing a poll-tax on adult males further fanned the prevailing discontent and formed the immediate pretext for, although it was not the ultimate cause of, the rebellion which ensued in the following year. The storm broke early in 1906. In February of that year an armed native force attacked a party of Police who were collecting poll-tax within a few

miles of the capital. Two of the Police were killed, and the fire of rebellion which had for long been smouldering, burst into flames and spread through the Colony and over the border into Zululand. Martial law was immediately proclaimed; the local forces of the Colony were mobilized and were re-inforced later by a detachment of troops raised and sent by the Transvaal Government.

At the end of March an incident occurred which, for a moment, led to misunderstanding with the Imperial Government: Twentyfour natives who had been implicated in the attack on the Police had been tried by court martial and twelve of their number were sentenced to death. After a careful review of the evidence, Sir Henry confirmed the sentences and reported his action to the Secretary of State. The next day Lord Elgin telegraphed for detailed information and instructed Sir Henry in the meanwhile to suspend the executions. The Natal Ministry thereupon resigned, on the ground that the action of the Imperial Government in ordering suspension was an interference with the rights of a Responsible Government. But the misunderstanding was transitory. The scrupulous care with which Sir Henry had examined the cases of the condemned men, and the jealous regard for his responsibility in the matter which had earlier sought and obtained from Ministers an assurance that they had no intention or wish to infringe the perogative of the Crown, convinced Lord Elgin. On March 30th the Secretary of State telegraphed to Sir Henry that His Majesty's Government recognised that "the decision in this grave matter rests in the hands of your Ministers and yourself" and the Natal Ministry resumed office. Three days later the condemned men were executed.

Into the constitutional question involved it is not here necessary to enter. It was true that an Indemnity Bill for acts performed in the Colony under Martial Law would ultimately require the assent of the Crown and that to this extent the responsibility of the Imperial Government was involved; but in Natal, where feeling ran high, opinion was unanimous that intervention from England in an act of internal administration, advised by Ministers and confirmed by the Governor in the exercise of his perogative, established a dangerous precedent, paralysing to the authority of the local Ministry and striking a blow at the roots of self-government itself. That this view was shared elsewhere is evidenced by the fact that the Governments of the Australian Commonwealth and of New Zealand telegraphed their anxiety to the Secretary of State and asked to be reassured as to the position adopted by His Majesty's Government.

It was not until the following September that the rebellion was suppressed. During the anxious months that intervened Sir Henry's counsel and advice were eagerly sought by and freely given to his Government, and the critical period of conflict only served to demonstrate the complete accord and understanding which existed between his Ministers and himself. In the exercise of his responsible duty he had early directed that all proceedings of Courts-martial should be submitted to him for confirmation or revision, and throughout the rebellion, until the abrogation of martial law, he investigated personally and with scrupulous care the details of each separate trial, weighing the evidence, taking count of mitigating circumstances, commuting sentences wherever possible and exercising by his authority a moderating influence. To this influence were in no small measure due the determination and self-restraint with which the emergency had been met, and when at last, the danger over, Lord Elgin telegraphed the congratulations of His Majesty's Government to the Colony, the telegram ended on a personal note of acknowledgment of the success which had attended Sir Henry in the execution of his difficult task.

Within a few months of the end of the rebellion Sir Henry, who three years earlier had been created a G.C.M.G., was appointed to the Governorship of Ceylon. But before he left the Colony he had found time to traverse the wide field of native policy and to appoint a Commission of Enquiry into the causes of disaffection and the grievances of the native races. His departure which was regretted by a host of friends and deplored as a real loss to the Colony occasioned an unusual compliment in the shape of a formal request by Ministers for the extension of his term of office.

Ceylon, where Sir Henry arrived in August 1907, furnished abundant scope for the exercise of his great administrative gifts. Fertile, prosperous and financially stable, with a small public

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debt and a surplus fund of over a million pounds, the Colony was ripe for a vigorous policy of development, and Sir Henry applied himself without delay to the preparation of a large programme of public works designed to touch the most salient points affecting the commercial and industrial welfare of the community. extension of rubber cultivation and the growing agricultural prosperity of the island called aloud for fresh means of access to the ports and markets. The vital importance to trade and agriculture of developing communications was ever present in Sir Henry's thoughts, and his professional military training no less than the natural trend of his mind fitted him in a peculiar measure to appreciate the practical possibilities and requirements of the time. New railways were opened to the rubber and cocoanut-bearing districts, and the construction of roads proceeded at a pace regulated only by the length of the Colony's purse and the capacity of the Public Works Department to deal with new undertakings. With a lively appreciation of the influence of material prosperity on moral well-being, he endeavoured by all means in his power to extend the cultivated area of the island, and he spared neither time nor thought if, thereby, the stubborn earth might be subdued to the needs of men, if, with his help, the wilderness might blossom and the solitary places rejoice. The whole problem of the agricultural well-being of the island was a constant care to him. He re-modelled the Botanic Gardens Department and enlarged it into a Department of Agriculture with a scheme of agricultural development including facilities for training teachers in village schools and the provision of agricultural scholarships. He found time to enquire into the financial condition of the native peasantry, and the recommendations of a Committee appointed to report on the introduction of agricultural banks led to the introduction of agricultural co-operative credit societies on the lines of societies already existing in India. Questions of land settlement and survey, with their intimate relationship to agriculture, also passed under his review. The work of the Survey Department was practically re-cast and he was responsible for the introduction in 1909 of a Landmarks Ordinance, providing for the permanent marking of boundaries, which, by protecting purchasers of land from the encroachments of their neighbours, conferred an inestimable benefit upon the public.

But of all his activities, there is none by which he will be better remembered in Ceylon, as there was assuredly none more important, than the share which he took in the development of the harbour works of Colombo and in the provision of increased facilities for handling the trade of the port. Schemes of a widely differing nature for connecting the harbour with the Colombo lake had from time to time been projected and abandoned, and even before his arrival

in the island Sir Henry had begun to study the subject. Personal familiarity with the conditions obtaining only strengthened his conviction of the necessity for some such undertaking, and in due course a considered scheme was included in his original programme This scheme was later referred to a Commission and of works. in some respects modified. In its final form it received the approval of the Legislative Council in 1910, and before he left the Colony Sir Henry had the satisfaction of knowing that work had actually begun. Other important improvements to the harbour were also effected under his instructions. The increased protection which an extension of the South West breakwater afforded, by liberating a valuable area of land led to the inception of an extensive scheme of works, including additional jetty and wharf accommodation; the breakwater itself was further protected ; arrangements were made for deepening the harbour, and railway facilities in the port area were increased and new yards erected.

Sir Henry's term of office was noteworthy also for the constitutional changes effected in the Government of the Colony. Not only was the Legislative Council re-modelled and enlarged but the elective principle was introduced for the first time in the history of the Island. Hitherto, all members of the Legislative Council had either sat *ex-officio* or had been nominated by the Governor, but in 1910 an Ordinance was passed providing for election by ballot of four unofficial members representing the communities educated on European lines.

As was only to be expected, Sir Henry displayed great interest in the Volunteer Force of the Colony and, from first to last, he actively concerned himself in all that made for the improvement of its organisation. He was largely responsible for the formation of an Engineer Volunteer Corps which proved a signal success, and the general advance in the efficiency of the various branches of the service during his administration was in no small measure due to his encouragement and to the changes which he introduced. It is not possible here to make more than a passing reference to the innumerable outlets which Sir Henry found for his abundant energy. Public health benefited under his rule by the expansion of the medical department, by the attention directed to the erection of .hospitals and dispensaries and by measures adopted to combat disease. The importation and distribution of opium were placed by Ordinance under direct Government control, and the sale of native intoxicating liquors was regulated by the creation of an Excise department, controlling manufacture and consumption on the lines of a system which was already working satisfactorily in Madras. Police work was reviewed and developed, and the prison system of the island amended by the adoption of measures for improving the condition of prisoners and by combining the teaching

of trades with the deterrent effects of punishment. Among other activities of his busy administration may be mentioned the completion of schemes for the supply of water to small towns, the revision of postal and telegraph rates and regulations, the establishment of trunk telephone lines and the consolidation of the game laws.

Enough has been said to give some idea of the constant care and thought which Sir Henry devoted to the interests of the Colony, and of the boundless energy with which he sought continually to promote its prosperity. And when the end came, when at length, broken in health, he left for the last time the island which he had served so well, he could look with satisfaction to the results of five and a half years of unremitting toil and render with confidence and pride a final account of his stewardship.

To the tasks of Government Sir Henry brought many great qualities. With his considerable professional attainments as an Engineer and the specialized knowledge acquired in his military training he combined great natural ability, keen insight; and quick sympathy. Possessed of a strong will and a fearless courage which neither popular clamour nor personal interest could shake, those who served under him and the peoples over whose destinies he from time to time presided had good reason to know that in Sir Henry McCallum was a man who, above all else, could govern. During a long and distinguished career in many lands and under differing conditions, he gave his whole strength to the varied tasks allotted to him, and in the countries of his adoption and the familiar places of his life there are many to-day who can testify not only to the energy and administrative capacity which marked his work, but to the great personal qualities of character which fitted him preeminently for the high offices of Government.

Among the virtues which make for successful administration there is none which Sir Henry valued more greatly or cultivated more assiduously than justice. In his public life and his private relations alike he was essentially a just man. Fair dealing was an article of his creed, and when at last the reins of Government fell from his hands, it was by the standard of justice that he wished his actions to be judged. When, in his farewell message to the Legislative Council of Ceylon penned at the end of his career, after summarisingthe results of his administration he wrote that " I have held steadily before me the scales of justice in my dealings with all independent of colour, creed or occupation" it was more than the past six years of office that his thoughts embraced. Rather, his words expressed the constant endeavour and aspiration of his mind, the ideal which, through the trials and achievements of his working years, he had kept steadily before his eyes. Of the exacting standard of duty which he set himself, his ceaseless vigilance, his untiring devotion

to the welfare and interests of those who were for the time being his subjects, the present writer who for many years was privileged to share his confidence can abundantly testify. No man ever gave himself more freely to the service of his country, and the unsparing . toil, the courage and the zeal with which at all times he faced and handled the problems confronting him gained their reward in the confidence and affectionate regard of men of diverse races and various creeds. Giving much himself he expected much of others. but if he exacted from those who served him something of the energy and the consuming zeal which inspired his own life in the conduct of affairs, no man was ever more considerate to his subordinates and assuredly no man was ever kindlier as a friend. A born leader of men, no opposition daunted him and no difficulties dismayed, and the regard for justice, the singleness of vision, and the tenacity of purpose with which he met situations of difficulty and danger inspired trust and confidence in those he governed and revealed his character in times of stress as an influence enduring and steadfast among the faltering hearts of men.

His memory will be green in the hearts of many friends to whom his death has brought an abiding sense of loss, and all who knew him and those, in many lands, who learnt his merit will mourn a man loyal in friendship, wise in counsel,

> " Strong in will, " To strive, to seek, to find and not to yield."

ARTHUR HEDGELAND.

CORRESPONDENCE.

THE WORD, "GADGET."

A correspondent writes :--This useful word cannot be found in any standard dictionary. The only one that throws any light on it is the Oxford Dialect Dictionary which contains the following :---

GADGE (Yks) Sewing term: to baste; to run or tack together lightly with long stitches.

(W. Yks) "Gadge me these trousers up."

(Norf and Suffolk) To measure, to ascertain the dimensions of, estimate. "I gadge up this allotment at $\frac{1}{4}$ acre."

Both dialect meanings apparently indicate a hasty extemporized operation.

Can anyone throw any other light on the origin of this useful little word. Perhaps the author of the following lines which were circulated in France could do so?

"All things bright and beautiful

" Gadgets great and small

"Bombs, grenades and trench boards

"The Sapper makes them all."

(Nore.—Webster's New International Dictionary gives the following :— Gadget—A contrivance, object or method ;—often used of something novel or not known by its proper name. Slang.—ED. R.E.J.)

REVIEWS.

A SHORT HISTORY OF THE GREAT WAR.

By PROFESSOR A. F. POLLARD, M.A., LITT.D. (Methuen). 10/6 net.

This book, which has been written for the use of students, is to be recommended as such on account of its clear narrative, abundant and carefully prepared maps and well-informed criticism of events, the true details and motives of which are still but imperfectly divulged.

F.E.G.S.

MATHEMATICS FOR ENGINEERS-PART II.

By W. N. Rose. (Chapman & Hall.)

This book fairly justifies the claim contained in the editorial notice that it occupies a position intermediate between treatises on the Calculus of a purely mathematical character, and those which merely illustrate its physical applications. Many practical problems are worked out in the text, and there are useful chapters on Fouriers theorem, Differential equations, the solution of spherical triangles, and the theorem of Least Squares. A feature of the book is its clear text and excellent diagrams. The exercises set are instructive and there is much useful information within a moderate compass. The treatise supplies a want.

J. M. WADE, Lieut. Col.

MAGNETISM AND ELECTRICITY.

By BROOKS and POYSER. (Longmans, Green & Co., 1918).

It is stated in the preface that this work is intended to afford such a range of general reading in the subject as is desirable for the majority of students before they begin to specialise either in pure science or in the various branches of electrical engineering, and this gives a very fair indication of the scope of the volume. The first eight chapters deal in detail with the subject of Electrostatics and Lines of Electric Force, while the next five are devoted to Magnetism and Lines of Magnetic Force, and these two sections certainly seem to prepare a student thoroughly before he sets out on the third and biggest section, viz.: Current Electricity. In this latter section the elementary principles relating to flow of current, electro-magnetic induction, and magnetisation are first considered fully. Then come chapters on the theory of Alternating Currents and Measurement of Inductance, followed by short dissertations on the subject of Thermo-electricity, Passage of a discharge through gases, Telegraphy, Telephony, Dynamo and Motors, Lamps, Measuring Instruments, Units and Dimensions, and finally, Electric Oscillations and Wireless Telegraphy and Telephony. A feature of the book is that the experimental method of illustrating and explaining all points as they arise is adopted and the student is thereby encouraged to prove for himself the truth of all that he reads. Apparently, however, the book is merely a reprint of the 1912 edition, with the addition of an appendix on Wireless Telegraphy and, where much is good, it seems a pity that no effort has been made to bring it up to date on some minor points. For instance the chapter on lamps makes no mention of the half-watt lamp. G.T.

PAGES D'HISTOIRE, 1914-1918.

(Librarie Militaire Berger-Levrault, 5-7 Rue des Beaux Arts, Paris).

(Continued from R.E. Journal for April, 1919).

The 156th number of this series contains the official communiques issued by the Central Government at Paris to the Provincial Authorities in France during the three months, April to June 1918; it is the XXXVII volume dealing with such matters. In an Appendix are contained extracts from the *Journal officiel* relating to the visit, in the early days of April, of the President of the French Republic to the Armies fighting in the region of Montdidier and to the messages which passed, in the month last mentioned, between the Sovereigns and the chief of the Allied and Associated Powers and the President of the French Republic.

The 157th number is entitled *Le Front*, sub-title *Les Étapes de la Délivrance*; it contains a series of coloured maps showing the Front in the Western Theatre at the following periods:—5th September 1914; after the victory at the First Battle of the Marne, 31st December 1914; the "stabilised front" 1915 to 1917; 20th March 1918; 16th July

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1918; 3rd August 1918; 3rd September 1918; 25th September 1918; and the 15th October 1918. This number is in continuation of the 39th volume of the series.

The 158th number is entitled L'Épopée de Zeebrugge et le "Vindictive." The author of the volume is Keble Howard (J. Keble Bell, Sec.-Lieut. R.A.F.) : he gives in ten short chapters a brief account of the brilliant feat carried out on the eve of St. George's Day 1918 by the British Navy which resulted in the bottling up of German submarines in the Bruges Canal by the sinking of the Iphigenia and the Intrepid in the Entrance Channel to Zeebrugge Harbour. The account of the affair appears in the volume in the form of interviews with some of the prominent actors in this daring naval raid. We are introduced in turn to Captain Carpenter; Captain Sandford; Sergeant Finch; and Captain Chater. The volume is illustrated. A chart showing the entrance to Zeebrugge Harbour, and also aerial photographs of the same, in which the obstructions caused to the fairway are to be clearly seen are contained in the volume. Other photographs consist of portraits of Admiral Sir Roger Keyes, Captains Carpenter and Sandford ; views are also published of the Vindictive, etc. French translations of the official accounts of the operations against Zeebrugge and Ostend are also included in the volume. It was in connection with the latter operation that the Vindictive was, in May 1918, finally sunk in Ostend Harbour ; a brief reference to this is also contained in one of the Chapters of the Volume.

The 159th number of the series is entitled L'Alliance Franco-Russe ; it is in fact a reproduction of the Third Yellow Book relating to the Great War issued by the French Government. The volume is divided into four chapters and contains a reprint of 107 despatches with, in some cases, the appendices which accompanied them. In Chapter I are disclosed the steps by which the Franco-Russian' Alliance was brought into existence; the correspondence in relation to the preliminary negociations is contained in 27 despatches, which extended over the period 24th August, 1890 to the 30th January, 1892, inclusive. The situation was a delicate one and unfortunately, at the time, M. de Giers, the Russian Foreign Minister, was suffering from a serious illness, which added considerably to the difficulties met with. In Chapter II is set out the correspondence relating to preliminary steps taken to frame a Military Convention to regulate the military assistance to be mutually provided by the High Contracting Parties in furtherance of the Treaty of Alliance between them. This part of the correspondence consists of 55 despatches covering the period 4th February, 1892, to 5th November, 1892, In order that secrecy should be maintained in relation to the inclusive. Alliance being then negotiated for as long as possible, it was decided that no special mission should be sent from France to Russia, or vice versa, for the purpose of discussing the terms of the Military Convention. However, an opportunity was created by the Military Manœuvres, carried out in Russia in the autumn of 1892, to bring high officials of the French and Russian Armies together: they were thus able to discuss the details of the Military Convention and to come to an agreement as to its scope. For this purpose, General de Boisdeffre proceeded in the August of the

year mentioned to St. Petersburg ostensibly to attend the manœuvres, but really to get into direct touch with General Obroutcheff and the Russian General Staff with the object of elaborating the framework of a Military Convention. Some difficulty was experienced in arriving at a formula acceptable to the representatives of the two nations. In Chapter III is contained the correspondence which followed in relation to the Military Convention after General de Boisdeffre and General Obroutcheff had laid the foundations of the same; it consists of 15 despatches covering the period 20th May 1893 to 12th August 1899. Finally, in Chapter IV. is published the correspondence relating to the Naval Convention between the two countries. The first despatch of this series is dated the 6th February, 1912, and the last the 16th August 1912. The original text affords valuable instruction and indicates how extremely difficult it is for a democratic government to negotiate an alliance with another Power, even where the forming of such an Alliance is vital to the continued existence, as an independent Nation, of the country it represents.

The 160th number is a Diary of the War for the period 1st January to 30th June 1918. It is the eighth volume of the series dealing with such matters.

The 161st number is entitled Les Glorieuses Journées de Lorraine et d'Alsace. The yolume contains an Introduction by M. R. Steinheil and is divided into three parts. In the first part is contained an account of the proceedings in the French Chamber of Deputies at the meeting held on the 11th November, 1918, when the French Premier announced that an armistice had been concluded by the Allies with the Central Powers. In this part are also published the texts of Marshal Foch's Proclamation to the Allied Armies dated the 12th November, 1918, and of the speech delivered by the President of the French Republic in Paris on the 17th November, 1918, when he reviewed the achievements of the War. The second part contains the texts of the Proclamations issued by the newly appointed Commissary of the French Republic at Metz, by the Mayor of Metz, and by General Gouraud on his arrival at Strasburg on the 24th November, 1918, and also the texts of the Army Orders issued by Marshal Pétain and by General Gerard after the signing of the armistice. In this part are also published the texts of the speeches delivered at Metz, Strasburg, Colmar and Mulhausen, on the occasion of the triumphal visit of the President of the French Republic and the Premier to the recovered Provinces. The third part contains an account of the meeting of the Chamber of Deputies held, on the 12th December, on the return of President Poincaré, M. Clémenceau, and the other Ministers from Alsace-Lorraine for the purpose of celebrating with due solemnity the restoration of French rule in the recovered Provinces.

W. A. J. O'MEARA.

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NOTICES OF MAGAZINES.

THE MILITÄR-WOCHENBLATT.

December, 1919.

No. 66.—The Officers Pensions Law and the necessity for amending it— A strong appeal for the amendment of the pensions Laws of 1871 and 1896. The writer maintains that those officers who came forward from retirement during the war and held, in the field, rank higher than that with which they originally retired, should have their pensions based on the higher rank.

France and England in Syria.—The article consists of extracts from the French press and adds such comments as are calculated not to improve French feeling on the question.

The *Militär-Wochenblatt* appeals to all members of the old "undefeated" German Army to hasten the formation of Regimental Unions and gives a list of those which have been formed during the last month, which brings the total up to 80.

Roll of Honour.—Infantry Regiment No. 53: 139 officers killed, 3 died of disease and 11 missing, other Ranks 2,750 killed. The heavy losses in senior officers in the early weeks of the war are noticeable, as are also the losses against the French at Perthes in September 1915 and on the 21st and 22nd March 1918 near St. Quentin.

No. 67.—The leading article headed Approaching Dangers is a protest against the draft of the new pensions law for officers and officials. Those parts of it which propose to take into account the officer's private means in assessing his pension are described as pure robbery and the writer comments bitterly on the doubtful pleasure of living in a so-called socialistic state.

The Corps of Officers and German Society.—The writer maintains that the abelition of the Officers Courts of Honour, decreed in August 1919, is a blow not only against the Officers Corps and the memory of those who have fallen, but also against the whole of German society. He states that this Society will regulate its code of honour by that of the Corps of Officers and is already longing for the re-erection of the old standards of truth and faith; and concludes with an appeal to all Officers Associations to do their best to set them up once more.

The National Union of German Officers appeals to all to support and subscribe to a presentation to Field Marshal Von Mackensen on his return to Germany, which shall make up to him for the humiliations to which he has been subjected.

The French Railways in the War is a reprint without comment of an article on this subject in The Times of 6th Sept. 1919.

Gazette dated 24th November, 1919, gives the names of the members of the Reichswehr Ministry. These include—Major-Gens. Reinhardt; Von Seeckt; Von Braun; Eisenhart-Rothe; and Cols. Kress Von Kressenstein; Wurtzbacher; and Hene.

Memories of the Great War, by General Conrad. Von Gossler, G.O.C. VIth Res. Corps, is reviewed with particular comment on the fact that in $2\frac{1}{2}$ years but few days passed when the author did not visit his troops in the line. The reviewer particularly wishes to bring this to the notice of those who imagine that the higher commanders spent their days in ease and comfort.

Roll of Honour.—Pioneer Battalion No. 14: 36 Officers and many other ranks killed.

No. 68.—Bulgaria in the Great War—A reply.—Dr. Freiherr Von Friesen declares that Radowslavow's statements concerning the German Army and its higher command are untrue and unjust and that they must be sharply repudiated. By the treaty concluded with Roumania on the 7th May, 1918, Roumania was obliged to surrender her gains of 1913 in the Dobrudia as well as to submit to a further rectification of the frontier. in favour of Bulgaria. The northern part of the Dobrudja became the condominium of all four allies because Bulgaria had not yet been able to make up her mind to give Turkey the ground west of Adrianople. and on the Maritza. Germany, who had performed most of the hard work, contented herself with certain economic advantages. Ferdinand is said to be rightly described as a politician with two irons in the fire and though he and Radowslavow sympathized with Germany, they waited to see who was going to win before they cast in their lot with either side. With Bulgaria it was not a war with existence at stake, but rather one of expansion and of revenge against the hated Scrbians. Hindenburg's 1915 campaign and especially the fall of Warsaw were the deciding factors, and in September she approached the Central Fowers and asked for strong German and Austrian Military support for her attack on Serbia. Radowslavow's assertion that these were also for ultimate employment against Greece and Roumania is disproved by the fact that as yet neither of these powers had entered the war, and above all by the consideration that Germany was at that time in no position to promise troops in any but limited numbers for limited objectives. Germany, in actual fact, gave all and more than she promised, and, with Austria, conquered Serbia for Bulgaria. By this time the losses on the Somme and the wavering attitude of Roumania compelled Germany to withdraw the greater part of her troops and to hand their conquests over to Bulgaria. These were purely military measures, which Ferdinand, unfortunately no soldier, did not understand and protested against, in spite of the fact that Roumania had now to be dealt with. Bulgaria gave but little help in the conquest of Roumania, but Turkish Divisions, offered by Enver, were gladly accepted; Ferdinand; however, deprecated their value and protested against their use, though it was due to the indifferent performances of his own troops in Macedonia that he had himself insufficient to spare for the conquest of the Southern Dobrudja and the accomplishment thereby of his greatest ambition.' In the event the

Turkish troops did very well and such Bulgarian formations as were employed in the Dobrudja were rather disappointing; "according to Ludendorff, who ought to know and has no prejudices." However the Bulgarians were not by a long way entirely deprived of German help. Nearly a whole German Division remained on the Greek frontier, and money, munitions and aeroplanes were freely given. In addition several Jäger Battalions, which were really required in Roumania andlast, but by no means least-the invaluable guidance of General Von Scholz, were lent. In spite of all defeats Roumania only accepted peace in the spring of 1918 and Radowslavow blames the German Army Commanders for this and for those parts of the treaty which did not please him, saying that it was all due to their interfering with. politics, a subject which they did not understand. The writer warmly denies that the Generals usurped the rôle of the diplomatists, puts all the bad points in the treaty down to the latter and asserts that the former were right in all their criticisms. Radowslavow's assertion that, on the collapse of Bulgaria, plenty of German and Austrian troops sappeared which had hitherto been asked for in vain, is next dealt with.

It is true that in June, 1917, Ferdinand had appeared at Kreuznach, but at that moment and still more in the spring of 1918 it was impossible to spare reinforcements. When Bulgaria eventually broke, Germany and Austria did each manage to send 2 Divisions to Sofia and Serbia, and in addition the picked Alpine Corps was set in motion from the West. If these came too late, it was due partly to bad transport conditions, but still more to the lack of resistance offered by the Bulgarian Troops; "The Bulgarian Army went home" said Ludendorff, and the writer has it direct from Germans who fought in the Alpine Corps that the harshest criticism of the Bulgarian Army is justified. In conclusion the writer asks whether it was reasonable to expect that Germany should'expose herself to invasion by the armies of France, England and America, merely to ensure that Bulgaria's greed of conquest should be gratified. Radowslavow states that the German Generals knew nothing of the art of politics; it should rather be said that he knew nothing of the art of war.

German Admiralty in the War comments on the recriminations started by von Tirpitz's Memoirs, and blames him unreservedly for his failure to establish in time of peace for the supreme direction of Germany's naval power. Such a state of affairs as regards her army would have been inconceivable. He saw the necessity and failed to meet it, because, he says, he could not bring himself to ask for his own advancement. Tirpitz expressed his surprise that, on the outbreak of war, the naval plan of campaign had not been discussed with the Army. The writer says that such an admission could only in circumstances like the present pass almost without comment.

No. 69.—The German-Turkish expedition against the Suez Canal in 1916 by Captain Von Heemsterck.—The writer gives a short account of the attack of February, 1915, wherein he says that five Turkish battalions reached the western side of the Canal. The whole adventure showed that nothing could be done without long and careful preparations which were begun in 1915, but, owing to the bad communication with Germany, whence all technical material had to come, these were much delayed. The attack on the Yeomanry at Katia on Easter day, 1916, is described as a premature pin-prick, which merely drew England's attention to her danger, and made her strengthen her defences. When the Turks made their attack in August, 1916, their howitzers which had been delayed in coming from Germany, stuck in the sand and only two batteries got into action. No details are given of the action, but the German Flying Corps is highly praised. Eighteen months later the German Engineers finished the Amanus tunnels and ran a light railway over the Taurus, and, as the writer remarks with some bitterness, at the same time British officers were going from Jerusalem to Egypt, on leave, with dining cars and sleeping berths, in 36 hours.

Military and political events in Russia.—It is stated that all the indications go to show that England intends to come to terms with the Bolshevists, having failed to defeat them by force of arms. France is said to be alarmed at this and to fear that her beloved Poland will come off badly and that Germany will derive advantage from the result.

Signs of the Times is the heading given to an advertisement copied from a provincial paper, which offers situations as night watchmen and says "Ex-Officers preferred."

General Maurice's article on Disarmament in the *Daily News* of 20th Nov. is very fully quoted but without comment.

No. 70.—Contribution to the History of the War.—This instalment deals with M. Painlévé's article "The Truth about the offensive of 16th April, 1917."

The Military and political events in Russia .- This article explains the disastrous consequences to Yudenitch of the secession of Esthonia from the anti-Bolshevist combination. The favourable situation of the Bolshevist forces is pointed out and England is declared to regard the discomfiture of Koltchak with equanimity. The situation in Russia is alleged to be due to England's wish to establish a strong influence in the Baltic and to weaken as much as possible her historic rival in central and western Asia; to France's hysterical terror of Germany and her strengthening of Poland; and to America's desire to exploit Siberia. The writer asks what will be the result of the short-sighted and selfish policy of these three powers as regards Bolshevism. America, herself already infected with Bolshevism, has rejected all idea of compromise with it, as has also France who wants to pursue her pro-Polish and anti-German policy. England's aims are, as ever, treacherous and selfish. Her ideal is to arrange a Siberian Russia, an Ukrainian and Cis-Caucasian Russia, possibly also a Baltic Russia and a government to include the northern territories of Murmansk and Archangel, all more or less under British protection, with the Bolshevists in the middle. The writer hopes the national pride of Russia and the traditions of her great past will bring all these schemes to the ground.

Lieut. Gen. Von Scriba, Editor of the *Militär-Wochenblatt* for the last 7 years, is giving up the post. He thanks all who have supported him and states that his aim has always been to encourage the study of the science of war and, particularly in these latter days, to uphold the interests of the Corps of Officers and the Monarchical ideal.

No. 71.—A long extract is given, of the law dealing with the compensation of those officers whose services are no longer required, owing to the reduction of Germany's forces, in accordance with the peace treaty.

Contributions to the history of the War is a second article dealing with M. Painlévé's account of the events preceding the French offensive of 16th April, 1917.

A few vacancies in Municipal and Police services are offered to exofficers. The pay varies from about 6,000 to 10,000 marks per annum.

Roll of Honour.—Bavarian Infantry Reg. No. 142: 63 Officers and 2,843 other ranks killed. Out of 7 Captains and higher ranks, 5 fell in the first month of the war.

No. 72.—A leading article on the general military and political situation regrets that Germany has not half a million reliable troops at her disposal. If she had things would be very different. France says she is still well armed, but only in order to reduce her still lower than at present. Chauvinist France regards the League of Nations with anxiety, fearing that when Germany is admitted to it, the Treaty will be revised. Germany's ruin is attributed to President Wilson's hypocrisy, and he is described as the most revolting type the war has produced. The question of one or two years' service in France is discussed and mistrust of America on the part of the French is alleged. Mr. Churchill's estimate of the present armed forces of Germany is said to be 20 per cent. too high, but even so France will not believe it, and regrets that she withheld the *coup-de-grâce* when it was within her power to give it, and so on. General Maurice's *Daily News* article on Disarmament is again quoted with evident satisfaction.

The River Ourcq in the War.—Lt. Gen. Von Görz discusses the part this river played, particularly in protecting the German flank during the evacuation of the Chateau-Thierry salient in July, 1918.

German East Africa in the War—A book by Dr. Schnee is very well reviewed. It states that no less than 2,600 kilometres were covered in ten months under great difficulties with constant fighting, a feat unsurpassed even by Xenephon.

Roll of Honour.—Field Artillery Regiment No. 60: six Officers and many other ranks killed.

L. CHENEVIX-TRENCH, Major, R.E.

REVUE MILITAIRE GÉNÉRALE.

October, 1919.

THE GERMAN ARMY BEFORE AND DURING THE GREAT WAR (1914-1918).

The article on the above subject begun in the number of the *Revue* for August—September, 1919, is continued in the number under notice.

The General Mobilisation. The fact that a general mobilisation had been ordered was made known throughout the German Empire on the evening of the 1st August, 1914. The first day of mobilisation was fixed for the 2nd *idem* (a Sunday); on this date, however, all units, etc., in the frontier zones had already been made up to their war establishments, and had also brought their "field grey" into wear. The arrest of persons suspected of being spies began at once, i.e., on the 1st August; some of the unfortunate individuals who came under suspicion were tried, condemned and shot out of hand in a truly German fashion; no doubt to strike terror in the hearts of those who might be engaged in this dangerous work, and could not be discovered. Details are furnished by M. Camena d'Almeida in the original article in relation to the classes called up and the progress of the German mobilisation.

The Establishments of the Combatant Units. Under this heading is given information relating to the numbers of reservists required to bring units up to their fighting strength; the departure of formations for the front; the formation of Reserves and mobile Ersatz units; and the utilisation of trained soldiers for building up Reserve and Ersatz units. Tables accompanying the text of the original article provide information relating to the composition of several of the Reserve and Ersatz formations, and show the regions from which the men composing them were drawn.

ARTILLERY MATTERS.

The article on the above subject by General Le Gallais begun in the Revue for August-September, 1919, is continued in the number under notice. Chapter I is brought to a close with a Section dealing with the factors which have introduced a new element in modern war, viz. Liaison; Aviation; and Tanks. Each of these matters is briefly discussed in the original article. Chapter II deals with The Employment of Artillery. In a brief introduction to this subject General Le Gallais points out that during the Great War there was nothing in connection with the employment of artillery which, so far as his experience goes, was in conflict with the general principles laid down in the latest French Regulations, viz. :---those issued in 1910 or 1911. In a Section dealing with the "War of Movement," General Le Gallais calls attention to the fact that the German infantry and artillery suffered heavy losses from. the French "75" guns; the former because it neglected during its. advance to make the best use of the terrain, and the latter because it. did not come into action in masked positions, and also because it neglected. when in movement, to draw all the advantages it might have done from the lie of the land. It is stated that all that could have been expected from the artillery was actually obtained from it, owing to the fact that rational methods sanctioned by experience were consistently adopted. (To be continued).

GERMAN OPINIONS ON THE WAR.

The sub-title of the original article is Deductions of the World War by Lieutenant-General von Freytag Loringhoven. In a short Introduction a very brief outline is given of General von Freytag Loringhoven's military career. It is pointed out that very few copies of his book,

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Deductions of the World War, a translation of which forms the text of the original article, got across the frontier; dealing as it did with the German plans for the next Great War, it contained a too candid exposure of Teutonic aims, so the export of the book was naturally forbidden by the German authorities. Chapter I deals with the political and economic position of the Central Powers. It is stated that the grouping of the Powers at the beginning of the Great War, and during its continuance, proved extremely disadvantageous to the Central Powers : indeed, it is necessary to go back to the desperate position in which Frederick the Great found himself during the Seven Years War to find anything comparable to the straits to which Germany and Austria were reduced during their late struggle in Europe. It is pointed out that it was Great Britain that succeeded in maintaining accord between the Entente Powers and binding them closer together, when the difficulty of destroying the Central Powers came to be fully realised. The favourable position which Great Britain occupied in the spheres of International Politics and Economy proved peculiarily advantageous to her. So far as Germany is concerned, being up to the period of the 1870 War practically an agricultural State, during previous European wars questions relating to International Politics and Economy were of secondary importance. However, owing to the development of her commerce and the growth of her population such questions became, at the outbreak of the late War, of prime importance to Germany. Measures, it is admitted, were taken to cope with the impending situation, but the preparations, which Germany had made in anticipation of the War, proved to be wholly inadequate : Germany found herself, in 1914 and the subsequent years, not only most disadvantageously situated in relation to the general political situation, but had also to grapple with an economic position which was as difficult as it could possibly be. The consequences of the blockade to which the Central Powers were subjected made themselves felt immediately, although they managed for a considerable time to cope with the situation and to develope their own resources. Nevertheless, there was no way of entirely getting over satisfactorily the disadvantageous situation created for the Central Powers, owing to the Command of the Sea being in the hands of their adversaries. General von Freytag Loringhoven states that Admiral Mahan correctly estimated the influence of Sea Power in relation to present day economic conditions: it was the pitiless use of Sea Power that hastened the economic catastrophe in Central Europe, which resulted in the Armistice of November 1918. Chapter II deals with the psychological effects produced by a national war on the masses. The author of the original article says that the war spirit manifested in the great national armies that took part in the late struggle is something the like of which has never before been experienced in the history of the world; the nearest approach thereto can alone be found in the chronicles relating to the French Revolution. That human beings have, it is pointed out, at all times been susceptible to mass suggestion, is demonstrated by the ease with which religious fanaticism can be fanned; in recent times such susceptibility has, it is suggested, increased. Among the factors which are assumed to have contributed to this increase of susceptibility in the masses are, it is

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alleged, political elections; such elections are said to excite unworthy passions and to destroy all sound judgment. The characteristics of the War, as they present themselves to the German, are briefly reviewed. France, it is said, in 1914, brought for the first time into the field against Germany's national army an army organised on the basis of compulsory service; an army, moreover, in which hatred of everything German had been developed to the highest pitch with the greatest assiduity for several decades, and which had been thoroughly imbued with the idea of a guerre de revanche. It is suggested that methods of franctireur warfare were adopted in Belgiun with the aid and approval of the authorities, and it was for this reason that the War acquired a character of brutality, a character "which is altogether foreign to the nature of our German soldiers." Great as were the tours de force in matters of organisation made by Great Britain, she was at no time able to overtake, it is suggested, the initial disadvantages with which she entered the War; that of a voluntary service army. General von Freytag Loringhoven admits that Great Britain attained a high degree of technical efficiency, but, in his opinion, her battle tactics always remained defective. The British Army, after its conversion to a national army, remained an instrument of economic warfare against Germany. No pains were spared, it is said, to work up a spirit of hatred against Germany in England, and such hatred, it is alleged, resulted in the maltreatment by British soldiers of German soldiersthe astounding accusation is made that both British and French soldiers showed themselves capable of much " brutality." The barriers which International Law had erected to assuage the severity of War, were, says General von Freytag Loringhoven, thrown down " under the effort of this new violence." He is naturally careful not to call attention to the initial and principal part which his own countryman played in

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the upsetting of these very "barriers." (To be continued).

The French Legislature has found little difficulty in coming to a decision regarding the ratification of the Treaty of Versailles.

It is stated that the new Government in Germany has created a Ministry of War consisting of six Departments, which are perfectly organised. The Great General Staff has, of course, disappeared. The reduced proportions of the German Army under the Peace Treaty can be readily seen from the subjoined Table :—

			1914	1920
Battalions of infantry	• •	• • •	600	63
Battalions of engineers	••	· • •	14	7
Squadrons of cavalry	•• •		550	79
Military Budget in millions of r	narks	••	' 980	1100(!)

The labour situation in Great Britain, the political situation in Fiume, the financial situation in Czecho-Slovakia, and the state of chaos in Russia are briefly touched upon.

W. A. J. O'MEARA.

REVUE MILITAIRE SUISSE.

No. 1 January, 1920.

ORGANISATION OF THE SWISS ARMY.

Colonel Sarasin points out in the original article that there exists at the present time a very general demand for a reduction in the military obligations imposed on the youth of Switzerland, and also for a reduction in the military budget of the Confederation. He estimates that the minimum expenditure on the Swiss Army, under present day conditions, should be 80 million francs; on the other hand, the Federal Council has decided that the Vote for the Army shall not exceed 40 million francs. Colonel Sarasin discusses the various modifications which should be introduced in the organisation of Switzerland's military forces in order to make the most of funds voted for their upkeep. He recommends that steps should be taken to ensure that only those who are in every way physically fit for military service shall alone be enlisted; this will naturally involve a reduction in the effective strength of the Army, but, as Colonel Sarasin points out, the advantage will be gained of raising the general standard of the personnel, and the higher quality of the Swiss soldier will, therefore, be some compensation for the reduction in numbers, which must now inevitably take place. A further recommendation is that although the Landwehr troops should continue to be brigaded as heretofore, on the other hand, they should not be considered as Battle units, but, on the contrary, as the real reserve to make good casualties in the first line units and formations.

THE STRATEGIC POSITION OF SWITZERLAND.

Colonel Feyler, the author of the original article, refers to the wide-spread idea that the mountainous character of a country gives it a special strategic value; he does not agree with this view. However, the Federal Government has advanced this idea in connection with its proposal that Switzerland should, in the interests of Europe, be admitted to membership, as a Neutral, to the League of Nations. Colonel Feyler briefly reviews the military significance of Swiss territory in relation to the campaigns which have preceded the Great European War; he gives the reasons which prompted the belligerents taking part in those campaigns, in some cases, to make use of Swiss soil, and in others to avoid it. The position of Switzerland during the critical days of 1914 is examined ; as well as the position after Italy came into the struggle. Colonel Feyler shows how it came to pass that Switzerland remained immune from invasion during the Great War. A sketch map, accompanying the text of the original article, shows the disposition of the Italian Army in 1915: one half of it is seen to be massed east of the Tagliamento for the offensive in the direction of Trieste. (To be continued.)

THE MILITARY ACADEMY OF ZURICH.

The Academy, which was closed down on the outbreak of War in 1914, has now been reopened. Major de Valliere calls attention, in the original article, to the debate on the organisation of the Academy.

NOTICES OF MAGAZINES.

which took place in the Federal Council in June 1914, when a fear was expressed by the socialists that an institution of the kind in question was the breeding ground of *caste*. Major de Valliere controverts this mischievous suggestion and explains the part that is played by the Academy in the national life of his country. A brief description is given of the Academy and the courses of instruction given there.

THE ARMED FORCES OF THE LEAGUE OF NATIONS.

The original article is a review of a Report made by Major Gaston Moch, of the French Artillery, to the Peace Bureau at Berne; the Report in question has been published under the title Les forces armées dans la Société des nations (sold at 1 fr.). Major Moch expresses the opinion—in unequivocal terms—that it is essential that the League of Nations should have armed forces at its disposal; he considers that "the problem of the organisation of the League of Nations is peculiarly a military problem." The various aspects of the question discussed by Major Moch are touched upon in the original article, the author of which is Capt. Fuldon.

NOTES AND NEWS.

Switzerland. Adverse criticisms, it would appear, are being directed by the German Swiss section of the military press to the provisions of the Swiss law, whereby the officers holding command of the higher units and the formations of the Army have been granted fixed annual emoluments on the same principle as the higher officials of the Federal Military Department. The writer of the original notes refers to Colonel Sarasin's article in the number of the *Revue* under notice (see *ante*); he evidently is not in agreement with the gallant Colonel's proposals in relation to the Landwehr being transformed into a depôt for feeding the active units, nor to the scheme for reducing the establishment of the troops of the Elite. The cutting down of the Vote for the Army has, it is stated, already resulted in the abandonment of the training of a part of the Landwehr during the current year.

Attention is called to a pamphlet by Monsieur P. O. Bessire, entitled *La question jurassienne*; the question of the alleged desire for separation on the part of the Jurassians is discussed therein. It would appear that the Jurassians are proud of their connection with the Canton of Berne and that the majority of them are by no means "separatists."

France. A special correspondent deals with the experiences of France during the great War: the War, he points out, enabled the French nation to discover what it was capable of in the fields of production, of courage, of tractability and of endurance. In view of all that France has gone through during the past five years, it is naturally with a tone of deep regret that he refers to the divisions and differences which now appear to exist in every quarter and every institution in France. His opinion is that it is not reorganisation that the French Army requires, but rather that it should be endowed with a "new soul." However, the reformers are not troubling themselves in the least with regard to the last mentioned aspect of the situation.

Now that the Censorship has come to an end, the question is being

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openly discussed as to whom shall be given credit for the "miraculous" victory on the Marne in September, 1914: reference is made to three works in which the claims of General Galliéni are favourably reviewed. These works are General Le Gros's La Genése de la bataille de la Marne, M. Victor Margueritte's Au bord du gouffre and General Percin's Galliéni et Sarrail. Other War questions which have been receiving a share of attention are those relating to the evacuation of Lille and the offensive of the 16th April, 1917; these questions are, it is pointed out, fully dealt with in General Percin's Lille and in an article entitled La verité sur l'offensive du avril 1917 published in a Special Number of the fortnightly review La Renaissance.

It is stated that in the early months of the late war General Gabriel Rouquerol prepared a series of *Notes and Criticisms* on the events of the time. He has now published his records under the title *Aprés la victoire*. The volume discloses the state of mind of those who were at the front; its author is silent with regard to those things that were well done, and confines his attention to those matters in which there was room for improvement.

Belgium. A special correspondent deals with the present day situation. The military and civil authorities of Belgium find that it is as difficult to resume conditions of peace after five years of a devastating war as it was suddenly to put on the garb of war after many decades of peace.

It is suggested that the task of first importance before the country is a re-organization of the Belgian Army; the military edifice built up during the progress of the recent conflict was not based upon any systematic plan, but on a succession of more or less lucky compromises. The time has now arrived to overhaul the structure, since it is in a frail condition owing to the wear and tear it has suffered. The failure of the authorities to revise the scales of pay of officers and N.C.O.s to meet the conditions arising from the rise in prices is leading to an exodus of officers and N.C.O.s from the Army who are being attracted into the fields of industry by the better remuneration and the brighter prospects offered therein.

The people of Belgium do not seem to be much enamoured with the idea of a League of Nations; there faith in 'solemn treaties' has been much shaken by their recent experiences. For this reason, the Belgians feel that one of the most interesting problems for them to investigate is that of military alliances. The Belgian people ardently desire to have the terms of the Treaty of 1839 revised; it is evident that they are much disappointed-with the provisions of the Treaty of Versailles so far as it affects their country. A defensive military federation from the Sea to the Alps is being advocated by quite a number of persons in Belgium.

Italy. A special correspondent points out that the great problem for consideration in Italy, in the year of grace 1920, is that of the organisation of the Italian Army. The recent elections have resulted in the socialist and the "popular" catholic groups winning 250 seats in the Lower Chamber: both these groups have programmes for reforms of an extremely bold kind, including a drastic reform of the Army.

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Although both groups desire to abolish the present organisation of the Army, on the other hand, they are not in agreement as to what shall take its place.

INFORMATION.

Brief notes are given under the above heading on the military press in Italy, France and Switzerland.

W. A. J. O'MEARA.

RIVISTA DI ARTIGLIERIA E GENIO.

September 1919.

THE ITALIAN EXPEDITIONARY FORCE IN MACEDONIA.

When the Italian contingent disembarked at Salonika in the beginning of August 1916, the inter-Allied army of Macedonia consisted of a few French and English divisions, two Russian brigades and the Serbian army, occupying a front of about 300 kilometres, extending from the Greco-Serbian frontier on the north-west of Lake Presba to the mouth of the Struma in the Gulf of Orfano.

To this army was entrusted the duty of covering the important base of Salonika and of barring the enemy's access to Greece; the length of front in relation to the small disposable force constrained it to a purely defensive attitude.

The Italian contingent, consisting of the 35th Division, under the command of Lieut General Petitti di Roreto, disembarked on the 11th August. It comprised :---

The Sicilian Brigade (61st and 62nd Infantry Regiments).

The Cagliari Brigade (63rd and 64th Infantry Regiments).

Two machine-gun companies.

One squadron of cavalry.

Four groups (8 Batteries) of Mountain Artillery.

Four Companies of Sappers, one Company of Miners.

One Company of Pioneers, one Company of Telegraphists, with numerous and well-equipped divisional services.

On disembarkation it came under the command of General Serrail, Commander-in-Chief of the Allied Army of the East, and occupied the sector Krusa Balkan on the lake Butkova. The length of this line was over 40 kilometres, and its importance required no slight efforts and . activity to ensure the safety of its lengthy defences.

In September the pressure of the enemy on the western portion of the front becoming more threatening, while an epidemic of malaria was reducing the efficiency of many units, General Serrail asked for an increase of the Italian contingent, and before long reinforcements including the Ivrea Brigade (161st and 162nd Infantry Regiments) and many small units arrived, which raised the numbers of the contingent to 50,000 men and 10,000 animals.

The expedition encountered considerable difficulties at Salonika, which was extremely crowded owing to the fact that it was the Naval

base of five armies, but all obstacles were quickly overcome, services were at once systematised, and within three weeks from their disembarkation the troops were able to enter the lines on Krusa Balkan, at 80 km, from Salonika.

The sanitary service was organised with special care. Five hospitals were established and supplied with complete equipment including bacteriological cabinets and all necessary chemicals, etc., and giving accommodation for 4000 beds. The *personnel* included fifteen voluntary nurses.

There were also two convalescent depôts and a sanatorium for malarial cases in the healthy wooded locality of Niaussa. The base hospitals further provided civil ambulance services which rendered the greatest assistance in succouring the victims of the great fire which broke out in Salonika in August 1917.

The magazines at the base contained bakeries and repair workshops, and the Artillery and Engineers also had numerous workshops, in the last of which much important work was done in providing and repairing the machinery for the artesian wells. Water mains were laid for a distance of about 6 km.

The motor transport service was carried out under great difficulties caused by bad roads and unfavourable climatic conditions. A sensible improvement in transport took place in July 1917, when it became possible to run an Italian train daily towards the front with 10 locomotives and 150 wagons imported from Italy. The two principal lines of railway were from Salonika to Florina about 180 km., and from Florina to Erzek, about 135 km., the latter of which, traversing a mountainous district, had been constructed by the Allies.

The counter-offensive conducted by the French and the Serbians in September 1916 in the neighbourhood of Lake Ostrovo and Farina, removed the immediate threats against Greece and against Salonika. The Bulgarians were forced to retire 40 to 50 km., and abandoned Florina. They retired to Monastir leaving the Serbians in possession of Kaymachcalan. The Serbians made some progress on the east of the Cherna, in the Vetrenek district, while the Italians engaged the enemy at Krusa and the English repulsed the Bulgarians on the Vardar and Struma.

In October, owing to bad weather, the operations were limited to the actions conducted by the Scrbians and French in the Western, or Cherna, section.

The offensive was resumed in November with the object of gaining possession of Monastir, a centre of great importance to the enemy. The principal attack was made by the Serbians, French, and Italians, who manœuvred in the Cherna valley with a view to occupying the town and the dominating positions around it. Meanwhile, on the front between the Cherna and the Vardar and in the neighbourhood of Lake Doiran the remaining Allied troops made an energetic demonstration against the enemy.

The Italian detachment which took part in the decisive attack consisted of the Cagliari brigade with a machine-gun company, two mountain batteries and squadron of cavalry. After a march of 200 km.



in the rain and through marshy and inundated country this detachment arrived at the steep mountain of Baba, on the north-west of Florina, and immediately became engaged in the tactical dispositions of the 57th French Division. On the 19th November it received orders to advance, with its left on Baba mountain and its right in touch with the French and Scrbians in the Cherna Valley. The steep mountainous country, rising to 1000 and 2000 metres, was tenaciously held by the enemy and the tactical difficulties were augmented by violent and persistent snow-storms. On the 19th the right wing of the Cagliari Brigade, after a sharp action, occupied the Dente di Velusina, which combined with the successful action of the left wing, deprived the enemy of positions dominating the valley and facilitated the advance on Monastir.

The same evening troops of all three nationalities, entered the

Macedonian capital, and on the 21st and 22nd the heights on the west and north of the town were occupied, but the operations were stopped by the intense cold and driving snow. The sector allotted to the Italian contingent was that near point 1050 in the Cherna area.

While these operations were in progress the rest of the Italian troops fell back from Krusa Balkan on Florina, and towards the end of November the whole force was concentrated between Monastir and point 1050. The district was devoid of vegetation and the line, partly in marshy and malarious ground, partly in rocky mountains dominated by the enemy, was one of the most difficult of the front positions. The French and Serbians, in their advance after the capture of Monastir, had halted on the slopes of point 1050, Piton Brûlé and Piton Rocheux, on a line which should have been only provisional but which owing to the force of circumstances became permanent in spite of its many difficulties. These positions were of great importance to the Allies, and although the enemy concentrated against them all the Prussian battalions and their best artillery, the Italian troops did so well that the Commander-in-Chief was always opposed to their transfer to another section. Continuously bombarded and without any natural cover the Italians had to erect immense fortifications in the face of great difficulties and sacrifices. It is sufficient to say that they excavated 110 km. of trenches and communications of a depth of 1'1 to 2'0 metres, for the most part in rocky ground, and about 500 caves in the rocks, and they also put up 130 km. of barbed wire, with a depth of 5 to 6 metres.

To the losses inflicted by the enemy were added those caused by sickness, including the epidemics prevalent in Macedonia, fever, dysentery, typhus, etc. During four months of the autumn about 6000 sick were sent back to Salonika each month, half of whom had to be repatriated.

The troops lived for 21 months without any detriment to their warlike spirit from the discomforts and dangers of these conditions.

The sector of Point 1050 was considered so unsatisfactory that the Serbian supreme command suggested to the Italians that it should be abandoned, but the brave soldiers of the Italians held it against all attacks.

The information acquired by the Commander in Chief in Salonika during the summer of 1918 regarding the internal condition of Bulgaria, that it was weary of the war and despaired of success, led him to infer that a general offensive if vigorously pressed would have good results. The forces at his disposal numbered 100,000 rifles and 1600 guns while the Bulgarians and Germans had 200,000 rifles and 1300 guns.

The principal action of the Allies was conducted against the enemy's centre in the Vetrinik—Koziak district, between the Cherna and Vardar, with the object of penetrating deeply into his positions, and cutting off the right wing of the Bulgarians threatening their communications and opening the road to Prilep and Uskub. This action was allotted to the Serbian army reinforced by two French divisions. A secondary attack was to be made by British and Greek troops in the Vardar sector, while another action with a different object was to be made by Greeks in the Struma sector. In the Monastir sector the Italian troops with the French on their left had to advance in the direction Tapolcani—Prilep, as soon as the Serbians and French had succeeded in breaking the enemy's centre.

On the morning of the 15th September the 2nd Serbian army and the French divisions attacked the Vetrinek Sector and in a few hours succeeded in breaking the enemy's first line. At the same time the 1st Serbian army advanced on the left, converging to the west in order to turn their right towards the Cherna. The enemy continued to give way at the centre but held on at the flanks, compelling the attack to a battle lasting five days. On the 21st the Allies finally occupied the whole of the zone comprised between the eastern branch of the Cherna and the Vardar.

The tasks assigned to the Italian contingent were the following :-I. In the days immediately preceding the Serbian attack to make a demonstration in the bend of the Cherna, so as to prevent the enemy from moving his reserves towards the Serbian sector :

2. To assist the Serbian attack by intensifying the demonstration, and stoutly to resist the enemy's counter-attacks in the Cherna sector ;

3. On the success of the manœuvre, to join in the pursuit with Prilep as the objective, the principal base of hostile reinforcements. The difficulty of these tasks was intensified by the unfavourable conditions of the Italian positions, and the weakness of their heavy artillery, which was reduced to three batteries in order to increase the allotment in the Serbian sector.

The demonstration which lasted from the 13th to 21st September in the form of a heavy bombardment and incessant Infantry action was successful in pinning the enemy to his positions, so that he was unable to send his reserves to the Serbian Sector.

At 7.45 p.m. on the 21st, having received notification that the Serbian menace to the Prilep defences was increasing, the Italian commander General Mombelli led forward his troops to the attack. An hour later the enemy's first line was completely broken and although the nature of the ground favoured his retreat several hundreds of prisoners were taken. The pursuit was carried forward during the night, and by the morning of the 22nd the Italians had penetrated to km. into the enemy's territory. On the 23rd his last resistance on the heights of Tapolcani was overcome and on the following day the troops were in readiness for the attack on Prilep.

But at 2 p.m. on the 23rd orders were issued that the Prilep objective was to be left to the French divisions on the right, and that the Italians turning 90° to the west were to advance on Krushevo, crossing the difficult massif of Baba Planina, in order to cut off the enemy from the Monastir region.

This arduous operation was commenced forthwith in spite of the fatigue of the troops, and was continued on the 24th. On the 25th the Italian right wing gained the ground at the foot of the mountains, but the centre was held up by the enemy's resistance at Krushevo. On the 26th this resistance was completely overcome, the right wing pressed forward under the Chesma mountain, the centre occupied Krushevo, and the left commenced an attack on Pribilci, where the enemy's retreat 181

from Monastir towards Sop had been arrested. The same evening a strong column pushed forward from Krushevo.

On the 27th the right wing overcame the difficulties of the ground on the higher slopes of Baba Planina and threatened the enemy's positions on the east and south-west of Kicevo. On the 28th the Italians advanced to the neighbourhood of Sop. On the 29th the right wing and centre carried out an encircling movement, while the left wing attacked on the south. The enemy, it is now known, had received reinforcements, including numerous machine-guns, during the night. The Italians encountered strong resistance and had to recognise in the Bulgarian commander a stout adversary.

The attack was renewed on the 30th and the situation favoured a success, when at 5.0 p.m. the order was given to suspend hostilities.

On that day the following numbers of prisoners were in the hands of the Italians :—A General commanding a division, two brigade commanders, 240 officers, 7627 soldiers, with 7000 rifles, 70 machine-guns, several heavy and light field guns, and a quantity of war material.

Bulgaria having been forced to capitulate the Allied army of the East carried forward its victorious offensive towards the Danube and Constantinople. The Serbian army reinforced by French and Greek troops was directed towards Nish and Belgrade. Some English and French divisions, reinforced by a third of the Italian contingent prepared to operate against Turkey, and the remainder of the English, French, and Italian forces traversed Bulgaria and marched towards Roumania, where it appeared that the German army of Marshal Mackensen had the intention of offering resistance. Turkey however soon capitulated, and Mackensen's army, owing to the collapse of the Austro-German resistance in Europe, was obliged to surrender. Only the French and Serbians, operating in Old Serbia in the occupation of Belgrade, met with any resistance.

The general cessation of hostilities arrested the advance and gave repose to the valiant contingent which in 27 months of hard fighting, arduous fatigues and privations, and sufferings of every kind, had gloriously upheld its country's flag, and emulated by its valour its brother combatants on the Italian front and in Albania.

The conduct of the men, severely tried for so long a period, their discipline and courage, established between them and their allies a true brothership of arms, and merited the repeated eulogies of the Commander in Chief.

The Italian losses in Macedonia numbered 2841 killed and 5353 wounded. The severe conditions of service undergone by the troops are confirmed by the fact that, between April 1916 and December 1918, about 80,000 men had been under treatment in hospital.

E. T. THACKERAY.
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