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Photo 1.-Navigation span of bridge. Note damage done to protective ice-breakers.



Photo 2 .-- Lift of 3 truss 140-ft. Bailey span.

The Dismantling Of Artlenburg Bridge

THE DISMANTLING OF ARTLENBURG BRIDGE (An Epic of the Elbe)

By MAJOR R. W. OBBARD, R.E. Photos by Lieut. J. E. Hill, R.E.

1. INTRODUCTION

THE River Elbe, the longest river with its mouth in Germany, rises in the mountains of Czechoslovakia and after crossing the frontier runs for 400 miles through the German countryside before reaching Hamburg.

At Lauenburg, on the border of the British and Russian zones, the river often freezes completely over and this freezing extends southward, in hard winters, as far as the border of Czechoslovakia. The fact that the general direction of flow of the river is north-westerly adds to the problem of ice conditions as the southern reaches of the river thaw before the mouth of the river is clear of ice.

When the thaw starts heavy boat ice-breakers start operating from Hamburg and force their way eastward as rapidly as possible in an attempt to reopen the river before the ice breaks. If the thaw should be so rapid that the ice floes break loose before these ice-breakers can reach them then enormous masses of ice several feet thick are carried down-stream and nothing built of timber or piles, no matter how well protected, can withstand this danger.

If the boat ice-breakers succeed in forcing their way up-stream against the pack ice rapidly enough to break it up into comparatively small portions, matters are better, but even then the ice floes, thus released, are capable, as they drift at a speed of 2-3 knots down-stream, of rapidly destroying any pile piers or protective ice-breakers that obstruct their passage unless the design of these is absolutely sound.

This break up of the ice is followed by the spring floods when all the snow from the surrounding countryside melts. As the floods travel northward from the southern thaw the floods build up more and more until finally, by the time the Lauenburg area is reached, any obstruction to the free flow of the river would, in bad years, cause the destruction of the river dykes and the flooding of an area of over 100 sq. miles.

For this reason no bridge has been built with more than 4 piers in the main river bed and spans between piers have been from 250-300 ft. in length. Piers have been built of concrete and stone and have been extremely massive. No attempt has ever been made by the Germans to build pile bridges.

2. HISTORY OF ARTLENBURG BRIDGE

Early in 1946 it was decided to build a bridge on pile piers at Artlenburg on the River Elbe. Here a magnificent two-way Cl. 40 (One-Way Cl. 70) bridge, over 500 yds. long was constructed by 5 Div. R.E. and 7 Armd. Div. R.E. under the command of 8 A.G.R.E. The bridge had one 140 ft. Bailey navigation span, five 65 ft. spans and twenty-four 45 ft. spans.

As Engineer training, the bridge amply fulfilled its object, but as its erection could not be begun before August it proved impossible to complete its protective ice-breakers before severe icing conditions set in. The winter was an early and exceptionally severe one and the Elbe was frozen the whole way across before Christmas

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3. REASONS FOR DISMANTLING

The first clearance of the frozen Elbe from Hamburg to kil. 546 (see Map) was successfully accomplished by the fleet of ice-breakers from Hamburg between 24th December and 4th January, but the fleet then had to race back to Hamburg to avoid being frozen in. Once again the Elbe froze the whole way across and this time the ice was thicker and the cold was more intense.

It was now clear that next time these boat ice-breakers cleared the river, the drift ice would do serious damage to the bridge and its incomplete protective ice-breakers. Hence the decision was taken to dismantle the bridge and salvage all stores possible. The risk of the bridge collapsing into the river and causing an inextricable block of girders, piles and Bailey trusses was too great to be countenanced, as such a collapse would not only have closed the Elbe to navigation and caused great losses of stores, but it would also have led to an obstruction in the free flow of the spring floods—an obstruction that in all probability would have led to the bursting of the river dykes and the consequent flooding of the whole countryside from Luneburg in the south to Harburg in the west.

4. TROOPS INVOLVED IN THE DISMANTLING

On 14th January two platoons of 565 Field Coy. R.E., under Lieut. J. E. Hill, R.E., left for the site and were placed under command of 11 Field Coy. R.E. who, in view of their previous knowledge of the building of the bridge, had been allotted the task of dismantling it. As the working strength of these two platoons was more than double the available working strength of the whole of 11 Field Coy. R.E., Lieut. Hill was detailed to be O. i/c work at the bridge site.

In addition to the above units there was a platoon—later built up into two platoons—under Lieut. W. R. Betts, R.E., of 346 Army Troops Coy. R.E., and detachments of 1 Field Squadron R.E., 4 Field Squadron R.E., 145 Field Park Squadron R.E., 24, 59 and 69 Mech. Eqpt. Pls. R.E., 1018 Port Operating Coy. R.E. and 9 Lt. Workshops R.E.M.E., an imposing list but in actual fact comprising a total of not more than 60 men.

On 8th February 565 Field Coy. R.E. took over the work as 11 Field Coy. R.E. had been recalled to their Div. area for training. At this stage there were twelve spans and all the piers of the bridge still to be dismantled.

5. Methods of Dismantling

(a) The Navigation Span (Phase I)

The navigation span consisted of sixteen 140 ft. long Bailey trusses specially braced and fitted with supplementary chords and the roadway was carried on top of these trusses. (See Photo 1.)

At first it was proposed to cut the bracing and remove one truss at a time, using a Kochring crane at one end and a 15B. at the other. As each truss was lifted it was to be placed on the remainder of the span for dismantling. What would have happened when the last 4 trusses had to be removed, is a problem to which every reader must find his own solution.

Fortunately, as it subsequently turned out, this method proved a failure. What happened was as follows : The cranes were positioned satisfactorily and took the strain and then the final bracing frame in the centre of the truss was knocked out. Immediately the truss whipped violently inwards towards the other trusses and then rebounded outwards with such violence that it twisted the special transom at each end, broke clear of the rakers and one end left its bearings altogether and fell into the river. The other end was luckily held on its bearings by the transom clamp. When the whip came, both operators felt their cranes lifting but the Koehring, which was at the end of the truss that remained on its seating, regained its equilibrium. The 15B. was less fortunate as although the operator released his brake and let his cable run to its full length, the final jerk when the cable could run out no further, toppled the machine over. Luckily no one was hurt and the operator jumped clear in time.

This initial failure led to the successful dismantling of the whole bridge as it was now decided by H.Q., B.A.O.R. that an 80-ton floating crane in Hamburg dockyard should be sent for, and this crane managed to work its way up to the bridge against the drift ice. Without it the bridge could not have been dismantled before the spring thaw and a mass of twisted wreckage —the cause of devastating floods, would now be obstructing the Elbe.

(b) The Navigation Span (Phase II)

With the arrival of the 80-ton crane at site it was decided to remove the remainder of the navigation span in 4 lifts. The first to be 4 trusses, the second 3 trusses and the third and fourth 4 trusses each.

For this purpose special 3 in. S.W.R. strops were prepared with a 3 ft. long eye at each end, secured by bulldog clips. The running end coming from the eye was clipped back on to the eye to ensure against any failure due to slip whilst under load.

The strops, suitably protected by packing, were placed round two 4 in. by 8 in. R.S.Js. fixed under the top chords of the 4 trusses 30 or 35 ft. apart (depending on the lift and accessability). The ends which passed round the R.S.J. were secured with shackles and the other ends were placed over the 4 hooks of the crane. The lift of the 4 truss girder proved highly successful, as the weight of the girder was just sufficient to take out the sag and both end posts came off their bearings simultaneously.

The second lift of 3 trusses was not so successful. The method of attachment of strops and the procedure for lifting was the same as before, but in this case, it was clear from an early stage, that the girder was going to bend and turn over on its side when lifted.

As soon as it was seen that trouble loomed ahead, the skipper of the crane, a Dutchman of great character, called Hoffweger, was summoned to say whether or not he was prepared to lift. On arrival at the scene he boomed out in his great voice : "Will the Brücker breaker !" On being hurriedly assured that the bridge was made of British steel and, therefore, would not break, he replied : "O.K. I lifter," greatly to every one's relief, as it was then too late to replace the bridge on its bearings and start again.

The subsequent result shook not only him but every one else. (See Photo 2.) The remaining lifts of 4 trusses each were uneventful. (See Photo 3.)

(c) Dismantling the 65 ft. Spans

Whilst the 80-ton crane was awaited, work was commenced on the dismantling of the 65 ft. spans next to the navigation span. For this work the mechanical equipment available was one Koehring crane, one 19 R.B. and one R.E.M.E. recovery vehicle on the north side, and one 19 R.B. and one D.7 fitted with P.C.U. on the south side.

On both north and south sides the down-stream half of the roadway decking was first removed and then one crane moved out to the head of each span on the decked half of the roadway.

In the case of the north side the Koehring lifted one end of a girder (total weight of each girder was 5 tons), and the 19 R.B. the other end until the girder was above road level. Thereafter the Koehring moved inshore on its tracks whilst the 19 R.B. jibbed round until finally the girder could be lowered on the decking alongside the 19 R.B. The recovery vehicle then towed the girder inshore,

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In the case of the south side the 19 R.B. lifted one end of a girder whilst the P.C.U. of the D.7. lifted the other end. (The blade of the D.7 was removed and the P.C.U. cable was attached to the girder instead of the blade.) As soon as the girder was above road level, both 19 R.B. and D.7 moved inshore. Finally the girder was disconnected from the crane and towed inshore by the D.7.

The arrival of the floating crane made the dismantling of the remaining 65 ft. spans comparatively easy, the girders being either lifted back on to the decked bays of the bridge and thence towed inshore or clse, whilst the river was still open, loaded straight into barges.

(d) Dismantling the Decking

The speed with which the floating crane could dispose of the bridge girders made it essential to discover a rapid method of dismantling the decking if the crane was to work to capacity and not to be held up.

The problem was solved by attaching slings from the Koehring crane to the ends of the spiking down stringers. The stringers were then pulled up until the complete decking throughout the 20-25 ft. length fixed to the stringers was standing at an angle of approximately 45 degrees with the horizontal. The Koehring then slowly moved inshore on its tracks until the stringers and decking had been pulled up over the vertical and the length of roadway had fallen back along the bridge just missing the crane in doing so.

Afterwards this complete 20-25 ft. length of decking would be picked up by the crane and taken inshore where a gang would be waiting to dismantle it.

(e) Dismantling the inshore 45 ft. Spans

The floating crane was used to lift the 45 ft. girders until the last eight inshore spans were reached.

At first the method of dismantling was the same as for the 65 ft. girders, but for the final span the crane had to lower the girders on to the ice whence they were towed ashore by a bulldozer with hyster winch, as it could not reach the decked portion of the bridge.

The R.S.Js. of the next four spans were lifted one at a time by the Kochring erane, which then jibbed round and laid the girders on the decking. This was slow and extremely tricky work as the crane was listed to lift 5,100 lb. at 30 ft. radius, if standing on firm ground, and the weight of each girder was 5,040 lb. Every time the crane took the load it appeared touch and go as to whether or not it toppled forward off the bridge.

For the final four spans extra heavy R.S.Js. had been used, but luckily by this time it was just possible to get the Koehring on to firm solid ice-covered ground under the bridge. The Koehring was then used to lift the offshore end of each girder whilst the R.E.M.E. recovery vehicle lifted the inshore end. The crane then jibbed round and the lorry drove slowly inshore until the girder could be lowered on the decking and unhitched from the crane.

(f) Dismantling the Piers

Whilst the work of dismantling the final spans was in hand, two parties, one from 565 Field Coy. R.E. and one from 1018 Port Operating Coy. R.E., were hard at work on the navigation piers removing the 9 in. by 4 in. bracing. This was extremely hard work, and the men carrying it out had to cling to the piers at temperatures of 20 degrees or more below freezing and in a wind that bit right through them. Work could only be carried out in short shifts followed by a rest.

It was intended at this period to unbolt or cut all the bolts holding the bracing to the piles, remove the bracing, and then pull one pile at a time. This was because one pile could be pulled up vertically through its own hole



Photo 4.-Bringing a complete pier ashore.

The Dismantling Of Artlenburg Bridge 3-4



Photo 5.—Piers awaiting dismantling. Note comparative size of men and masses of ice.



Photo 6.—The ice drift in progress. Note shore spans of the demolished Lauenburg railway bridge in the distance.

The Dismantling Of Artlenburg Bridge 5-6

in the mass of ice welding the pier into a solid block whilst, if more than one pile at a time was pulled the lift would not be vertical, and the piles would be crushed and damaged by the ice.

For this work the crane used a 3 in. S.W.R. cable, which passed over a single sheaf block at the top of the jib and was worked from a winch aboard. It was only a matter of minutes to fasten a chain fixed to the end of the cable round a pile and draw it.

This method broke down, however, as it was discovered that the piles were connected by bracing that had become frozen in under water level and could not be reached. As a result the pulling of one pile caused underwater upheavals and after a couple of piles had been pulled the single sheaf block that had been designed to withstand a load of 14 tons, broke under a load of 21 tons.

This was extremely fortunate as it persuaded the skipper of the crane to try his luck at lifting a complete pier at a time. To this end the two main blocks of the crane were brought into commission, and four long 3 in. strops were placed over the 4 crane hooks. All eight ends of these strops were securely shackled to piles.

The first lift on the north pier of the navigation span was successful, but as most of the bracing of the pier had already been removed the pier collapsed under its own weight and the weight of the ice it was carrying as soon as the piles were drawn. However, the remnants were successfully picked up by the crane and carried ashore.

The second lift of a triple bent pier containing 24 piles and an additional 3 cut water piles was a great success. At 55 tons the pier showed signs of moving and after as much as possible of the surplus ice surrounding it had been knocked off by an ice-breaking tug that accompanied the crane the piles gradually pulled. The pier was lifted by the crane to the full height of its jib and carried ashore in one piece. (See Photo 4.)

After this success the crane continued lifting both piers and protective icebreakers complete and carrying them ashore, but the condition of the river became worse and worse and the ice thicker and firmer until an additional dead weight of up to 30 tons was added to the piers. The pull required to loosen even double bent piers gradually increased to 75 tons and finally the crane had to admit failure when there were still five double bent piers standing in the river.

The time to use explosives had clearly arrived so it was planned to set a couple of 15 lb. charges of 852 (plastic) on each side of the remaining piers. These charges were lowered to the river bed alongside the piers and were positioned so as to give the piers a twist.

The plan was a complete success; all the ice was blown completely away from each pier, the piers were loosened sufficiently to be drawn by the crane and yet in no case were more than a couple of piles damaged.

Meanwhile all the piers on land (see Photo 5) had been dismantled. Here once again the recovery lorry had proved its worth, as its winch was used to topple the trestle bents off the short pile piers supporting them. Once the trestles had been toppled over on to the ice small parties of men made short work of dismantling them.

6. WEATHER CONDITIONS

The work of dismantling the bridge was carried out for practically the whole time under sub-arctic conditions.

On the 14th January when the two platoons of 565 Field Coy, R.E. arrived at the site the Elbe was frozen the whole way across. A comparatively mild

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period followed for a few days and during this period the heavy boat icebreakers forced their way eastward from Hamburg to the relief of the bridge and then carried on still further eastward.

This mild period was a time when masses of drift ice released by the boat ice-breakers drifted down-stream and menaced the bridge. Two of the bridge protective ice-breakers were carried away, and there was serious danger that the navigation span piers would collapse before the 80-ton crane could arrive and remove the span.

On the 21st January the 80-ton crane arrived and at once started work.

The weather had now turned much colder again, and though drift ice continued to pass the bridge it gradually diminished in size and quantity until early in February the river froze the whole way across once more.

This time the ice grew thicker and stronger until lorries and trailers were crossing the river on the ice and this meant that next time the ice broke up, instead of drift ice of the size and type that had already demolished the two protective ice-breakers coming down-stream, great ice floes several hundred square yards in area and several feet thick would come drifting down the river (see Photo 6). Hence it became absolutely essential to complete the work of dismantling the bridge before this should happen.

Meanwhile it was only with great difficulty that the two boat ice-breakers that had been left at the bridge for local protection work, were able to keep a clear patch of water round the bridge for the crane to work in. Gradually this elear patch of water grew smaller and smaller, and despite every effort the ice closed in, until finally by the 10th March all further work was impossible.

However, by this time, due to supreme efforts the work of dismantling was completed and the work of constructing rafts of piles and heavy bridge timber on the ice was able to go ahead unhindered.

7. LESSONS

The following were a few of the lessons learned the hard way :

- (a) Mechanical equipment can be used for more tasks than are thought of in text books, but when old mechanical equipment, such as the equipment left behind at the bridge site by the builders of the bridge, has to be used, it requires a first-class mech. equipt. officer in charge if it is to be kept running. Also it must be run at regular intervals during the . night in extremely cold weather or it will never start when required during the day.
- (b) The R.E.M.E. recovery lorry did absolutely invaluable work and never broke down. It is recommended that every Field Pk. Coy. should be equipped with at least one of these lorries.
- (c) A works store run by an intelligent sapper must be improvised at the works site and all tools must be returned to this store daily. If a store is away from the work it will mean constant losses of stores.

8. Envoi

By the 10th March, 565 Field Coy. R.E., with two pls. of 346 Army Troops Coy. R.E. under command, were ready to depart to Soltau where their next job, the construction of a brigade training camp was awaiting them. Artlenburg bridge—all 500 yds. of it—had been completely dismantled and the construction of rafts for taking salvaged piles and timber to ports on the Elbe was well in hand and could be safely left to a detachment.

The work had been completed before the ice had had a chance to break and destroy the bridge. There was now no chance of a twisted mass of wreckage blocking the river when the spring thaw came and the water level rose. The prospect of burst dykes and devastating floods was now only a vision of the past.

Thus ended an epic of the Elbe. The river had for once been beaten and over a hundred square miles of the countryside had been saved.

9. FINALE

After the 10th March the construction of rafts continued at a feverish pace and by the 19th all the timber remaining in the river bed had been made up into large rafts of sizes varying from 40 ft. by 90 ft. to 75 ft. by 150 ft.

At midday on the 19th a fleet of seven ice-breakers from Hamburg finally reached the bridge site and passed on up-stream clearing the centre of the river as they went.

By the 21st the river had risen sufficiently to float some of the rafts, but it was not possible to tow them to the safety of Geestacht harbour as had been intended. The ice already coming down the river proved to be far too heavy and thick to permit the available tugs to carry out this task and, in addition, Geestacht harbour itself was still blocked with heavy ice too strong for the local boat ice-breakers to deal with.

Meanwhile, the ice conditions higher up the river were becoming extremely serious. The thaw had started several days earlier in the south and caused the usual sudden rise in water level. This year the Elbe had frozen at a low level and now this sudden rise had lifted the ice and broken it away from the river banks. This ice had been maturing ever since the freeze up had started in December and most of it was several feet thick. It came drifting down the river—some of it all the way from Czechoslovakia—and a great ice jam formed at the sharp bend in the river round about kil. 508. More and more ice piled up both on and behind this jam and higher and higher rose the water behind it, until by the 21st the water level had risen 14 ft. and water was practically topping the dykes.

Matters were now desperate as already the main spring flood had reached Magdeburg and it looked as if the dykes would be breached even before the flood waters reached the area. Fortunately at this critical moment the rapid thaw and the great water pressure caused the ice jam and all the ice blocking the river ahead of it to start moving. The whole river was in motion.

By this date the boat ice-breakers had forged ahead to kil. 547, but the whole fleet was helpless in the face of this great ice drift and it was only with great difficulty that these boats struggled to the safety of the harbour at Boizenburg. Meanwhile other ships on the Elbe had been warned and had made for the shelter of the nearest harbours.

The resulting scene defies description. All the ice from kil. 547 to 508 was in motion and slowly breaking up into tremendous floes and all the ice piled up in the great ice jam and all the ice behind it was similarly in motion, in fact all the ice from a river length of more than 500 kil. had become jammed in a short 50 kil. stretch and it was all moving forward relentlessly and gaining speed as it moved.

⁶ By 0500 hrs. on the 22nd the leading ice floes, many of them 100 yds. by 100 yds. by 1 yd. thick, had reached the old railway bridge at Lauenburg.

Although the centre span of this bridge had been demolished and there was a gap of 600 ft. between the remaining piers, yet an ice jam started to form and it was only by good fortune that this jam burst after a couple of hours of great anxiety.

By midday on Saturday 22nd the main ice floes had started to arrive at the bridge site. No craft or raft could have survived in the nightmare that

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followed. The main channel of the river was packed with a grinding, crunching mass of ice rushing forward at a good 4 knots, whilst in the calmer water near the bank huge ice floes moved relentlessly forward removing everything that blocked their path.

Meanwhile the water level of the river had risen by a metre in under 5 hours and all rafts that the river could reach were just absorbed into the ice drift. Steel cables, 12 in. dogs and 14 in. diam. piles might have been made of string, bamboo and matchwood.

The great ice drift continued for less than 24 hours and left the river practically clear of ice. Never before had the oldest inhabitant of Lauenburg seen anything that had even approached it in its relentless fury.

Meanwhile the main flood had topped the dykes at Domitz on the 22nd, despite the clear run of the ice drift ahead of it and there is no doubt that any hold up of the ice drift at Artlenburg would have caused a catastrophe. Three days later the flood reached Artlenburg and almost overnight the river rose to within a couple of feet of the top of the dykes. Then very slowly the water level started to fall and all danger was past. The winter, the ice drifts and the floods were at last over and the countryside was safe.

10. MORAL

There ought to be a moral to this epic but what it is, if any, each reader must decide for himself from the following observations :

First it is most unwise to boast that a river such as the Elbe has been beaten. Section 8 of this story had scarcely been written before the river rose in its wrath, seized all the rafts that it could reach, chewed and crunched them and finally swallowed them up subsequently spewing out a few poor useless splinters from its mouth.

Secondly there were two major disasters and one minor one and each time the apparent disaster led to success and the saving of the countryside.

These disasters were :

- 1. The early winter made it impossible to complete the protective icebreakers of the bridge on time and this meant that the decision to dismantle the bridge had to be taken early. Had these ice-breakers been completed there is no doubt that the bridge would have withstood the first and second periods of drift ice without damage. But nothing built of piles and timber could possibly have withstood the final ice drift. The bridge must inevitably have been destroyed with all the consequent catastrophe and its destruction could not have been foreseen in time as ice drifts only occur once every fifteen years or so and ice drifts such as this one only once in a lifetime.
- 2. The failure to lift the 140 ft. Bailey truss and the loss of the 15B. led to the urgent calling up of the 80-ton floating crane from Hamburg. Even a couple of days' delay in obtaining the crane would have spelt disaster as even as it battled its way up-stream against the ice floes the ice-breaking fleet was racing back to reopen the lower Elbe and reach Hamburg before it was too late. Thereafter it was not until the 19th March that this fleet was able to reopen the river to the bridge.
- 3. The breaking of the block at the top of the jib of the 80-ton crane whilst piles were being pulled singly led to the successful plan to lift a complete pier at a time, which in turn enabled the river to be cleared before the thaw started. Previously the Dutch skipper had steadfastly refused to make the attempt and his word was law so far as the capabilities of his own crane were concerned.

And so leaving the reader to contemplate on whether or not there is a moral to this tale the story finally closes.



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PRESTRESSED CONCRETE IN PRACTICE

By MAJOR A. J. HARRIS, B.Sc. (ENG), A.M.I.C.E., (LATE R.E.) Photographs by courtesy of Messrs S.T.U.P. (Procédés Frevssinet)

THIS article is intended to be purely supplementary to the excellent account given by Colonel Devereux and Major Bak in the March, 1947, issue of *The R.E. Journal.* The present writer has had the honour and rare good fortune to spend the last eighteen months in the Paris office of S.T.U.P. whose chief engineer is Mr. Freyssinet, the inventor and leading developer of Prestressed Concrete. This article will thus concern itself with a few practical findings on the scope, value and limitations of prestressed concrete considered as a civil engineering technique.

I. GENERAL

It will be remembered that prestressing is applicable to a structure composed of a material of low tensile strength. Concrete is, of course, the material most used, but stone is equally suitable. Prestressing essentially induces in such a structure permanent compressive stresses such that tensile stresses are completely eliminated over a chosen load range.

It must be appreciated first of all that, apart from the materials employed in common, this system has no other similarities with reinforced concrete. A prestressed concrete member is fundamentally a member to which an extra load has been applied, the prestressing load, which load produces the compressive prestresses cancelling out the tensile stresses which develop under normal loads. It so happens that this prestressing load is commonly produced by stretched steel wires, but this is by no means invariable ; it has on occasion been produced by the action of jacks, by hydraulic pressure and by other ingenious, if eccentric, means. Since moreover, the concrete is now acting entirely within its elastic limits, the structure becomes a homogeneous elastic body, in sharp distinction from the state of complicated cracking and plastic strain set up in every reinforced concrete member. From this it should be evident that prestressed concrete is fundamentally different in its theory, its practice, its typical forms and in its behaviour from reinforced concrete and is in no way to be considered as reinforced concrete with stretched bars.

However, since it is with reinforced concrete that it will inevitably invite comparison, let us examine how prestressed concrete is found to compare.

(i) There is a very large saving of material. The previous writers gave a brief description of Luzancy Bridge (see Photo 1). This bridge replaced a reinforced concrete bowstring arch bridge designed for half the load and of slightly smaller width; nevertheless the new structure used some 80 per cent of the quantity of concrete and 10 per cent of the quantity of steel. A large part of this 10 per cent was high tensile steel, of course, but on any account the saving is considerable. These figures are perhaps not entirely normal; in general, where comparison is possible, rather more concrete is saved, say a saving of 30 per cent, and perhaps a little less steel, say 70 per cent-80 per cent.

It will be noted that savings of concrete are of great value in large structures in which the dead weight is important. Prestressed concrete beams carrying very heavy loads have in fact been constructed over spans as large as 194 ft., a span which no reinforced concrete beam could touch. (ii) There is great extension given to the scope of processes of prefabrication. Precast segments can be strung together like beads on a string, the wires tensioned and the segments rendered monolithic. Since by hypothesis the stress on the joint is always compressive, the segments act together as an elastic whole. By the use of this technique, very large structures can be assembled from small elements or sub-assemblies, cutting to a minimum the need for shuttering. This has many advantages in practice. It means that concrete work, instead of being subject to the hazards of in situ mixing and placing, can be carried out entirely in the factory, with the best of granulometric control, using methods of vibration compression and heating, etc. (by means of which Mr. Freyssinet has on occasion made concrete of 20,000-lb/sq. in. strength at 28 days and has regularly turned out concrete of a strength of 15,000-lb/sq. in.) and also, and not the least important, with careful control of cost.

Luzancy Bridge is a good instance of this technique, and at the moment 8 bridges of the same type, rather slenderer, using rather less concrete and steel and built over a larger span (242 ft.) are being manufactured to go over the R. Marne. All the components of these bridges are being constructed in a central factory, where they are assembled into beams by prestressing. They are then shipped to the site on barges and hoisted into position. There is no shuttering or falsework in the gap whatsoever.

- (iii) Numerous technical advantages, amongst which one might mention :—
- (a) Reduction of depth of section in bending.
- (b) Complete freedom from cracks. If cracks open under excessive loads they close again on removal of the loads.
- (c) Much smaller deflections.
- (d) Very high resistance to fatigue and alternating loads.
- (e) An automatic safety factor in that the structure is never more highly stressed than immediately after the application of the prestress before the various relaxations due to creep, shrinkage etc., have taken place.

2. Test Results

Now let us look at the other side of the picture. Prestressing forces are large (Luzancy Bridge had a total of 12,000 tons)—the casual inquirer is apt to wonder whether the structure might not one day disappear with a loud explosion. On the other hand, everyone has heard of creep . . . what safeguard is there that the prestress will not slowly diminish and finally disappear ? In fact, how lasting are prestressed structures ?

The ideal answer, to present such a structure which has stood for hundreds of years is not, unfortunately, possible. While Gothic architecture used prestressing by gravity very widely, the example is not entirely relevant, and the oldest prestressed structure of the modern type now in use dates from merely 15 years ago.

All that one can do then is to examine the factors which might lead to deterioration and find what degree of safety we have. These factors are :---

- 1. Creep of concrete and of steel
- 2. Failure under sustained load
- 3. Failure under alternating load
- 4. Failure of anchorage of steel in concrete
- 5. Deleterious effect of occasional overload

These factors will be examined in turn.

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(1) Creep of Concrete and Steel

These phenomena are much the most important and, of the two, the creep of concrete is the more considerable. Creep of steel we may dismiss. It exists, it has long been accurately measured, its extent is of little importance in relation to that of the concrete. There do exist, moreover, steels for which the claim is made that they have no creep at all.

With concrete it is different.

When the idea of prestressing concrete first occurred to Mr. Freyssinet, this phenomenon was unknown, though he suspected its existence. Realizing that if it did exist its exact evaluation was vital to the success of his ideas, before proceeding any further with prestressing he carried out exhaustive research on the problem, as a result of which the existence of creep was proved beyond doubt, its nature and extent were known, and a theory was produced to account for it. Since then much further work has been done on the subject and has, in the main, borne out Mr. Freyssinet's first conclusions. As a result it is known that creep is extensive, but tends to an asymptotic value which can be determined with some exactitude. It thus ceases to be an insuperable difficulty.

(2) Failure Under Sustained Load

We have many instances of structures in steel and in concrete having stood up to sustained load for many centuries, for example many early metal bridges in England and elsewhere, and certain Roman structures in concrete. If these materials can exist under load apart, there is no reason why they should not when in combination.

(3) Failure Under Alternating Load

We here come to the question of fatigue.

Firstly, as far as steel in tension is concerned, the vital question is not intensity of stress but range of stress. Now steel in a prestressed concrete member suffers a variation of stress between maximum and minimum load of, at most 4 per cent; normally, the figure is much smaller. So small a variation is unimportant and unlikely in the extreme to produce failure by fatigue.

The concrete, again, is perpetually under compression when the typical phenomena of fatigue do not arise, and the capacity of the material for sustaining alternating load is almost unlimited under such circumstances. The account of a few tests might be of interest.

Two telegraph poles, one of prestressed concrete and one of reinforced concrete, both designed for the same working load, were tested together against an alternating load at their heads varying between plus and minus 1.5 of the working load. After a few hundred alternations the R.C. pole began to crack : after a few thousand it failed completely. After 500,000 alternations the P.S.C. pole, however, was completely unaffected and the test was discontinued.

Two prestressed concrete beams, of section 6.3 in. by 10.2 in. and 7 ft. 1 in. span were designed to support a load of 11.6 tons without the production of tension. The first was tested statically to 27 tons when cracks were produced in the lower fibres. On release of the load the cracks closed up again. The beam was then subject to a load alternating from 11.6 tons to 17.4 tons. 1,366,500 alternations were affected, followed by 300,000 alternations from 5 tons to 18.4 tons. The beam remained completely unaffected, and was then loaded statically to destruction, which occurred at 35.4 tons by crushing of the concrete.

The other beam underwent 517,600 alternations from 5.8 tons to 23.2 tons and was then tested to destruction and failed at 36.8 tons.

(4) Failure Of Anchorage of Steel

The steel wires are anchored, it will be remembered, in two ways :---

(i) By bond

(ii) By anchorage cones.

Of these two methods, anchorage by anchorage cones is the more certain. Tests were carried out some years ago, both static and dynamic, on standard cones. The static tests showed that the wires broke before the cones failed. In the dynamic test, a tension varying from 2 tons to 18 tons was applied to a 10-wire anchorage (the service load is 16.7 tons). After about a half a million fluctuations, the testing machine broke, the anchorage being unaffected.

Anchorage by bond needs more care in that concrete, to grip the wires effectively, has to be of extremely good quality. A slight decrease in quality entails a large decrease in gripping power. However, the telegraph pole and the beams—whose tests were described above, depended upon bond for their prestress and the results obtained are sufficiently reassuring. It should be remarked that in anchorage of this sort, concrete is placed around wires already stretched and thus of reduced diameter. When the tension is released allowing the wires to compress the concrete, there is a slight expansion at the free ends which produces a wedging effect, which adds its resistance to that of pure adherence.

In certain cases anchorage by cone is supplemented by the adherence of grout injected into the cable, as in Luzancy Bridge. Here the male cones in some cables were completely removed without any slip of the wires.

(5) Overload Effect

Considerable overload is possible on a P.S.C. member without harmful effect. Cracks open up under the excess load and close up again on removal of the load, with a residual extra deflection which is either nil or minute.

An interesting example of this is to be found in tests on prestressed concrete high pressure pipes, in which the ring steel is stretched. A sufficiently high overload produces a failure of the concrete resulting in cracks through which the water gushes, thus reducing the pressure. As the pressure is reduced, the steel wires, so far unaffected, reassert themselves and draw the concrete together once more, the pipe being completely watertight again. This property is of great value in long pressure mains where the effect of a hammer blow is to be feared.

3. PRACTICAL SCOPE AND LIMITATIONS

The material and technical advantages of prestressed concrete are not gained without one important factor to offset them—the labour required to prestress the cables. There are still certain gains from the labour point of view—for instance the placing of the cables and the very light secondary mild steel reinforcement usually necessary is much more easily carried out than the complicated bar bending and placing operations necessary in reinforced concrete work. Nevertheless, stretching the cables even with the latest design of jack is still an important matter. A 12-wire cable, for instance, producing a prestress of about 20 tons will need two jacks, a high pressure pump and six men, and will take about 10 minutes to effect. Now the stressing of this cable will cost about the same whatever its length, in consequence the longer the cable the less important the extra labour costs.

Similarly with an installation for manufacturing precast elements the initial cost may be high while the labour costs of production can be very low.



Photo 1 .--- Luzancy Bridge, General view.



Photo 2,-General view of runway at Orly.



Photo 3 .--- Longroy Bridge, General view.

Prestressed Concrete In Practice 1-3



Photo 4.-10,000-ton Press. View of model with some stressing bands (horizontal and vertical) in position ; saddles resting on jacks to be seen at top. Bands and saddles later rendered with concrete and cement.



Photo 5 .--- 10,000-ton Press, Laboratoire de Travaux Publiques. General view.

Prestressed Concrete In Practice 4-5

Hence, at the moment, prestressing is of most interest in :--

- (i) Large in situ works
- (ii) Production of precast elements in great number
- (iii) Special works where one or other of the properties peculiar to prestressed concrete, e.g., greatly reduced depths of beams, outweighs other considerations.

At the moment in France the economical limit for bridge work is somewhere round about 40 ft. Many bridges of smaller span than this have been built, but they have been either mass production schemes, e.g., for the replacement of a large number of small span bridges in Normandy or works with special features.

For mass production, less clear limits can be laid down as so much depends on the complication of the process, but certainly a production of several hundred elements would be needed to make the process a paying proposition.

In the last category fall many works for which prestressing alone offers a solution. Some instances of these will be described below.

4. Applications

(i) Aircraft runway at Orly

Photo 2 shows a general view of the runway at Orly, showing various stages of construction from right to left. (a) Placing of sand bed, (b) Placing of waterproof paper, (c) Placing of slabs, leaving space for diagonal roller joint, (d) (in background) placing of cables and filling of joints, (e) (left foreground) precasting of slabs.

The essential feature of this runway is the diagonal roller joint. The runway is faid between two rigid abutments (which may be several kilometres apart) and the surface is cut up by a series of roller joints making an angle of 45° with the axis of the runway. The prestressing cables run transversely across the runway. On tensioning them the force acts on the roller joints and produces an equal stress in the longitudinal direction which reacts on the abutments. When the runway expands, the longitudinal expansion, being held by the abutments, acts again on the roller joints and thrusts the triangular segments out sideways, producing a slight extension on the prestressing cables. This design has these advantages :—

(1) The roller joints, being prestressed by the cables passing through them, have practically the same strength as the rest of the slab. In consequence the weak spots of ordinary concrete runways, the expansion joints and slab corners are completely avoided and a continuous slab is produced.

(2) By means of the roller joints, steel lying in one direction produces a stress in two; the quantity of steel is thus half of what would otherwise be needed.

(3) A very thin slab is produced which cuts down temperature stresses to a minimum.

The slab is 64 in. thick and is designed for an aeroplane with max. wheel load of 85 tons. A test on a trial element showed cracks first appearing in the upper surface under a point load of 130 tons. The sub-surface of the trial element was unconsolidated; that of the runway was consolidated, but was of very average quality. The completed runway has stood up as intended to static tests, and is now under dynamic test.

The interest of the scheme is that it is a solution to a problem hitherto all but insoluble—the problem of finding a surface capable of standing up permanently to the largest aeroplanes now in service.

(ii) 10,000 Tons Laboratory Press

This press is in use in the Laboratoire des Travaux Publiques for the testing of large structural assemblies. It has a working chamber of 11 ft. 6 in. by 32 ft. in which the high power hydraulic jacks move on a gantry. The structure consists essentially of a mass concrete tube, whose cross-section is of the shape of an oval with a central rectangular cavity, which cavity forms the working chamber. This mass concrete tube is bound round by high tensile steel bands, which pass over saddles on the crest of the oval which themselves rest on hydraulic jacks. Photo 4 shows a model of the press without the concrete casing, and photo 5 shows the actual press itself looking into the rectangular cavity shown in the model. The bottom portion below the cavity in the model is below ground in the actual press. After the hardening of the concrete, the jacks were inflated thus stressing the wires and the spaces between the saddles and the main block were packed with concrete and the jacks removed. Similar binding was carried out in a horizontal direction at the level of the chamber sill and ceiling.

The interest of this press lies in the promise it carries for the use of P.S.C. in machine beds, frames, etc. Smaller presses have been constructed on somewhat the same principle for use in laminated wood production.

(iii) Longroy Bridge (see photo 3)

This bridge is the prototype of numerous in situ, slab bridges of 66 ft. span, which have since been constructed; it is of 2 ft. 3 in. overall depth at the centre. The quantities of material employed in a similar bridge of only 46 ft. span, compare as below with those which would be required for a typical R.C. bridge over the same span.

	R.C.	R.C. (reduced depth)	P.S.C.
Concrete	83 yd ³	86 yd ³	70 yd ³
H.T. Steel			3.2 tons
Mild steel	15.5 tons	20 tons	1.2 tons
Depth at centre	3 ft. 6 in.	2 ft, 7 in.	1 ft. 7 in.

A modification of this bridge has been designed for use in the French Colonies. Of 33 ft. span, it is constructed from rectangular slabs 11 ft. by 3 ft. 3 in. by 1 ft. 1 in. These slabs have holes left in them for the cables. Three are assembled by prestress into a strip which is launched by derrick and preventer tackle. Successive strips are launched and transverse cables fed through holes running across the slab and then stressed, thus solidifying the bridge into an elastic whole. This project is of great advantage when it is required to build a number of bridges scattered over a large area with means of communication not very highly developed.

MISCELLANEOUS

The process has also been employed in France in the construction of numerous slab and beam bridges, in floating caissons for harbour works, quay wall repairs, reservoir construction, piling and under pinning, tunnels in bad ground, the construction of various types of dam, and factory building frames.

Railway sleepers, flooring joists, roofing elements, telegraph poles, power line pylons and high pressure pipe lines have all been mass produced in prestressed concrete.

All these works were designed in the Paris offices of S.T.U.P.

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REPARATIONS AND RESTITUTION FROM GERMANY (JULY, 1947)

By BRIGADIER E. A. L. GUETERBOCK

INTRODUCTION

PLAIN justice demands that Germany should compensate the Allies for the grievous losses caused by her latest war of aggression. Prudence demands that Germany should not again be allowed to develop the means of aggression. These two principles were embodied in the reparations and disarmament clauses of the so-called Potsdam agreement. The more important of these clauses are as follows :--

" Economic Principles

In order to eliminate Germany's war potential, the production of arms, ammunition and implements of war as well as all types of aircraft and seagoing ships shall be prohibited and prevented. Production of metals, chemicals, machinery and other items that are directly necessary to a war economy shall be rigidly controlled and restricted to Germany's approved post-war peace-time needs . . . Productive capacity not needed for permitted production shall be removed in accordance with the Reparations Plan . . . or if not removed, shall be destroyed."

" Reparations from Germany

In accordance with the Crimea decision that Germany be compelled to compensate to the greatest possible extent for the loss and suffering that she has caused to the United Nations and for which the German people cannot escape responsibility, the following agreement on reparations was reached :---

- 1. Reparations claims of the U.S.S.R. shall be met by removals from the zone of Germany occupied by the U.S.S.R. and from appropriate German external assets.
- 2. The U.S.S.R. undertakes to settle the reparation claims of Poland from its own share of reparations.
- 3. The reparations claims of the United States, the United Kingdom and other countries entitled to reparations shall be met from the Western Zones and from appropriate German external assets.
- 4. In addition to the reparations to be taken by the U.S.S.R. from its own zone of occupation, the U.S.S.R. shall receive additionally from the Western Zones :---
 - (a) 15 per cent of such usable and complete industrial capital equipment, in the first place from the metallurgical, chemical and machine manufacturing industries, as is unnecessary for the German peace economy and should be removed from the Western Zones of Germany, in exchange for an equivalent value of food, coal, potash, zinc, timber, clay products, petroleum products and such other commodities as may be agreed upon.
 - (b) 10 per cent of such industrial capital equipment as is unnecessary for the German peace economy and should be removed from the Western Zones, to be transferred to the Soviet Government on reparations account without payment or exchange of any kind in return."

The Potsdam agreement specifically mentions capital industrial equipment and external assets as reparations. It does not exclude other forms of reparations such as items of current production and labour. There are obvious difficulties in devising any scheme for reparations labour in view of the great shortage of man-power in Germany, due to war casualties. Current production is logically inadmissible as a source of reparations, as all industrial productive capacity surplus to that required to maintain the agreed standard of living in Germany, is to be liquidated, and, therefore, none is available to manufacture products for reparations. There are no great surpluses of raw materials and none of agricultural produce. Thus reparations have been limited to capital industrial equipment, ships and external assets, and, in the opinion of many, should continue to be so limited.

Restitution is the return of loot taken by the Germans from occupied countries, and the policy is based on the following clause in the London Declaration of 5th January, 1943 :--

"... reserve all their rights to declare invalid any transfers of, or dealings with, property rights and interests of any description whatsoever which are, or have been, situated in the territories which have come under the occupation, or control, direct or indirect, of the Governments with which they are at war, or which belong, or have belonged, to persons (including juridicial persons) resident in such territories. This warning applies whether such transfers or dealings have taken the form of open looting or plunder, or of transactions apparently legal in form, even when they purport to be voluntarily effected."

Restitution may, therefore, apply to articles of almost any nature. There is no limit to restitution, other than that automatically imposed by ensuring that the items claimed were actually taken by the Germans out of the claimant country under conditions specified by certain rules which have been agreed as the practical interpretation of the London policy.

In general restitution does not conflict with reparations, but it may do so in the case of capital industrial equipment. For example, a piece of machinery may be surplus to Germany's peace-time requirements and, therefore, available for reparations, and may also have been removed by force from, say France, and, therefore, restitutable. Where there is doubt regarding eligibility for restitution or delay in presentation or processing of a restitution claim, direct conflict arises between reparations and restitution.

THE MAIN REPARATIONS PROGRAMME

The main reparations programme of capital industrial equipment exemplifies the principal reparations activities. There have been certain delays, interruptions and variations. Nevertheless certain basic procedures have to be carried out.

(a) Selection

First comes the selection of possible reparations plants. This is done initially by Zones and the Zonal lists are consolidated with a view to consideration on an "all-Germany" basis. Under the terms of the Potsdam agreement, all deliveries from the Russian Zone of Germany go to Russia and Poland. Deliveries from the Western Zones go 75 per cent to the so-called Western Powers and 25 per cent to Russia and Poland (the Eastern Powers).

(b) Valuation

It is, therefore, necessary to value the plants, in order to allocate East and West or sub-allocate between Western nations, who agreed in the final act of the Paris Conference, January 1946, the percentages to go to each country. . . .

REPARATIONS FROM GERMANY

TABLE OF SHARES

Country									Cat	egories
<i></i>									A	ЪВ
Albania -	• -						••		.05	.35
United States	of Am	ter	ica						28.00	11.80
Australia									.70	.95
Belgium						• •	••		2.70	4.50
Canada	• •								3.50	1.50
Denmark							••		.25	.35
Egypt									.05	.20
France					• •				16.00	22.80
United Kingo	łom								28.00	27.80
Greece									2.70	4.35
India						• •			2.00	2.90
Luxembourg				· •					.15	.40
Norway	••			• • ·		••			1.30	1.90
New Zealand					•••				.40	.60
Netherlands		• •			••	• •			3.90	5.60
Czechoslovak	ia							• •	3.00	4.30
Union of Sou	th Afri	ica	(sub	ject to	certa	ain pro	ovisos)		.70	.10
Yugoslavia	••	•	.`					••	6.60	9.60
				To	tal				100.00	100.00

Category A includes all forms of German reparations except those included in Category B.

Category B includes industrial and other capital equipment removed from Germany, and merchant ships and inland water transport.

Valuation is carried out on a procedure approved by the four Controlling Powers. Due, possibly excessive, allowance is made for depreciation for age and war damage.

Expression of Interest (c)

Recipient countries must be allowed sufficient information and time to indicate their interest in plants or parts of plants ; in other words, to bid.

Allocation (d)

Plants are allocated first between East and West. This is done by the Allied Control Authority in Berlin. Sub-allocation of their quota between Western Powers is done by the Inter-Allied Reparations Agency set up in Brussels as the result of the Paris Conference of January 1946.

Dismantling Guidance (e)

The recipient country will have certain requirements regarding the order of dispatch, the means of transport and the method of packing. Teams from the recipient countries, therefore, come to the plant to advise the British Control staff and take receipt of the items. The recipient country, through its team, may reject 10 per cent of its allocation, a provision introduced to avoid waste of effort over unwanted items.

(f)Dismantling and Packing This is an engineering job. Its magnitude may be gauged by the target of 100,000 tons per month, of equipment to be dismantled in the British Zone in such a way that it can be re-erected. Parts have to be numbered in accordance with re-erection drawings which have to be made, and packed so as to preclude serious damage during transit.

(g) Dispatch

Material is sent by rail or barge to agreed export places on the boundary of the Zone concerned.

(h) Recording

Accurate records have to be maintained so as to keep the quotas of the various recipient countries in the correct proportion, to check progress, and, what is very important, indicate the amount of "reciprocal deliveries" to be handed over by Russia. Under the terms of the Potsdam agreement, Russia has to deliver raw materials, etc., to the Western Powers to the value of 60 per cent of the reparations equipment which is dispatched from the Western Zones to the Eastern Powers.

REPARATIONS SHIPPING

As far as the above procedures are applicable to merchant ships, they have been carried out. 'The German sea-going merchant fleet, apart from certain small craft, has been divided up between the Allies.

INTERNATIONAL COUNCILS, ETC.

Although the policies and procedures outlined above, may, at first sight, seem simple and straightforward, countless difficulties occur. These difficulties are caused by such factors as the nature of the international bodies which make the decisions, the natural reluctance of the Germans to co-operate in reparations, the dire shortages of materials in Germany, lack of transport and the manpower "ceiling" of British staff allowed. Though the Allies are in need of reparations equipment quickly, there have been most serious delays, and one of the important factors contributing to these delays is the nature of the international bodies concerned.

Germany is governed quadripartitely and the main forum for top level discussions is the Co-ordinating Committee. Selection of plants is effected through the quadripartite Economic Directorate and the other processes are effected mainly through the quadripartite Reparation, Deliveries and Restitution Directorate. Both these directorates report to the Co-ordinating Committee.

In all the quadripartite bodies, decisions have to be unanimous. Thus, one dissentient member can hold up action indefinitely. Failure to reach agreement in Directorates or their committees is generally in the long run reported to the Co-ordinating Committee and there is a certain reluctance to be the "odd man out" on lower levels unless the delegate there is sure that he will be supported when the case is referred higher. The effect of this procedure is that many matters of comparative detail have to be referred up through various stages to the highest level, only to remain unresolved there because of differences in national outlook.

All nations are actuated to a greater or less extent by considerations of self interest. In the reparations field, it is obviously to Russia's advantage to value everything as low as possible, thereby getting as much as possible in her 25 per cent from the Western Zones and paying as little as possible in reciprocal deliveries. Neither U.K. nor U.S.A. are directly interested in restitution, as neither country was invaded; therefore both these countries, and indeed Russia also, regard reparations as having a certain priority over restitution. On the other hand France, with the support of many smaller

allies, places a high importance on restitution which is not debited against any reparations quota.

Whereas all decisions in the various Allied Control Authority bodies in Berlin have to be unanimous, decisions in the Inter-Allied Reparations Agency (I.A.R.A.) in Brussels are taken on a majority vote. Theoretically the small nations in I.A.R.A. could block the policies of the three main Powers, U.S.A., U.K., and France. Russia is not represented in I.A.R.A., but certain countries such as Yugoslavia and Albania are, and they are subject to a certain degree of Russian influence. Several small nations have only very small reparations percentages, and it is often difficult to give them fair treatment, without complicating matters by dealing with very small packets.

I.A.R.A. is a "sovereign" body, which corresponds direct with the Allied Control Authority and is prepared to express its views very forcibly.

In the light of the above factors, some of the difficulties and complications in the main reparations procedures may be mentioned.

SELECTION OF PLANTS

Considerations of the requirements of the whole of the Zone are often at variance with the local views of those responsible for the economic control of a particular town. It is often difficult for the man on the spot to understand that a certain factory which has always supplied the requirements of the local population may on the broad view be surplus to Germany as a whole. It is difficult to get an accurate definition of plants. For example the power station in a plant may supply the surrounding area and yet be far too big for that task alone, once the war potential load has gone. Part plants are particularly awkward, as, for example, a plant which in 1936 made agricultural machinery and now again makes agricultural machinery, but during the intervening years was expanded to make I.C. engines for aircraft.

Quadripartite confirmation of availability for reparations clearly depends on an agreed level of industry plan, which has so far been held up owing to failure to achieve economic unity of the four Zones of Germany.

Then there are such factors as the requirements of the occupying forces, e.g., R.E.M.E. workshops, united nations' financial ownership of plants in whole or part, as well as restitution claims for portions of a plant.

VALUATIONS

The agreed formula is a compromise and is not always easy to apply. It necessitates laborious calculations of the value of every item in a factory. In a large plant, a single copy of the valuation inventory which is reproduced on paper about double foolscap size, may stand six feet high. Apart from the 17 copies required in Germany, I.A.R.A. require 200 copies. Thus the copies of one inventory stacked on top of one another, might well stand 1,300 feet high. The photostat reproduction of inventories receives about the biggest allocation of sensitized paper in Germany.

Buildings are a thorny problem. Those with gantries integrated in the main structure are often an essential part of the plant. Certain other steel framed buildings may be moveable, and may be wanted by the recipient country, but may have to be kept in Germany owing to the shortage of all natures of accommodation.

Spare parts do not in general conform to the definition of capital industrial equipment. But are duplicate sets of rolls in a rolling mill spare parts or not?

Valuation depends on the production of documents by the firm. In many cases all useful documents have been destroyed. In others, the firm hides the documents.

All valuations have to be approved quadripartitely. If any of the other controlling powers so demand, quadripartite check has to be made at the plant itself. One or two such quadripartite checks in the early days involved several months of argument.

EXPRESSIONS OF INTEREST

A recipient country expresses interest in a plant sometimes because a government factory requires it, but more often because a firm wants it. The process of notifying firms, collecting bids and arranging prices lies generally outside the scope of work in Germany. But it takes time and may well involve visits by interested parties to the plant.

Such visits as well as quadripartite valuation tours and foreign dismantling teams necessitate an organization of hostels, transport and conducting officers in Germany, with a controlling "Cook's Tour" agency.

ALLOCATION

It is obvious that allocation can only be done after valuation, if the quotas of recipient nations are to be kept in proportion. As a gesture, however, a number of plants were allocated as an advanced list in the autumn of 1945, before they were properly inventoried. When proper inventories came to be prepared, many discrepancies were found in the roughly appraised lists on which allocation had been made. Items had been allocated, which did not exist or were not available or were wrongly described. Many officers have spent many months in sorting out the resultant confusion.

Owing to the failure to reach international agreement on economic unity and the level of industry, there ensued a pause for 18 months in the allocation of plants. In an effort to get some reparations out of Germany, a scheme of multilateral deliveries of individual items was adopted in the British Zone. Russia refused to participate in the scheme, but the western nations were asked to submit lists of urgently required items. Only a proportion of these items proved to be suitable for the scheme and identifiable. Over 5,000 pieces totalling over 20 million Rm. value were found up to 1st July, 1947, by which time it was obvious that little more could be achieved on these lines.

Big plants have to be split up into several units of allocation, if the whole plant is too large and "expensive" for any one nation to be able to afford the lot or require all the component parts. For example, the Krupp complex comprises 83 distinct shops, of which some, notably the locomotive shops, must be retained as essential to German economy. The balance of Krupp's *Gusstahlfabrik* is available for reparations and is split into 32 units. Such splitting up is often awkward to arrange, particularly when part of the plant is retained in Germany. Certain supply services, including public utilities and conveyor systems, are designed to serve many units of the complex and cannot themselves be divided up conveniently. Careful investigations have to be carried out by technical experts in such cases.

DISMANTLING AND PACKING

It is a simple engineering task to lift, dismantle and pack ordinary machine tools. Very large tools require special gantries, etc., but on the whole, a machine shop has the crancage necessary to install or dismantle the machinery in that shop.

Chemical works, coke ovens, blast furnaces, boilers, etc., present more difficult problems. Years of use have encrusted bolts and rivets and have strained or warped plates. The post-war years of idle standing in the open have often done even more damage. It has generally been impossible to arrange for machinery and plant to be adequately cleaned, oiled and preserved. Labour has not been available, nor have materials. Often bomb



By permission of Royal Netherlands Blast Furnaces and Steelsorks

Reparations and restitution from Germany



Improvised 80-ton crane to lift from railway truck to barge.

Reparations and restitution from Germany 2
damage has rendered it difficult to get at machinery without considerable clearance. Certain recipient countries are prepared to take items which have little more than scrap value, such as cracked and rusted ash chutes, old boiler tubes cut from water tube boilers, etc. Other countries are only interested in higher grade material. In any case they can only reject 10 per cent of the unit of allocation allotted to them. Even if they do not want all the 90 per cent it has to be debited against their reparations account.

The practical problem is a vast engineering one. Various estimates have been made of the total tonnage involved in the British Zone, varying from $1\frac{1}{2}$ million to $7\frac{1}{2}$ million tons and depending on the level of industry plan. On an average for every 100 tons of material dismantled, the packing materials required include some 20 tons of bulk timber, 0.065 tons paper, 0.028 tons paint, 0.055 tons grease, 0.628 tons steel for nails and bolts, etc. These are purely average figures. Obviously some items require little or no packing. Others, such as glass or porcelain vessels require 100 per cent by weight of timber. Delicate items such as platinum anodes have to be boxed in cases weighing many times the weight of the anodes.

The provision of these packing materials is fraught with great difficulties. Shortage is universal, and all materials are "controlled." Bids have to be put in months ahead, requiring careful forward planning and constant progressing. Emergency measures such as organizing and running a saw mill in a forest have been necessary.

Labour is scarce and the German *arbeitsamt* officials are prone to allot to reparations the halt and the maimed and the aged. Naturally, little enthusiasm can be hoped for from hungry men employed on this uncongenial and heavy work. The output is not large and three tons per man per month is all that can be expected. In many cases it is less, particularly when there are heavy overheads, such as draughtsmen, watchmen, etc. During the severe cold weather in the first months of 1947, outdoor work had practically to stop. Even so, a diver worked under 6 inches of ice to cut the top off a submarine steel pile which would have interfered with barges.

The work is done by contract under British supervision. Only British control staff may give orders to the Germans, and Allied dismantling teams put their requests and complaints to the British staff.

While contractors have a considerable quantity of tools and plant such as derricks, winches, compressors, slings, etc., a large additional pool of such equipment has had to be collected for loan where required. Much improvisation is necessary. On two occasions during 1946 a 100-ton crane had to be constructed to deal with particularly heavy loads. Three large barges which had been sunk under load by R.A.F. bombing, had to be cut, raised and removed in portions to clear a waterway.

Dismaniling provides plenty of nice problems. There was the traveller of a 30-ton gantry of some 70 feet span which had only $1\frac{1}{2}$ in. play at each end while it was being lowered.

There is a thin shell cylindrical tank about 20 feet long and 10 feet in diameter with a manhole on its side. The tank is painted inside with a special enamel and has to be moved without developing even a hair crack in the enamel lining. This problem still remains to be solved.

Sufficient drawings have to be produced to enable the plant to be reerected. The recipient nation is also entitled to copies of all operating instructions which exist.

There are never sufficient British control staff to provide more than one at a plant. Indeed one man has often to control a group of small jobs.

The average plant has a capital equipment to the value of about £100,000.

The biggest run up to many millions and the smallest consist of a few machine tools.

Krupp's steel works at Borbeck was a big unit, comprising ore preparation plant, coke ovens, blast-furnaces, a rolling mill and a power station, valued at about 12 million Rm., which is probably equivalent to a sterling valuation of $f_{1,100,000}$; the equipment weights 91,437 tons. The work was due to finish in 1947, and should have taken 22 months, and employed a maximum of 2,529 Germans at one time, apart from overheads such as drawing office, administrative staff, etc., supplied by the central Krupp organization.

Two high class machine tool factories have been dismantled; Schiess, Kölnerstrasse and Lorick (Düsseldorf) for Russia, and Waldrich (Siegen) for two Western countries. The former contained 29,186 tons and took 16 months and the latter, of 3,220 tons, took 9 months. Some particularly good and well preserved machinery at Hanseatische Kettenwerke, Hamburg, has gone to four Western powers.

Krupp's Gusstahlfabrik, owing to bomb damage, is likely to have a value of only about 30 million Rm., say £2,700,000, although it contains some 250,000 tons of equipment. The Stahlwerke, Watenstedt, is valued at approximately 46 million Rm., equivalent to £4,000,000. The huge modern Hermann Goering complex near Brunswick, now called *Reichswerke*, a complete integrated steel plant from ore preparation to finished products, overshadows almost all but the Krupp complex in magnitude. None of these three had been allocated by July, 1947, but preparatory work was already then in hand.

Concurrently with big projects such as these, a large number of smaller plants and individual items have been dealt with all over the British Zone.

DISARMAMENT

Reparations action is an obvious form of industrial disarmament, but it is not a process which is applicable in all cases. Reinforced buildings have to be demolished. Special structures such as wind tunnels, gun shrinking towers or pits, etc., are unsuitable for reparations. Certain special purpose machinery has to be destroyed rather than be released for the armament production of any other nations. Excessive electric power lines, water or gas mains and other forms of utilities must be liquidated and are often not suitable for re-erection elsewhere. Disarmament action is closely bound up with reparations, both in planning and execution.

Unfortunately the tempos of the two processes are entirely at variance. Disarmament has to proceed on the time-table agreed at the Moscow conference of spring, 1947, and is closely watched by inter-allied inspection teams. Reparations have not yet got into their full stride owing to absence of agreement on the permitted level of industry. Often disarmament staffs are anxious to get on with their demolitions while reparations staffs cannot move the equipment out of the way because there is nowhere to which to move it.

RECORDS

A highly organized statistical office has had to be set up, in addition to the working records which each Branch maintains. All items are recorded on Hollerith machines, so that periodical dispatches can be accurately recorded and total values computed. The various allied authorities keep a jealous eye on progress. Questions and complaints are frequent and require speedy investigation and answer. Sometimes such complaints are put forward for purely political reasons to cover up some other matter, by getting a shot in first, having the complaint on record and trusting that the answer will be overlooked or obscured by the next complaint.

RESTITUTION

It has proved to be remarkably difficult to get quadripartite agreement on exactly what is to be given back. Beyond the principle that identifiable goods taken by the Germans by force during the period of occupation are to be returned no clear approved rules exist. It is hard enough to decide what constitutes force. Arguments have been produced to prove that all transactions during German occupation were under duress, even if paid for, in as much as the Germans paid in occupational currency of no international value. The German authorities operated through a number of official looting agencies and also through private dealers. Many works of art changed hands through the medium of normal art dealers and were duly paid for at very high prices. Many items such as ores, metal products and cattle are unidentifiable.

The procedure is that the claimant country puts in a claim in sufficient detail to enable the items to be identified on the ground. The German authorities have to submit a report on the claim and the Zonal control staffs adjudicate.

From the British Zone alone, such diverse items have been restored as 1,600 Polish thoroughbreds from stud farms, $\pounds 1,000,000$ worth of jewellery including uncut jewels, unused postage stamps of a pre-war value of some 20 million Rm., 1,412 locomotives and other rolling stock, etc. One of the most interesting cases was a steel rolling mill which was newly erected in Holland in 1939-40 but had never yet worked. The Germans took all the machinery and buildings and re-erected them near Brunswick. They had, however, not been quite completed, when the war ended. Once more they were dismantled and returned to their original site near Ijmuiden, re-erected and were officially put into production in May, 1947, 14 months after dismantling at Brunswick had started. The weight of equipment involved in this mill amounted to 11,950 tons.

Other industrial restitution claims which have been fulfilled include the return to France of a nitric acid factory and to Holland of a wireless valve factory which the Germans set up in a nine-storied underground works in a chalk mine. The total value of restitution claims released from the British Zone alone up to 1st July, 1947, is some 120 million Rms.

EMPLOYMENT OF GERMANS

In order to reduce the commitment of British manpower, Germans are employed wherever possible. Obviously there are certain tasks involving decisions and negotiations affecting the allies or of a security nature and these tasks must be left to British staff. There must also be a degree of control to prevent evasion, go slow or ca'canny. Subject to these provisos, the utmost use is made of Germans including high-grade technicians and administrators.

CRITICISMS AND ENCOURAGEMENTS

It has become fashionable in certain quarters to criticize reparations, as preventing the recovery of Germany. The amount of reparations equipment which had been allocated from the British Zone by 1st July, 1947 totals 640,000 tons weight and has been valued at 166 million Rms., which might be considered as equivalent to £15,000,000 on a British valuation. Of this amount only some 128,000 tons had actually been loaded by 1st July, 1947. The total from the Western Zones loaded by that date was approximately 178,000 tons. These figures are insignificant compared with the total productive capacity of the area. Furthermore, Germany built up a tremendous industrial war potential which is far in excess of any reasonable peace-time requirements and very far in excess of what the available labour and coal could operate for many years. There never has been any intention, at any rate in British minds, to liquidate industrial capacity which is essential to German recovery to a reasonable standard of living. But the surplus industrial capacity should go, both as a matter of disarmament and to recompense the allies for their vast losses caused by German aggression. The real trouble is not the removal of the equipment but the uncertainty produced by the protracted failure to reach agreement on the level of industry. The U.K. and our allies are sadly in need of industrial equipment for their own recovery, and have on many occasions expressed their gratitude for what has already been delivered. The chief source of reparations equipment in Western Germany is the British Zone. It is there that the bulk of the work lies.

The principal division concerned in the British Element of the Control Commission is the Reparations, Deliveries and Restitution Division. It has been difficult to find sufficient capable administrators and engineers to deal with this gigantic task of reparations and restitution, and it has never yet been possible to build up to the full authorized establishment either on the British or German sides. The British staff of this Division are almost entirely civilian and were recruited from serving and ex-members of the three fighting services, including several sappers, the established and temporary Civil Service, and from industry. Some are employed on administrative staff work, some on negotiations, some on adjudication of claims and many others on progress, provisioning and execution of engineer work. It is a source of pride and gratification to all to feel that their work contributes directly to the rehabilitation of the U.K. and our allies.

ROADWORK IN THE ADVANCE

By LIEUT.-COL. G. F. HUTCHINSON, D.S.O., R.E.

INTRODUCTION

IN any advance over normal European country the vast majority of work performed by Engineers in the field is road-making, road-mending, or in some way connected with roads. It is, therefore, probably worth while to record such practical experience as is available for reference in the future.

PART I-MOUNTAIN TRACK FOR JEEPS AND TRAILERS (See Plate 1)

During the summer of 1944 the 8th Army, having captured Rome and advanced rapidly almost a hundred miles further north, was engaged in a slow but steady advance in close contact with the enemy. By the end of July, 10 Corps, which then consisted of 4 and 10 Ind. Div., was fighting forward, on either side of the River Arno, just north of Arezzo. In this part of Italy the narrow valley of the Arno runs roughly north and south and is flanked on both sides by hills rising to over 4,000 ft.

The advance necessitated clearing the hills, a task to which the Indian troops were well adapted, before the main road up the valley could be opened. Unfortunately the hilly country on the east bank of the river, known as the Alpe Di Catenaia, was almost devoid of roads or even tracks, without which maintenance became rather a problem.

From the German side, their troops were thin on the ground, as they had probably appreciated that a rapid thrust through such country was both difficult and unlikely. From our own point of view a quick push across the top of the hills would, therefore, be likely to produce a good dividend, if, and it was a big if, such an advance could be properly supported by all arms with adequate provision for maintenance. Moreover, it would be an excellent rehearsal for breaching the Gothic line, which ran across Italy through somewhat similar mountainous country only 18 miles ahead. It therefore came down to a question of whether the Sappers could construct and maintain a track across the hills with sufficient speed to keep up with the infantry advance.

On the evening of 30th July, 10 Ind. Div. was instructed to carry out an operation known as Vandal, commencing not before the night of 2/3 August, to seize the high ground of the Alpe Di Catenaia, and to open a track through the hills connecting the lateral road Anghiari-Arezzo, on which the division was then based, with the next lateral (the last before the Gothic line) running from Rassina through Chitignano to the large monastery of La Verna on the slopes of Monte Penna. Maintenance was to be carried out entirely on a mule and jeep-trailer basis, and the attack was to be launched by a brigade group, which it was thought would be sufficient if the advance went fast enough.

Planning commenced immediately, but was handicapped by an embargo placed on reconnaissance for security reasons. A brief trip in an Air O.P. disclosed that the hill feature was covered with grass as well as a certain amount of rock, and that there were many trees, but no alignment could be made even tentatively in the time permitted. Consequently planning had to be almost entirely confined to a close study of air photos. Fortunately the area had been well covered with stereo pairs. The R.E. staff at Corps H.Q. produced an alignment from these, which agreed very much with that produced by the C.R.E.'s staff, and was accepted as the basis of the plan.

Some concern was felt regarding the question of water. A geological report produced by Corps indicated that there might be an acute shortage, and arrangements had to be made to meet this.

Rock outcrops were to be dealt with by a drilling section of the Royal Canadian Engineers. Unfortunately the diamond drills, with which they were equipped, consumed enormous quantities of water, and were, therefore, not very popular. Over and above the two D4 and one D6 angledozers held by 41 Fd. Pk. Coy. R.I.E., one D6 and three extra D4 dozers were provided, making a total of seven angledozers in addition to an autopatrol, and two trailer compressors.

As regards labour the whole of the three divisional field companies and a detachment from the field park company were to be employed, and two companies of Italian artieri (about 70 working men each), in addition to the drilling section already mentioned.

The plan then was to construct a mule track to keep up with the leading infantry, and, quite separately and downhill of the mule track, a jeep track, which initially was to be one way only, later being widened as time and labour permitted. Traffic was to be operated in blocks, with parking areas where down convoys could be held while up convoys passed them. Both tracks had to be completely defiladed from the east, where one flank was somewhat open, and at the same time all possible cover made use of to obtain concealment from the enemy to the west of the Arno. It was decided to work to ruling gradients and curves laid down for jeeps in R.E.T.M. No. 10.



PLATE 1

The allocation of labour to this plan was 61 Fd. Coy., R.I.E., less one platoon, to the mule track, moving entirely on a mule and man pack basis; 10 Fd. Coy., R.I.E., with one platoon of 61 Fd. Coy., two companies of artieri, and the Canadian drilling section were to construct the jeep track; leaving 5 Fd. Coy., R.I.E. to follow up widening and maintaining the jeep track. The C.R.E. with a Tac. H.Q. moved with Bde. H.Q., and a detachment of the field park moved from roadhead to roadhead to establish water points, sharpen picks and shovels, maintain bulldozers, construct signs and do any other work that became necessary. All companies, other than 61 Fd. Coy. on mules, had to carry all their requirements in jeeps and trailers. For this purpose, and for the maintenance of the column, a pool of jeeps and trailers was collected by the A.Q. from Corps and from other units in the division.

The engineer plan of course depended for its success on rapid and accurate recce, but work could not wait for recce to be completed. Successive roadheads were selected off the map and from air photos, and recce parties were to be sent forward with the leading infantry to work backwards from these, and link up with other recce parties going ahead of the working field companies. All recce parties were equipped with copies of the air photos, which had the provisional alignment marked on them. The selected alignment was then to be marked with tape, 2 in. for the mule track and 6 in. for the jeep track.

The final 24 hours before the operation commenced was a period of hectic re-grouping, with field companies hurriedly completing existing commitments, which could not be left, collecting their jeeps and trailers, which, as might be expected, failed to arrive at the appointed time and place, assembling their equipment, and moving to their concentration areas. During this period two things occurred, which materially influenced the plan. Firstly the C.R.E. was told that he had to get Sherman tanks to the top of the mountain to support the infantry. This was a rude shock and caused a somewhat sleepless night. 5 Fd. Coy. were diverted to this task, and a British company, 571 Army Fd. Coy., less one platoon, was obtained from Corps Troops R.E. as the follow-up company on the jeep track. The second event was a successful recce on foot for a mile and a half forward of the start line down to beyond the Torrente Sovara. This confirmed the alignment thus far, and more important still the direction to be taken for the first half-mile beyond the stream, which was the difficult part. Moreover, the stream itself, which was known to be dry, was found to contain water only a foot below the surface. This alleviated our water supply fears.

The start line was the road Castello Di Montanti-Scille, which had been secured 24 hours carlier, and at 2200 hrs. on 3rd August, 3 Mahrattas of 20 Ind. Inf. Bde. crossed the start line on their long approach march of almost 3 miles to their first objective. This involved an initial descent of 500 ft. to the T. Sovara, followed by a climb of 2,500 ft. to Monte Filetto, yet this feature together with pt. 1201 had been captured at the point of the bayonet by first light, a very fine achievement. Two Sapper recce parties had gone with them, one to align the track backwards to the T. Sovara, and the other to work forward as opportunity offered.

Work on the tracks commenced by the light of a full moon at midnight, and by 0600 hrs. in the morning the track was open as far as the T. Sovara; 10 hours later it was open to the first jeephead at 363459, a total distance of 2.5 miles. By this time the mule track, which caused very little difficulty, was up with the leading infantry, and by 2000 hrs. the first troop of tanks arrived at jeephead.

Meanwhile the Mahrattas, maintaining the momentum of their advance B against a thoroughly surprised enemy, had captured Monte Altuiccio by the evening, and 2/3 Gurkhas passed through and seized Il Castello early on 5th August.

By 1600 hrs. on 5th August the jeep track was through to pt. 1087, where the second jeephead was formed, an advance of over 2 miles, and uphill the whole way. This was within easy reach of the infantry by mule pack. By 0700 hrs. the next morning it had reached 337481, near the summit of Monte Filetto, a further $l_{\frac{1}{2}}$ miles ahead.

The tank track kept pace with the jeep track, but owing to heavy showers it became so slippery that tanks could not move up the steep slopes. They did, however, reach the top of Monte Filetto by first light 7th August, but took no part in the battle. Before this the Mahrattas had reached Regina, a feature the enemy had been defending most stubbornly, but continuous counter attacks, and the difficulty of supplying ammunition to the forward infantry by mules along an exposed ridge, forced them later to withdraw.

At this stage, most unfortunately, 4 Ind. Div. were removed from 10 Corps, and taken away (as we subsequently discovered) to the Eastern flank, to concentrate for the assault on the Gothic line. Their commitments in the centre had to be taken over by 10 Ind. Div. which so extended us, the front being some 30,000 yds. that operation Vandal had to be called off, when it showed signs of developing into a most successful effort.

As far as the Engineers were concerned some 6 miles of jeep track had been built, and by 1800 hrs. on 6th August this was easily passable to jeeps and trailers as far as the summit, 6 miles of good going in 66 hours, which included a descent of 370 ft. in the first 1.6 miles, and a climb of 2,300 ft. in the next 4.4 miles. The four platoons with 10 Fd. Coy. averaged 34 hours each on the job during the first three days, and that time was exclusive of all time spent marching from camp to work, etc. No surfacing material whatever was used on the track, which, being over good ground, carried jeeps and trailers without difficulty. During the actual operation it rained quite hard each night. The C.R.E. in consultation with the staff closed the track for several hours each time this happened, with the result that no rutting occurred, and the rain served to bind the surface and keep down the dust.

Later on, as the advance continued in a more leisurely tempo across the whole front, the track was eventually completed a distance of 14 miles to its original destination, as well as two lateral offshoots of 3 miles each. Drier weather during this period caused a great deal of dust, but at no time did the track become unusable. Rock outcrops were encountered in a few places, but were never serious, and the Drilling Section was not employed in that capacity, though they worked on the track as ordinary Sappers.

A number of interesting lessons were learned as a result of this operation. Some of the most important are mentioned below :

(a) The organization of traffic on the jeep track worked very well indeed in itself, but was severely interrupted by failure to control the "B" echelon attached mules. These had to operate forward of jeephead to the leading troops, but having got to the jeephead and discovered the jeep track leading forward, which was already under construction, decided to make use of it; and no power, from the G.O.C. downwards, succeeded in eliminating this trouble. The mules were everywhere, led in strings by Indian muleteers, whom no one could convince that the track had not been built for their especial benefit. Unit mules also were not guiltless in this respect. To counteract this nuisance notice boards were erected by the dozen in English and Urdu, with pictures depicting a mule or a jeep as the case might be, and special paths were taped showing the way from jeephead to the mule track. Much trouble was, however, still caused by units' "F" and "A" echelon mules, which were picketed near the jeep track and continued to make use of it. For any future operation of this sort it is thought that intensive briefing of unit commanders beforehand, with threats of the direst disciplinary penalties, would be the only way of checking the nuisance.

(b) The second big lesson was that the ruling gradients given in R.E.T.M. No. 10 were too severe for intensive use on long hill tracks by jeeps and heavily laden trailers, especially when they were driven, as was sometimes the case, by none too skilful drivers. Wheel spin frequently developed and vehicles failed to make the grade. Under these circumstances the following figures are, therefore, recommended in place of those given in Appx. "G" to the R.E.T.M. :

Maximum grade for short slopes.... 1 in 5 Maximum ruling gradient for long climbs 1 in 8 Minimum outside radius of bends at hair-

pins	 25 ft. (the figure of 12 f quoted is surely a misprint 	t.).
Width of track on this curve	 9 ft.	
Normal width of track	 8 ft.	
Minimum width of track	 6 ft.	

These figures were worked to on this jeep-trailer track after the first two days and proved satisfactory.

(c) The minimum requirements of transport, in the light of our experience, for Engineer troops engaged on the operation are probably worth recording:

:		Mules	jeep-trailers
Fd. Cov., less one pl., on mule track	• •	40	3
Fd. Coy., plus one pl., on jeep track	••		21^{-1}
Fd. Coy, on tank track			13
Follow-up Fd. Coy. (if more than 3 m	iles		
from roadhead)			13

(d) The tentative alignment produced from a study of air photographs very closely approximated to that actually adopted on the ground, which shows the value of good stereo pairs for this class of work, where ground and air recce have been prohibited.

PART II-ROAD MAINTENANCE (See Plate 2)

Where a division is allotted only one road, as is very often the case, the maintenance of this becomes a vital necessity, and sometimes a very real problem.

After the initial break-through of the Gothic line in September, 1944, 10 Ind. Div. in its own turn was moved across to the eastern flank, and took over again from 4 Ind. Div. in the neighbourhood of San Marino. The division found itself as usual in the hills, this time in the foothills, which bordered the southern edge of the great Po valley. As a divisional axis we were allotted the one road running forward from Coriano-San Marino and thence successively as they were captured to Sogliano-San Paola-Monteleone-Sorrivoli-Diolaguardia-Roversano across the F. Savio to the next main lateral, known as Route 71.



This road was in a precarious condition as far as the F. Marecchio when we took it over. In fact the Division had the utmost difficulty getting into the line at all, and it got worse and worse as we progressed. It crossed this river by an excellent high level Bailey, aptly known as "Noisy" bridge, and thence approached the fords over that famous stream the Torrente Rubicone by a couple of cart tracks. Incessant rain and heavy traffic had churned these up into a sea of mud. It took much of the resources of the Div. Engineers to keep one approach open at Trebbio, and of 5 Corps Troops R.E. on the other at Poggio Berni. And this was only achieved by unceasing work on ditching, and by pouring mountains of brick rubble on to the road surface.

The crossings of the Rubicone were in part fords and in part low level Baileys (very low), which rested most insecurely on mud banks protruding above the water level. There was no secure bank, to which they could be anchored, but they served their purpose.

From the river the road climbed by reasonably easy stages to Sogliano, which had been captured by 2/3 Gurkhas, 20 Ind. Inf. Bde. being once again in the lead, two nights after the Division had taken over. Thenceforward the road descended rapidly by a series of 17 hairpin bends to the T. Fiumicino, where the Germans had unexpectedly, and most unusually, failed to blow up the bridge. This was the only route across the Fiumicino valley within the Div. sector, and the traffic congestion along it had to be seen to be believed. There were four brigades to be maintained, and at many of the corners three ton lorries had to reverse before they could get round. Rain was incessant. Under conditions like these the firmest traffic control at the highest level becomes imperative. Otherwise it degenerates into a dog-fight between the C.R.E., who states that the road should be restricted to one-way traffic at certain hours, with nothing but jeeps allowed to proceed in the opposite direction, and Brigade commanders, who demand the two-way use of the road behind them as essential for their normal maintenance in the line. This is not essential as was well proved by the Germans, who carried out all their maintenance at night, mostly with animal-drawn transport, and never moved at all by day.

However, we kept the roads open somehow, and the infantry magnificently continued their advance. San Paola was captured by 2/4 Gurkhas of 10 Ind. Inf. Bde., and Sorrivoli by I D.L.I. If we had experienced difficulties in our road maintenance before, they were nothing compared to what we en-countered ahead of Monteleone. The country had all along been clay, and the roads gravel with no proper foundation and little or no drainage. They had been constructed for occasional farm traffic, and were generally adequate for that purpose, but for nothing more. The addition of continuous traffic by heavy military vehicles broke up the surface in 24 hours. Now, to add to these difficulties, the axis narrowed until it was wide enough for oneway traffic only, and even a jeep passing in the opposite direction was sufficient to push both vehicles into the side drains. Furthermore the road was flanked on both sides by high overgrown hedges, which effectually shielded the surface from the drying effect of the wind between the almost unending rain. Water ran down the centre of the road as if it were a river, and springs gushed out of the hedges at the most awkward places. In addition the enemy had cratered nearly every road junction, leaving deep pools of water in basins of clay. The work of repairing craters, clearing the hedges, diverting the springs, potholing, drainage, and widening of corners, extended the Sappers to the utmost. Eventually by 16th October the road got so bad that it had to

be closed for 24 hours to all traffic, except Engineer repair vehicles, and two small essential maintenance convoys limited to jeeps and trailers only. For 24 hours on end the three field companies, helped by pioneer labour and numerous infantry working parties, struggled to repair the damage and make it passable once more. And they were successful. Moreover, as a result of this lesson, the road was limited to convoys, which were given block timings, and the size of vehicle was restricted to 15 cwts.

By 21st October 25 Ind. Inf. Bde, were across the F. Savio at Castiglione, and 10 Fd. Coy. were making arrangements to build a Bailey across the old bridge site to support them. Owing to the state of the roads, no bridging equipment could previously be brought forward of Sogliano, some 15 miles away, and eventually it was decided to send it from Corps resources back at Santarcangelo, which, though much further away still, could at least come forward part of the way along Route 9, the two-way tarmac Corps axis. Elaborate arrangements were made to guide the vehicles forward, and advantage was taken of a slight improvement in the weather and consequently the roads. The plan was to bring the equipment up to the site by daylight, except for the last mile or two, to unload and conceal it during the night 21st-22nd October, and then to build the bridge the following night.

The first part of the journey as far as Monteleone, where the column finally came on to the Divisional axis, was accomplished safely, except for delays in the heavy traffic. Just as it approached the sharp descent beyond this village, however, dusk was falling and a drizzling rain began to descend again. The heavily laden vehicles slithered down the steep hill to the ford at 604980, but the ascent up the already greasy slope beyond to Sorrivoli was more than even four-wheeled drive vehicles could manage. And many of them were only two-wheeled drive, nothing better being available. The drizzle increased to a downpour, and though prodigious efforts were made to manhandle them up the slope (bulldozers were of no assistance as they broke up the road surface even more, and in the clay got bogged as quickly as anything else), many lorries went into the ditch or off the road altogether.

The following day was spent in unditching, and assembling, and replacing the lorries, and at night the column was got down to the Savio and unloaded at the site, with only one casualty, a lorry which after unloading went off the road in the dark and over a 100 ft. khud side. Amazingly, out of eight passengers none was killed, though several were seriously injured. Eventually, on the night 23rd-24th October the bridge was completed, and the axis connected up to Route 71.

Some of the difficulties of road maintenance and methods of overcoming them have been mentioned. Of all methods the most effective by far is that of adequate traffic control, and this is a staff responsibility, which cannot be over-emphasized: One other aid, not mentioned above, is a sensible use of road signs and notices, though this is complicated where most of the drivers do not read English, and many of them not even their own language. A little imagination mixed with a little humour not only helps to ensure that notices receive attention, but also I feel sure helps the morale of both those who write and those who read. At one road junction at the top of a long hill leading down by a series of endless bends to Mercato on the F. Savio appeared the sign:—" MAE WEST has curves. So has this road. Take them easily and enjoy the ride."

And months later on the 13 Corps axis up to Castel Del Rio a most appropriate warning from some obviously fed-up Sapper :—" Don't dam our ditches; dammed ditches don't drain."

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PART III-TEMPORARY ROADWAYS IN WINTER (See Plate 3)

Mid-December, 1944, found the 8th Army static, and facing the enemy along the line of the F. Senio. The advance had been brought to a standstill by endless bad weather, the resultant mud, and a shortage of ammunition.

10 Ind. Div., still in 5 Corps, and still in the foothills, had 2 N.Z. Div. on its right, and the Polish Corps on its left. The Division had in fact by 16th December two companies across the river, belonging to 4 Baluch and 3 Royal Garhwal Rifles, but, when it became evident, two days later, that there was no immediate chance of supporting them in this position, they were withdrawn.

G.O.C. 5 Corps, however, still had hopes of crossing the river and continuing the advance, and with this object recces were put in hand and plans carried forward. The supreme difficulty, as far as 10 Ind. Div. was concerned, was a complete absence of approaches to the river. Before the battle between the Lamone and the Senio there had been one forward road in the sector, and this led from Pergola to the road junction at 248245, and thence to another junction at 248257. Of this stretch a mile was in full view of the enemy in Castel Bolognese. From the second junction the road ran S.W., defiladed from the Germans for a short distance, and then finally over the brow of the hill, and once more in full view down to the demolished bridge at Tebano.

This road had been used by tanks in the initial fighting, and in the existing very wet conditions they had removed what little surface it ever possessed, and sunk deep into the formation below, leaving ruts a foot deep, full of mud and water. The two junctions where the tanks had turned were particularly bad, and the road in this area became quite impassable to wheels whenever it rained. Attempts to repair it were uniformly unsuccessful. By daylight it was clearly impracticable, and by night the enemy had spandaus on fixed lines trained on it. Furthermore, the slightest noise of mechanical equipment brought down heavy shelling. Consequently, after several unsuccessful attempts, further work was abandoned, and it was decided that, if there was to be an attack across the river, some other route must be found.

The country ran in a series of three parallel and steep ridges between the main Divisional lateral and the river. Each of these ridges had another lateral running along the top, each one a little closer to, and all in view of, the enemy. Strangely there was only the one road, already mentioned, joining these laterals, except for a few cart tracks, which descended straight down into and up the other side of the intervening valleys. Since the ground was heavy clay, and it had been raining steadily for a month, they were all quite impassable to wheels, and indeed even tanks could not move across country. Eventually a track was found, which joined the second minor lateral to the third and last overlooking the Senio, and which had not too severe a gradient, though it was not passable even to jeeps in its existing condition. This ran from Rizzi 244242 to 230246, and except for a short distance, where it breasted the hill, was defiladed from the enemy. In summer this could have been utilized with very little work, but in the prevailing conditions it would have to be made into a securely metalled road.

At this stage there were six days before the attack, which was planned to go in on Christmas Eve. Without a very great deal of work the track could not be made two-way, and this was quite out of the question in the time available. It was, therefore, decided to make it one-way for jeeps and trailers only, with holding areas for waiting vehicles at either end.

From the engineer point of view then the problem was to construct a track, of which the alignment only existed, three-quarters of a mile long, across sodden clay, and up a steep hill. It was to have the formation improved, ditches both sides, a layer of coir matting or brushwood, a layer of sommerfeld a layer of chespale or polepale, whichever was available, and finally since it was essential to prevent skidding on what was bound to become a greasy surface, the whole was to be metalled. All the materials, except brushwood, had to come from Faenza, over 5 miles away. There was no stone at all in the district, so that, for metalling, brick rubble had to be carted from the many demolished buildings in Faenza. The move of all this material and its distribution on the site alone were formidable tasks, which were complicated by the fact that, since the approach road was also in view of the Germans, dumping had to be carried out entirely by night, along a road that itself was very bad, muddy, and up a steepish hill.

For this move it was calculated that transport would be required as follows:

Sommerfeld track	10×3 tonners }	
Polepale	60×3 tonners say, 200×3 tonners	
Rubble 3 in. deep 🚽	120×3 tonners)	



The approach road.



Polepale in position.

Roadwork In The Advance



61 Fd. Coy. R.I.E., metalling the end of the track.



General view of the finished track.

Roadwork In The Advance 2

which meant that, with five nights available for work, no less than 40 lorries each night would be required. In fact a certain amount of rubble was obtained locally from buildings in the vicinity, and the nightly requirement of lorries was reduced to an average of 30. Distribution of the material was another problem. The sommerfeld and polepale were unloaded at the start of the track by infantry labour, and distributed either by "Weasels" or by bulldozers towing sledges. The rubble was more complicated, as each lorry load had to be driven in, unloaded, and then backed out.

Once material was on the track, work could, of course, be carried out by day, which was a great help. The labour available for this task was 61 Fd. Coy. R.I.E., plus two platoons of 5 Fd. Coy. R.I.E., 1401 Indian Pioneer Coy., and infantry labour for unloading and distributing stores. Rubble was loaded each day by mechanical shovels into tippers provided by Corps, and 3-tonners from the Div. R.I.A.S.C. column. The whole convoy was then assembled and despatched as soon as it was dark. Only one turn round could be accomplished in one night, owing to the extreme slowness of progress. As it was, many of the two-wheeled drive vehicles had to be helped up the hill from Faenza by towing. Artificial moonlight enabled the drivers to see something of the road, since any form of vehicle lighting was obviously ruled out, and without the aid of the searchlights it is difficult to see how the materials could ever have been delivered.

One amusing sidelight on the construction was that on the track itself were two farmhouses, which strangely had been left quite intact by the battle. One was occupied by the battalion H.Q. of 4 Baluch and the other by battalion H.Q. of 1 King's Own. On hearing of the difficulty of getting brick rubble, the Corps Commander himself ordered that these two farms were to be demolished, and the rubble used on the track. The unpopularity of such a move with the battalions concerned, still more with the owners who were also in residence, can be easily imagined, and as might be expected all the blame was put on the C.R.E. 1 However, by starting on the outbuildings, and bringing in as much as possible from Faenza, the Sappers just managed to complete the track without blowing up the farms, and in time for the projected offensive, which in the event was postponed and finally cancelled. The track was somewhat waggishly christened "The Sappian Way."

CONCLUSION

In conclusion it may be worth making two points.

First in connexion with the construction of jeep or other tracks, particularly against time, the key to the problem lies in sound organization. The technical problem is generally not very great, and the choice of materials is often limited to what there is available locally, augmented sometimes by stores from the nearest engineer park. The difficulty lies in the collection and distribution of these stores and the best use of labour.

Second in connexion with road maintenance. Prevention is better than cure. The amount of work required to repair a road is out of all proportion to the labour required to control it properly, and prevent the damage occurring in the first place. Provided that tactical considerations permit, the limitation of vehicles, by weight, number and direction of movement, is a prime factor in the maintenance of a road in reasonable condition. Finally it should be said that no system of control will function successfully without well trained police, and without a determination on the part of the Staff to enforce their own orders.

MILITARY GOVERNMENT

By Brigadier J. Spottiswoode, M.C.

I' has been a very popular thing to throw stones at the efficiency and morals of Military Government and Control Commission in Germany, and to make the most of the undesirable actions of the small minority in their midst.

A short account of the work done by the solid core of Military Government, may, therefore, be useful. The main theme of the following is the Admin. Officer concerned with the administration of the Germans on the lowest level of Military Government authority, the *Kreis*, and no attempt is made to cover adequately work of other governmental or economic divisions. Though based on official experience it is plain that any opinions, etc., are purely personal.

To those who have not served in Germany, a short description of the framework of its local government's structure, as we found it, may be useful. The lowest unit is the *Gemeinde*, roughly a parish, which vary greatly from little country parishes of not much more than 100 inhabitants, up to towns of .30,000 or so. These each have a *Bürgermeister*, honorary in the smaller ones, often part-time, and with staffs to correspond. In some areas, *Gemeinden* are collected into *Amter* (plural of *Amt*), under an *Amtsbürgermeister* who was a paid official with a whole-time paid staff, and who did much of the work of the *Gemeinden*.

The next level, which is universal, is the Kreis. A Land Kreis may have fifteen to forty or more Gemeinden, and is headed by a Landrat. The populations, mostly vary from 60,000 to 150,000, with a few much bigger. The Stadtkreise, with Oberbürgermeisters, are towns of over 30,000.

At the next level, the organization of the old state of Prussia and of the late Länder which were the descendants of the old German States, differed. The Prussian areas had a level of Regierungsbezirk, with a Regierungspräsident, of 8-25 Kreise, with corresponding variations of population and importance. Then three or four Regierungsbezirke made up the Province, with Oberpräsidenten. In the old Länder there was no Regierungsbezirk level, but the Kreis reported straight to the Land which had a Minister Präsident at its head.

The plan to exercise Military Government in the British Zone involved training, at Wimbledon and Eastbourne, large numbers of Basic Military Government Dets. of four Officers, six O.R's, and a heterogeneous selection of G. 1098. There were also large numbers of specialist officers, Finance, Legal, Labour, etc., who were to be attached as required to the Basic Dets. The four officers of each Det. consisted of two Admin. and two P.S. (Public Safety = Police), though there was, to start with, a considerable shortage of the latter.

Some of these Basic Dets. were attached to formations to go in as Spearhcad Dets., almost, if not quite, with the leading troops, in order to get down as early as possible to providing some order in the administrative chaos which was inevitable in the circumstances. On entering a heavily destroyed town such as, say, Osnabruck, with shooting still going on, communications disrupted, essential services destroyed, the senior administrators all vanished, and the remainder unreliable, police disintegrated, and with our own troops very likely all having vanished forward into the blue, it may be well understood that there was a man-sized job to be done to prevent the civil population becoming more of a handicap to the military operations than was necessary. This was the original purpose of Military Government, as it is now the object of C.C.G., to prevent Germany becoming more of a handicap to the British people than is necessary.

In the above catalogue possibly the most difficult problem has been omitted —that of the foreign workers who, with the Occupation, became Displaced Persons. These were the labour whom the Germans during the war had forced or recruited for work in Germany to the tune of some eight millions. With many of them, particularly those belonging to the west, the immediate reaction to liberation was to set out for home. For this purpose, the acquisition of the best available means of transport, and of all available food for the journey was an obvious necessity. Many more saw a probably ficeting opportunity for unrestrained looting, raping, and general lawlessness after a long period of repression. Some remained law-abiding and co-operative, but the problems produced by these members of allied powers, from whom some protection had to be provided for our enemies as early as possible were obviously exceedingly difficult ones.

The job done by these Spearhead Dets. often bordered on the miraculous. Through roads were cleared and kept cleared, a minimum of essential services was provided, food supplies organized, some sort of police force restored, a comparative reign of law instituted, and a skeleton public administration revived. It was often necessary almost to pick a German haphazard out of the street to instal as *Biirgermeister*, but whoever he was, and whatever local standing he had previously had, the Basic Det. commander remained the fount and executive of civil power dealing with every imaginable, and many unimaginable, problems of general and individual interest.

It was, in many ways, unfortunate that these Spearhead Dets. were attached to army formations, both militarily and by mutual trust, since it resulted in their being picked up and pushed on for the next job, wasting their local knowledge of personalities and places so hardly acquired. They often even had no chance to hand over to any relieving Det. Thus it happened that an area might have to experience the brief rule of two or even three Dets. before it could settle down to any continuity. This gave the plausible but deleterious German a much longer run for his money before he was found out.

As soon as capitulation took place and the Zonal frontiers between the Allies took form, the organization settled down to one Det. per Kreis, while one took on each R.B. and two amalgamated for each *Province* of which, for our administrative purposes, there were five—Nordrhein, Westfalen, Hannover, Hamburg, and Schleswig Holstein. The existing *Lander* were incorporated into one or other of these provinces. The R.B. and P. Dets., of course, rapidly grew to cope with their responsibilities. A few became R. Dets. (Relief) to look particularly after D.Ps., and every one settled down to a steady but still exciting grind of exceedingly hard work.

Luckily, security in the early days was never a serious problem from the German angle. Any Germans still harbouring hopes of a come-back kept their feelings strictly to themselves, and it was almost impossible to find one who admitted to ever having in any way sympathized with the Nazi. The vast bulk were almost pathetically anxious to co-operate, do what they were told, and, if possible, tell tales of their neighbours.

The threat to public safety came almost entirely from the D.Ps., who, as Allies, could not be put behind wire, had plenty of arms, and very definite ideas of the functions of a conquered people. In the early days, all robberies, murders, etc., were automatically put to the debit of the Russians by whoever ٦,

reported them, and when the Russians had all been repatriated, this mantle passed to the Poles.

The really basic job facing Military Government officers, when they took over their areas, was the reconstruction of a German public administration, and the material available was not very promising, to say the least. Nearly all the able and senior members of a previous service had disappeared or were unacceptable owing to political unsuitability. There remained those who had left or been pushed out when the Nazis took over in 1933, and these were naturally mostly aged and rusty. Then there were the nonentities who had not achieved sufficient standing under the Nazis to be politically unsuitable. There were the young and inexperienced officials, and such men of some totally different background, who could be brought in from outside. Naturally all these classes were diffident of their own capacity, and reluctant to take personal responsibility for dealing with a position of quite unprecedented difficulty. They were scared stiff of going unwittingly against our wishes, or of implementing the inevitably unpopular measures, unless it was quite obvious that they were the immediate instruments of Military Government. On the whole, they worked hard and conscientiously, but were not of the stuff to relieve the Kreis Det. of much responsibility. Moreover, the shaky creaking machine was constantly being disorganized by demands from Field Security who, for their own good reasons, insisted on individuals being sacked, or, possibly, actually took them away into custody with little or no notice. The cases in which an individual had never had any connection with any Nazi organization were very rare, so few could really feel secure. The problem, therefore, of preserving the momentum of the public services was up against the severest friction.

In this problem of denazification, the Kreis Det. had also its own very positive duty. Every holder of, or applicant for, any post of public importance or authority had to fill in a *fragebogen*, a questionnaire on his past history and politics, with severe penalties for falsification. Recurrent new editions grew in complexity and inquisitiveness, and people spent so much of their time filling them in that they became a somewhat rueful joke. Bogen in German, also means an arch, and it was said of types of architecture that Roman was *rundbogen*, Gothic spitzbogen, and English fragebogen.

Since an applicant had to have his *fragebogen* evaluated by the Field Security before appointment, many thousands of these documents passed through the hands of the *Kreis* Det. Commander for remarks. He then had to wait a very indefinite time for it to come back, since the F.S. staff was very small, and all too often discovered in the end that it had been lost. There was very often a shortage of forms, and at one time it was reported that blank *fragebogen* forms were available in the black market at ten marks a time.

One or two days a week the Kreis Officer turned out in his best bib and tucker, under large Allied flags, as a magistrate without a Clerk of the Court. The Summary Court had powers of one years' imprisonment and fines up to 10,000 marks. It worked mainly, of course, through interpreters in two languages, but when D.Ps. were involved, in three or four. The cases varied from the most innocuous curfew infringements to the preliminary investigation of capital offences. The most heart-rending cases which still had to be treated firmly were common, and guidance as to the severity of offences was sketchy. Though mostly without previous experience of civil courts, there were few officers who failed to make their courts dignified, respected, and trusted for justice.

There was then, and is now, only one item in which there was no shortage

and that was shortages. Coal to keep the essential food process establishments going was seldom better than critical and equally seldom failed. It was begged, borrowed, and if necessary stolen, mostly on the initiative of a Military Government office, though here the German himself was not slow to show a little initiative. The allocation of tyres and petrol for the Kreis was regularly cut well below the most honestly minimum of demands. To bring in the food and coal in the rickety ill-shod Kreis lorries towards the end of the month needed arts of blandishment and improvisation of no mean order. The Army, till its own position became too difficult, was usually amenable to reason in lending the transport to avert the final disaster : Medical stores (insulin was sometimes kept in the drawer of the Det. Commander's office table), building materials, road repairs, water supplies, drainage, electric current, local finance, schools, local factories, and many other public and semi-public matters came very definitely on the Kreis Det. Commander's plate for action, though he had the assistance of functional experts to a greater or less degree. As, however, he seldom had the full time of an expert in any function, it was not often that he could afford to lose detailed up-to-date knowledge.

A very special and human problem was that of refugees, and one which tied up closely with the frightful position of accommodation. For a monthor two after the capitulation the roads were a mass of humanity moving mostly westwards. Some of these were D.Ps. off home, distinguishable by the smiles on their faces. Some were returning evacuees hoping to find something left of their homes in bombed areas. Many more were refugees from the east, perhaps with some goal in mind of a friend or relation, but more likely merely escaping from the Goebbels-inspired terrors of a Russian occupation.

The D.Ps. were mostly collected on the line of the Rhine, fed and registered in camps and dispatched home in some sort of order as possibilities occurred. Evacuees rapidly multiplied the population and difficulties in the destroyed cities, already desperately short of all civilized amenitics of shelter and services. The refugees who had no fixed goal mainly went to the country districts, where the food was, thereby reducing the possibilities of dispersing the town populations. Apart from the one and a half million people officially imported from east of the Oder—Neisse line, there must be between two and two and a half million others who are now in the Zone but not natives of it. This official influx from the east was a very special problem owing to the numbers, the speed of arrival, and the dreadful condition in which many arrived.

Much time was taken up by interviews with private individuals of all sorts on personal matters, with no limits to the variety of subjects. It was always a problem for the Det. Commander as to how much of this personal work he should take on. It took a lot of time off active administration, but, on the other hand, it served both to keep the Military Government officer in the picture of unofficial life, and also added to his standing with the people as a whole.

On top of these multifarious duties, it must not be forgotten that the Kreis Det. was a small military unit with all the detailed administrative work which that involved for the O.C. and his second admin. officer. Since his O.R. strength was so small and recruited near the end of the war, much of it from the point of view of its redundancy for other purposes, the O.C. was lucky if he could count on any experienced unit administrative help there.

Taking the job as a whole, therefore, it can be well appreciated that it was one that needed, and in practice nearly always received, the highest qualities of conscientious hard work, tact, common-sense, perseverance and sense of humour.

So much for the early days which lasted some months, but in the nature of things, conditions and policy developed. Looking down the perspective of time, the broad development of policy appears to have been steady and consistent. From the point of view of the Kreis Det. Commander at the time, the many threads of policy with which he dealt in detail appeared tangled, inconsistent, often impracticable, and always further constricting his original freedom of action, so, all too frequently, high decisions of policy were somewhat imperfectly carried out on the ground. In the normal British fashion, the officer in charge of a district had developed an intense local patriotism which, necessary as it was for an enthusiastic performance of the job, was difficult to disregard when called on for action in accordance with new wider co-ordinating policy which appeared to be against local interests. The general lines of policy were, of course, directed always towards centralization on the British side and devolution of responsibility to the Germans as soon as, or even earlier than, they were capable of assuming it. This policy was necessitated by the steady reduction in available staff, and facilitated by the improvement in communications and general state of order.

Function after function was removed from the Kreis Commander, and specialist officers took on wider and wider areas. While this removed responsibility from the Kreis Det. Commander to a certain extent, it did little to relieve the essential interest he had to have in all aspects of his Kreis administration. It also resulted in his being flooded with technical laws and directives, not always perfectly framed, without the immediate assistance of the technical expert, and of which the Germans always wanted to know the meaning and implications.

With a nearer approach to civilized conditions a number of new difficult problems were introduced. Political parties, Works Councils and Trade Unions, Youth Groups, Local Government Councils etc. In practically all these, the German idea of their functions and procedure differed radically from ours, and the main burden of agreeing the two fell on the *Kreis* Det. It was work too, that was not so easily resolved on common-sense principles. It meant mugging up reams of instructions on intricate subjects, which were out of the run of normal general knowledge and often even appeared at first sight to be based on anything but common-sense. Still nobody wanted to have to cat his words to the Germans more often than he could avoid. So great care had to be taken in interpretations.

This was a painful period of transition. Staff was rapidly disappearing, unit accounting was being tightened up to peace-time standards, one could no longer call up the *Bürgermeister* and tell him to do this or produce that, while visitors were becoming more frequent, important and exigent. The work was less exciting, but, worst of all, the wings of independent action were being steadily clipped. It became necessary more and more to withdraw active control of matters which had been one's absorbing interest, and force it into the reluctant hands of the German official. However much the political crowd called for more responsibility to be handed over to the Germans, the individual who was to receive and exercise it was seldom happy unless each decision had an obvious Military Government stamp on it.

That transition period, as it affected the *Kreis*, is over. The *Kreis* Det. is gone, leaving behind the *Kreis* Resident Officer with a clerk, interpreter and a car. His office work is supposed to be negligible, his knowledge encyclopaedic. He must keep up-to-date with all developments of policy. He must keep in close touch with every local twist and turn of events, and render sage reports

on them. He must know well every personality of importance in the Kreis, and many of none. He must ensure not only that the German administration knows what we want them to do, but that they get reasonably near to doing it. He must act as their liaison officer with, and buffer between, other branches of C.C.G. He must demonstrate in his own personal actions that the British way of life is what we think it is, and hope that others do too.

In most Kriese, there only being twenty-four hours a day and seven days a week, he cannot do it all 100 per cent, but the great majority make a very good shot at it. It is, therefore, not surprising that he sometimes fails to see the joke of being depicted in the Press as an idle, dissolute scoundrel living in luxury amid a starving population.

THE ASSAULT UPON WESEL ON THE RHINE

By "J.J.D.G."

PRELIMINARIES

LIFE in 84 Field Company presented a dismal picture at the end of February, 1945. The Company had been repairing roads almost without a break since we left Antwerp three months earlier. Here we were—still at it, on even worse roads between Helmond and Venlo on the Maas, with dim prospects of any release from the job; and all the time we knew that the Rhine party was being planned and No. 7 G.H.Q. Troops Engineers had so far been left off the list of invitations. Great was our exasperation.

The first ray of hope pierced the gloom on 10th March when the O.C. was ordered to report to a Brigadier in one of the few intact houses of Venraij. He was informed that he was to officiate as the C.R.E., of No. 1 Commando Brigade, and had about a fortnight before the curtain went up !

For the first week the O.C. was seldom seen by the Company, though his driver was worn to a frazzle taking him from Venraij in Holland, to 12 Corps H.Q., at Eisden in Belgium, and from there to "some ruddy awful Jerry village littered with mines, this side of the Rhine."

Suddenly the Company was whisked up to Sonsbeck, about 12 miles from the Rhine at Xanten. There we took over the late Burgomaster's house from some Canadians who kindly presented us with half a cow which they had not had time to eat themselves. Speculation and excitement ran high when an intensive training period of bayonet fighting, minefield clearance and assault demolitions was embarked upon ; but it was not until 17th March that the lads really knew what the form was. That day the Company spent at Well on the Maas with a lot of tough looking gentry with "Commando" on their shoulders, with whom they practised embarkation in "Buffalo" landing craft.

That clinched it—and there was a general feeling of relief throughout the Company.

CONCENTRATION

On 19th March the whole Brigade group moved into an area west of the main Xanten road and about 5 miles from the river opposite Wesel.

The plan for the attack is shown on the sketch map at the end of this article.

The Americans were somewhere on our right flank and 8 Corps (British) a few miles down-stream on our left.

The assault, preceded by an historical artillery barrage, was to be launched silently at 2000 hrs. No. 45 Commando was to seize a shallow bridgehead, then the others—3, 46 and 6 Commandos—were to pass through, swing west, and the whole Brigade enter Wesel from the north, while the Huns were to content themselves by shelling the evacuated beach-head. The crossing of No. 3 Commando was to be in storm boats and the remainder by "Buffalo."

The Sapper tasks allotted were :

(i) Launching the storm boats.

- (ii) Clearing mines on the far bank beach exit.
- (iii) Clearing mines existing on the near bank "Buffalo" circuit.
- (iv) Clearing any mines encountered on the way into Wesel.
- (v) Opening a jeep road through the bomb debris of the town.
- (vi) Establishing mine-free approaches for the subsequent "Buffalo" ferry service between Wesel and the near bank.

This was all pretty straight forward provided the fine weather held. In case it did not, we had to be prepared to lay endless chesspale tracks to enable loaded jeeps to reach the "Buffalo" ferry. We also laid in a stock of made-up charges, "Beehives" and "General Wades," in case we met anything too tough on the other side.

It had been decided to launch the storm boats in a basin 2,000 yds. downstream of the beach-head, then send them up "flat out "—empty—to the embarking point directly opposite the beach-head.

Our first problem was to get the lorries up to the region of the basin, offload and get them out again. This could only be done by cutting a number of gaps in the thick, thorn hedges beforehand. But how—if our plan was to remain undetected by an intelligent enemy air observer? The solution was to cut out each gap at the roots during the two preceding nights, but to support the cut hedge by pickets and wire, so that the whole could be readily dragged aside on the night of the operation.

Two D.6 Angledozers were concealed in sheds at selected points. Their task, apart from any necessary recovery work, was to dig "funk holes" in which the "Buffaloes" could shelter during the counter battery fire we expected after the first assault.

The only set-back we had, was when, during a final rehearsal by the "Weasel" amphibious craft, our recce officer was thrown off and severely injured when it ran over him. This was a sad blow, for it was he who was to lead the volunteer "Gapping Party," whose task was to clear any mines from the route into Wesel. The subaltern who filled the vacancy so ably had no rehearsal before the operation.

On the 20th we were treated to a good side-show. Some enterprising Hun observers had been spotted in the spire of the great church in Wesel. This would not do at all, and the Brigadier asked the R.A.F. to eliminate them. That night a single Lancaster came over and dropped a "Blockbuster." But next morning the church was still there 1 So, at 1000 hrs., two infuriated Typhoons circled round and literally mowed the spire down with rockets.

THE ASSAULT

At 1700 hrs. 23rd March we got the word that Operation "Widgeon" was on! The artillery barrage really settled down to serious business, and at 1800 hrs. the footsloggers started marching into their assembly areas, north of Ginderich.

At 1925 hrs. No. 1 Platoon with a Gunner working party, moved silently to the storm boat basin as dusk settled down. They worked like beavers, smoothing off the launching ramps and filling slit trenches which traversed the edge ; they also pulled aside the "gaps" in the hedges and taped the traffic circuit. At 1955 hrs. the first lorries appeared, and then Sappers and Gunners really got down to it. There were a few old-fashioned remarks flying about, but by 2040 hrs. the last of 40 storm boats was afloat and the job was done.

We hardly had time to appreciate our good fortune that the Huns, some 400 yds. distant on the opposite bank, had neither seen nor heard us. A concentration of mortars on that basin when 150 men were "milling about" on the edge of it, would have been disastrous.

At exactly 2200 hrs. the first storm boat turned out of the basin and led the convoy upstream to the embarking point where No. 3 Commando were waiting behind the flood bank.

Meanwhile the "Buffaloes" had been moving up to the west bank with No. 45 Commando already on board. So at 2200 hrs. also, the first flight of "Buffaloes" waddled into the Rhine at Perrich and headed across. Included in the first wave was our No. 2 Platoon which had already checked the home bank for mines, and now had the task of "delousing" the landing beaches on the far side. There were one or two stowaways for this outing, including the 2nd in Command who had somehow escaped from the office truck and now exhibited astonishing activity.

From then on everything went like clockwork. The spectacle was something of a mixture between the Aldershot Tattoo, Boat Race day and a Point-to-Point, and there was the same air of exhilaration which had a supercharging effect on everyone.

At 2230 hrs. when the leading Commandos were within 1,000 yds. of Wesel, "Bomber" Harris took the stage. A pathfinder marked the target with a neat ring of parachute flares, through which 500 tons of bombs were dumped on the town in 15 minutes.

The Commandos then moved in according to schedule l

Curiously enough we hardly noticed this effort by the R.A.F. going on within a mile of the beach. The heavy crump of bombs was a mere sombre accompaniment to the lively crackling of the artillery of all sizes which was slinging several hundred tons a minute at the far bank. A burning "Buffalo" lit up the whole proceedings on the landing beach, and the full moon made going so easy that the luminous Bofors shells were barely necessary to indicate the direction of the assault.

It was at about midnight that the Hun got properly under way with his counter battery fire and plastered our bank with mortars and everything else he had got, but he had missed the boat in more senses than one. However, it was very uncomfortable and a number of casualties were suffered.

At about 0300 hrs. on the 24th, the O.C. was reminded that the Americans were having a party of their own. He had just returned to Brigade H.Q. when he was greeted by a playful burst of machine-gun fire from the right flank, which punctured the front tyre of his jeep.

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CONSOLIDATION

At first light on the 24th, the Commandos in Wesel started to make themselves at home. The joy of Brigade H.Q. at finding that the German garrison H.Q. was billeted in the next house cannot be underrated. The invitation which the Commandos extended was at first ungraciously received. Half a magazine of Sten ammunition presented to the German General in two bursts, elicited more cordial reactions among his staff.

The zealous way in which the Huns were winkled out and taught manners was most edifying. Old hands at the game, the Commandos eyed the enterprising Sappers with mild annoyance as they noticed how well they were equipped with Mauser pistols and wrist-watches.

At 1030 hrs, we were treated to that marvellous "air drop"—which so effectively broke the Hun effort to concentrate his reserves. The first wave over our narrow sector of the front, consisted of 100 Dakotas full of paratroops. The next two waves were gliders, over 30 Dakota Tugs each pulling 2 gliders in each formation.

As soon as the "drop" went in, the enemy counter battery fire ceased abruptly—for the very good reason that the paratroops had landed in the middle of the enemy gun area, and overran it immediately.

Our greatest admiration went out to those Dakota crews—many of whose craft came rocking back, with engines blazing, to crash on our side of the river.

At 1400 hrs. on the 24th, the Brigadier signalled "Town clear, establish ferry." Heartened by this news, the O.C., Brigade A.Q., and other Staff Officers hastened down to inspect the river bank, opposite the town. Too easy this was ! And the party proceeded to collect some of the fish which had been killed by the night's bombing.

Half an hour later the O.C. was showing the D.A.P.M. the traffic circuit to the ferry head, when a Hun machine-gunner opened up from a house on the opposite bank, which had been overlooked. His jeep was again punctured, and a new evasive action record was established. But a message was wirelessed back to Brigade Rear H.Q., and within 20 minutes our mortars had administered the antedote.

Without much more excitement the ferry-head on the near bank was cleared of mines by No. 3 Platoon, and ferrying began at about 1630 hrs. The first "Buffaloes" lurched out on the far side, where a batch of about 90 prisoners were waiting for evacuation. But separating the prisoners and the "Buffaloes" was a "double-oxer" of barbed wire, and two rows of antipersonnel "S" mines in between.

The O.C.'s consternation can well be imagined when a trusting Commando thrust a pair of wire-cutters into his hand as though it was a special treat reserved for him.

Next day—Palm Sunday, the 25th—was neither peaceful nor a day of rest. The Brigade's immediate task was finished, but like locusts, the Americans swarmed across and into Wesel. By dusk that night they had completed two Class 40 bridges and half finished a Class 70 within 300 yds. of each other. Double lines of traffic were travelling on a 3 mile circular road which had been bulldozed through the debris of the town.

The whole operation had contradicted military history and gone precisely to plan. But the thing which really puzzled every Sapper in the Company was how the 2nd in Command produced that night in Wesel, not one, but two tots of rum per head all round.



THE PAZUNDAUNG CREEK BRIDGE

By MAJOR J. B. BROWN, R.E.

A FTER the recapture of Rangoon, when stores began to come in by sea, it was necessary to send some of them up-country by rail.

Unfortunately, just outside Rangoon there was a very effective obstacle, the Pazundaung Creek. This had originally been bridged by one road bridge, one double line railway bridge and one single line railway bridge.

The road bridge was demolished by us in 1942 and the Japs had dropped one span of each of the other two as a parting gift when they left in 1945.

It was decided to form a road-railway transhipment point at Togyaungalle, on the far side of the creek; stores to come from Rangoon by road.

The single line bridge was being repaired for the railway but could not be ready in time and the site of the old road bridge was out of the question. As the countryside was paddy fields and the monsoon was on, it was essential to stick to an existing bridge line and the only suitable place was the old doubletrack railway bridge. It was decided to use this site and convert the railway embankment into a road. Plan 1 shows what the bridge looked like before work started.

A Class 12 bridge was specified.

The following points affected the plan :---

- (a) At the north end of the standing bowstring span the roller bearings had disappeared. This end was therefore 2 ft. 8 in. lower than the south end.
- (b) The fallen bowstring had gone down off line. The Bailey, therefore, had to be built and launched off line so that the transoms should clear when the bridge passed into the bowstring. Luckily the bridge was wide enough for this to be done without complications.
- (c) The fallen bowstring was still sinking.
 - (d) The last subsidiary span on the north bank had only one pair of girders left.

It was decided to bridge the gap with Bailey having a central pier on the top of the fallen bowstring. This pier was to be made by bridging across between the two trusses with R.S.Js. which would rest on specially constructed saddles. Plan 2 shows the construction of the pier. As will be seen six 20 in. by $6\frac{1}{2}$ in. R.S.Js. were employed. This is considerably more than necessary structurally, but a good broad pier was needed in order to ease the jacking problem when it came to breaking span.

The spans were to be 110 ft. and 140 ft. D.S. and T.S. respectively. (As the equipment was American the derated classification was used.)

No special parts were available for broken span bridges, e.g., junction posts and links, and a continuous bridge with improvised parts, which could very easily have been constructed, was ruled out by the fact that the pier was still sinking. In actual fact the load of the Bailey coming on to the bowstring apparently caused the final penetration of the mud and no further sinking was recorded.

The standing bowstring span and the subsidiary spans were to be decked with Bailey decking, the transoms resting on the existing railway stringers. The subsidiary span with the girders missing would be bridged by a 50 ft. S.S. Bailey.

In order to fix the saddles, which were prefabricated by an E. & M. Coy. in Rangoon, and the R.S.Js., it was necessary to get a workshop lorry and welding set as close to the site as possible. The only feasible method was by water and a R.C.L. (Ramp Cargo Lighter) was borrowed for the job. The machinery was embarked in Rangoon and this floating workshop was moored alongside the bridge and proved ideal.

The R.S.Js. also came by water on a barge.

The Bailey equipment was brought to the south end of the bridge by rail prior to the removal of the track.

A series of plain rollers was constructed from the south end, over the subsidiary spans and through the bowstring to the launching rollers on the central masonry pier. The whole series was packed up appropriately to compensate for the difference in level between the two ends, to give a level launch.

The entire bridge was then built at the south end and pushed forward as the panels were added at the back. The whole launch went forward with the greatest of ease, entirely by hand, 90 men being required for the full bridge. The final 20 ft. was accomplished with tackles attached to the nose asthere was by then insufficient tail left to push on.

There appears to be a tendency for American Bailey to creep sideways on its rollers during launching, however carefully the rollers are levelled, and this was no exception. During the first half of its travel to the launching rollers it had crept 3 in. to the right, from then on it started to come back, and by the time the launching rollers were reached the bridge was running straight again. This it continued to do for the rest of the launch.

On its arrival on the far bank the launching nose was detached complete, jacked down on to a further series of rollers and continued its travels until it became the 50 ft. S.S. over the final subsidiary span.

Breaking span over the central pier presented no unusual difficulties as plenty of packing under the central launching rollers had been allowed and it was, therefore, possible to jack the centre well down below the ends.

The end abutments were of timber sleepers from the railway, that at the south end being an ordinary crib, and that at the north end a specially constructed one built to fit on to the end of the bowstring.

The time factor was extremely pressing as the transhipment point was wanted urgently and could not be started until the bridge was complete and the necessary machinery got across. Between the bridge and the transhipment point was one more small bridge, 90 ft. long, half a mile away from the main bridge. This was to be decked with Bailey decking and, in order to have it ready simultaneously with the other, every part was carried up by hand. The equipment was taken over the creek, which was tidal, by Mk. II assault boats, a perilous but entirely satisfactory operation.

The units employed on the bridge were a Field Coy., and a det. of an E. & M. Coy. Work was started on the prefabrication of the saddles on 21st July and the bridge was opened to traffic on 12th August. The bottleneck was the construction of the saddles, which from first to last took a fortnight. This was due to the rain, the monsoon being in full force, which prevented arc welding for a considerable part of each day.

The bridge was more than adequately tested. One day when the author was coming away from the bridge he encountered a 10-ton lorry loaded with P.S.P. (Class 18) closely followed by a 3-ton lorry similarly loaded (Class 7) obviously heading for the bridge. Hurriedly turning his Jeep the author dashed in pursuit but owing to the narrowness of the road was unable to overtake them. Ignoring notices, sentries and rules as to intervals between vehicles, the two vehicles proceeded to cross the bridge, to the dismay of the author. However, apart from a phenomenal sag, the bridge stayed up, and careful examination afterwards showed no sign of strain. PAZUNDAUNG CREEK BRIDGE



PAZUNDAUNG CREEK BRIDGE



NOTE

THE DOWNSTREAM PANEL POINT IS GELOWER THAN THE UPSTREAM ONE. SADDLES WILL BE THE SAME CONSTRUCTION GER.S. JOISTS, WILL, BE WELDED TO THE TOP OF THE SADDLE ON THE LINE "X-X" FOR THE DOWNSTREAM SADDLE.

PLAN 2.

RECONSTITUTION OF THE ARMY IN INDIA

Submitted by E.-in-C., G.H.Q., India.

INTRODUCTION

On the 3rd June, it was announced that the policy of partition between the Union of India on the one hand and Pakistan on the other had been accepted by the leaders of the main political parties in India. Partition and the passing of responsibility for Government was to take effect from 15th August, 1947.

For several months before then, planning at G.H.Q. had been concentrated on nationalization of the Army, with the possible exception of a small British Military Mission, to take effect from June, 1948. Although much of the work done was of great value, the split of the Army and advancement of the date necessitated drastic modification of plans for which there was very little time. It speaks highly for the hard work of the staffs concerned and for the cooperation of British and Indian officers that the task was completed so quickly and smoothly.

The agreed basis for the proportionate split of units was two thirds to India and one third to Pakistan.

ENGINEER STAFFS

He was the direct successor to the Engineer-in-Chief in India. From henceforth his duties would be to ensure that the partition policy was carried out smoothly and impartially. He shed his old functions as the Es.-in-C. of Dominions were ready to take them over and the staff would gradually dimisnish. He would eventually disappear when the Supreme Commander's H.Q. was abolished.

E.-in-C. Army H.Q. India

He had to build up his staff and office *ab initio*, though he received a framework from the E.-in-C. in India. There were very few R.E. officers on his staff.

E.-in-C. Army H.Q. Pakistan (Rawalpindi)

He had the advantage of the old staff of the Chief Engineer, Northern Command, from which to expand, but he was faced with many other problems which were more difficult than those confronting E.-in-C. India.

TROOPS AND UNITS

There were two favourable factors which simplified the partition of units. Firstly, all units (except those overseas) had been reorganized on a one-class basis during the cold weather 1946-47. Secondly, the disbandment of the war-time R.I.E. groups at Lahore, Sialkot, Jullundur (Tn.) and Deolali (Tn.) had just been completed, though their records had yet to be disposed of.

Broadly speaking, the plan was as follows :---

ENGINEER CENTRES

(a) Q.V.O. Madras, Bangalore, remained unchanged.

K.G.V's.O. Bengal, at Roorkee, lost its Muslims (50 per cent of the strength).

Royal Bombay, at Kirkee, lost its Muslims (40 per cent of the strength).

A new Engineer Centre was to be set up at Sialkot, for Pakistan. H.M. The King graciously approved the assumption of the Royal title by all the Corps in Pakistan, which were split from Indian Corps bearing the title. The Engineer Centre at Sialkot then, became the H.Q. of the Royal Pakistan Engineers.

The old centres retained their titles superimposed on R.I.E. (b) The Class Composition of R.I.E. Groups was to be :---

1110 01400	Compo	sicion of	*****	D. Groups was to be ;
Madras		• •		As before
Bengal			• •	Hindus and Jat Sikhs
Bombay		••	• •	Mahrattas and M/R. Sikhs
TTL	- ta - C	1100	*	TO D

The division of V.C.Os. and I.O.Rs. presented no great difficulties, except complications regarding Meos and the few other Muslims domiciled outside the Punjab. Most of them eventually chose to go to Pakistan. The departure of P.Ms. from Bengal and Bombay Groups was a hard blow, not only because they were the largest classes but also because most of the key appointments were held by them.

The greatest difficulty arose over the provision of equipment and property for the R.P.E. Centre, which had to start from scratch. Under the terms of partition, Pakistan was entitled to one third of the Engineer Centre equipment of the old combined total. This might have been provided by drawing half each from Roorkee and Kirkee. This was considered, however, to be too complicated and likely to lead to difficulties. Therefore the whole was provided by Roorkee, who are thus left temporarily short of certain articles (they were still holding much in excess of their peace scales, left over from war expansion). This can be made good from resources at India's disposal.

The distribution of regimental and mess property was still more delicate. It will doubtless be known to readers of this note that the R.E. Corps Committee had agreed, on the recommendation of British Officers serving in prepartition India, that the mess silver and assets should be presented to the officers of the Dominions. There is no question that this has been very greatly appreciated and will help both to cement good relations and to uphold the continued existence of officers' messes, though not necessarily as the years go by in the same form as we now know them.

A representative Committee, under the chairmanship of the Commandant S.M.E., was formed to work out the details of apportioning funds and assets. The split of the R.I.E. War Memorial Fund and the War Groups Funds, to be used for benevolent purposes, was included in their review. As a result Bengal S. & M. were again the chief sufferers initially, though they retain their fine buildings and it is hoped that E.-in-C. India will be able to arrange for them to be assisted from other sources. This applies particularly to the officers' mess.

It will be many years before the R.P.E. Centre will be able to furnish themselves with all the amenities which have been built up by the old corps. But they have a fair share of funds, and though they may lack the local resources for the welfare of troops' families, they should be able to carry on the benevolent work for ex-sappers in the same way as before.

At the time of partition, the S.M.E. was already in a state of suspended animation. The previous accommodation at Roorkee was being handed back to the Thomason College, who had lent it during the war. As a *quid pro quo* for this free loan, most of the workshop equipment installed by the Army was left for the use of the College. A proportion of the field works equipment was allotted to K.G.V's.O. Bengal Centre, to replace that sent to Sialkot.

The S.M.E. had never been able to build up any private or mess funds and assets. So the question of partition did not arise.

India's S.M.E. will be at Kirkee and construction had already started. Although some courses will start in early 1948, it is unlikely to be fully functioning before late in the year; a great drawback, as will be seen when the officer position is described.

Pakistan is in a rather worse position. The S.M.E. will be a wing of the Engineer Centre, but has nothing, except good B.T. Barracks-no stores, no organization, books or papers, no officer instructors. There are, of course, some excellent Muslim V.C.O. and N.C.O. instructors who were with the old S.M.E.

The state described above refers to the situation in the immediate postpartition period. It may well be that the Dominions will alter the Order of Battle, class composition and recruitment, and even the location of Engineer Centres.

MILITARY ENGINEERING SERVICES

The post-war establishment for the M.E.S. had been approved about two months before the date of partition. The geographical split was simple, as it so happened that the Inter-Dominion boundary virtually coincided with a C.R.E's. boundary, while East Pakistan was covered by an existing G.E's. area.

The E.-in-C. Dominions took over responsibility for works from the date of partition. It was, therefore, necessary to split the budget into three portions India, Pakistan and Joint Head. The latter covered works expenditure on installations which were, for the time being, controlled by the old G.H.Q., such as Stores Depots and certain instructional establishments, until they were partitioned. The budget split presented no great difficulties, as the requirements of Northern Command approximated closely to those of Pakistan.

Those who know India will remember that, before the war, by far the greater part of the army in India was quartered in Northern Command. Pakistan is therefore better provided for permanent accommodation than is India, where many of the troops are living in temporary war accommodation long past its estimated life. On the other hand, Pakistan is short of Ordnance Depots and Workshops, and the P.M.E.S. will almost certainly continue to carry out civil works in the Frontier Areas.

Before 15th August, all M.E.S. personnel were invited to opt for either Dominion. Naturally, this followed communal distinctions with very few exceptions. The result was that Pakistan would lose about 70 per cent of its staff (representing the non-Muslim element of the old Northern Command M.E.S.). The numbers of Muslims to be transferred from Southern and Eastern Commands to Pakistan were small.

After moves, which from Pakistan to India would represent a considerable volume, were complete, Pakistan would thus be left short while there would be a surplus in India. This will necessitate heavy retrenchment and still more distress.

MOVEMENTS

The plan was to move major infantry and artillery units first, followed by other major units (in which were included the Muslim contingents from Roorkee and Kirkee), minor units such as Engineer Coys. and finally individuals, which included M.E.S. personnel and their families.

This programme was greatly delayed by political disturbances and then in late September by disastrous flood damage to rail and road communications in the Punjab. The whole programme was delayed by over a month. Hence the men of the R.P.E. Centre were not concentrated at Sialkot until the end of October. Moves of units were similarly delayed.

Owing to the communal feeling in civilian circles, the transfer of M.E.S. personnel was very badly dislocated from the start. Most of them have been

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brought to safety, but many of them have lost all their possessions, some have become scattered and detached. It will take months to sort them out and get their documents into proper order. There still remains about 50 per cent of the original numbers to be evacuated by the planned method, which will now take place in January.

During the recent communal trouble, all commanders testify to the reliability, high morale, discipline and non-communal outlook of Engineer units engaged on I.D. duties in the Boundary Area. They have been chiefly engaged on Infantry duties but the occasional Field Engineering task has cropped up.

STORES AND PLANT

There are still huge stocks of stores in E.S.Ds, as disposal has been progressing slowly for the last two years. By far the greater part is located in India. All the mobile plant is at Kankinara, near Calcutta (India), while nearly all the static plant is at Lahore (Pakistan).

The general basis for allocation of stores, arrived at after much discussion, was :-

Unit Equipment: M.E.S. Tools and Plant : War Reserves :

in proportion to units alloted.

as per pre-partition Command scales.

🗿 India, 🚦 Pakistan

Other warlike equipment : } General Stores

In proportion yet to be settled.

It was obvious that the physical movement of the mass of stores and plant to implement this allocation would be extremely uneconomical and, owing to shortage of rolling stock, would be spread over a very long time. A financial settlement was not acceptable. A committee has, therefore, been formed to determine what items each Dominion needs, and the rest may be disposed of and the proceeds divided on the agreed proportions. To go through the thousands of items entails a vast amount of paper work and the task will certainly not be completed before 31st December. An Inter-Governmental Committee will then be formed, but will be badly handicapped by lack of officers with stores control experience.

OFFICERS

The lack of trained and experienced officers is the biggest problem that both Dominions have to face. The shortage of the normal non-specialist Engineer officers is bad enough. For Engineer staff officers and E. & M. officers, the outlook is still worse. Pakistan is much worse off than India. A proportion of the deficiency is being made up by commissioning selected V.C.Os. of sufficient education. But their usefulness is practically confined to field units.

Military officers have been almost entirely eliminated from M.E.S., except for very few B.Os. remaining and some deferred Indian Emergency Commissioned Officers.

The M.E.S. officers who now fill C.R.Es. and G.Es. appointments were nearly all pre-war S.D.Os. Some of the present Assistant Engineers (corresponding to G.Es. under War Office organization) were overseers.

Up to 31st December, the seriousness of the position will not be fully apparent. Although a comparatively small proportion of R.E. officers volunteered for further service after 15th August, the presence of non-volunteers awaiting shipment had tided over the last three difficult months.

Both Dominions have now realized that they must, to varying extent, call for the help and guidance of R.E. officers for a further period. At the time of writing it is impossible to forecast the response to the terms which are being offered.

CONCLUSIONS

There is no question that the natural quality of the rank and file will be as good as ever. But their state of training and administration will depend entirely on the standard of the officers.

In stores and equipment, Pakistan will initially be in a very bad way. It is to be hoped that the transfer of their agreed share will be carried out without delay.

There is no need to labour the officer difficulties. It must, of necessity, take years to build up an adequate and efficient corps of officers. The problem is aggravated in the case of the Engineer arm in these countries, where there is no reservoir of accumulated engineering experience.

There are re-adjustments of outlook to be made. The rank and file, in their conservatism, have not yet fully realized that the British officer, to whom they had been so long accustomed, will very shortly have disappeared. It must be admitted, too, that there is a long way to go before the R.I.E/R.P.E. officers build up the bond of understanding that has existed between R.E. officers and M.E.S. staffs for decades.

Throughout the period of reconstitution, there has been nothing but the most cordial goodwill between R.E. officers on the one hand and R.I.E/R.P.E. officers on the other. May it ever be so.

THROUGH THE SAHARA ON A LORRY

By MAJOR A. W. NORTHOVER, M.C., R.E.

THE Sahara to me, has for many years been a fearsome nut that I wanted to crack. So, not being as wise as my years might suggest, I took my wife and we started on 27th March, 1947, as members of a convoy of four lorries (old troop carriers) and four trailers for Cape Town via Calais-Marseilles-Algiers-Sahara, etc. The fare was only £106 each, but it actually cost us £800 before we reached our goal.

The four lornes, with trailers loaded to danger point, and each vehicle packed tightly with twelve passengers and their meagre baggage and two or three drivers, started from Algiers-after long delays-on a wet cold day, to wit, 5th April, 1947, after spending a sleepless, cold night in a "bivvy" tent which was not too large for one person let alone two of us ! Going on we reached Bokhari-a very dirty Arab town-at 6 p.m. travelling all day on good roads through the lovely emerald-green country and grandeur of the Atlas Mountains : but a hard, cold wind blew in the back of the lorries until most of us were almost frozen to our seats. We were off again the next morning at 7 a.m. without food and reached the desert proper with the Sirocco wind travelling with us the whole day, so we ate and drank nothing that was not mixed with sand. One breathed sand and our appearance became indescribable through it. After some eleven hours of this, with only a short stop, we reached the casis and town of Lagouat at 6 p.m., slept cold again, after a miserable cold meal, when it rained for the first time in six years 1 The camp was in a big grove of tall firs, and the local Touaregs were on the spot to lift
unconsidered trifles as usual. There are some marvellous tropical gardens in this town, surrounded by high walls which prevented a closer inspection. But the little we could see from the lorries fairly made our mouths water. Oranges, bananas, coconuts, lemons, bread-fruit and figs, not to mention peaches and apricots and mangoes all growing out of season, so to speak, and to be had cheap ! We "stocked up" of course all we could get.

to be had cheap! We "stocked up " of course all we could get. After leaving Lagouat at 5.30 a.m. the following morning, with the cold, strong East wind (Sirocco) still with us, we entered a really bleak flat sandy plain, with nothing but sand as far as my field-glasses could reach, and had another really devilish day, which at last broke some of the women, and there were tears and tempers. The tears, however, were found to be a mistake on the ladies' part, as the passage of the brine down through the thick sand on their faces proved inconceivably funny-or so thought I, who was the cause of one of the " tempers." After hours of misery we reached the town of Ghardaia and were billeted in the Foreign Legion Barracks. Alas ! there were no lavatories and we slept in barrack cells. Still, it was cover, and we welcomed it. The usual French barracks-one-storey brick huts shaped like Nissens, built around a square, and a well of questionable water in the middle, towards which all the ground appeared to have been carefully graded so that the surface water should join the drinking water in the well ! Most of us had dinner that night in the Atlantic Hotel-a poor meal and very expensive. It was here that a young Foreign Legion officer gravely warned us of the great danger of going any further, particularly around the Tamanrasset area, but being still cock-ahoop we pooh-poohed him. But he was right ! We left Ghardaia at 5.20 a.m. on the 9th of April, without breakfast as the Commissariat was still not organized, and on a cold bleak unfriendly morning entered the most typical "desert "land to date. It was indescribably severe and we were "bogged " again and again and everybody had to push. This desert was full of shining black and brown rocks and the glare and heat from them hurt the eyes. Still, at this spot we saw two gazelles twenty yards from the lorries ! It was hot, that day, the Sirocco still with us, and we were almost stifled in the lorries. We reached a dreadful spot called El Wal-" the Well "-at 3 p.m. and camped there for the night. A Touareg or two lived here and in broad daylight raided one of the party's " personal effects," e.g., pinched his razor and washing gear which, as I pointed out to the loser, didn't matter after all, as one couldn't shave or wash anyhow !

We found an improved road surface after leaving El Wal and entered a much more interesting desert—most picturesque with sugar-loaf hills and marvellous colours. This desert was not all sand, but mostly hard-surfaced, with numerous small stones and blown scattered sand dunes. We had to dig ourselves out once or twice and had our first accident—a broken steering arm in No. 1 lorry.

There is an amazing bit of desert just here and remarkable scenery. Immense, rocky plains swept clean of sand which, settling fifty feet deep in the valleys around, looks like great lakes of yellow water. Get a lorry into *that* sand and you've "had it"! We reached El Golea at 3.30 p.m., leaving the broken lorry ditched and sending back the required part, which cost the promoter 1,000 frances (Algerian) per hour and took five hours to make! We enjoyed the oasis and town of El Golea. The Arabs were friendly and there was a lake where we could wash again. I'm afraid we had forgotten the necessity of bathing dresses and went in indecorously without them ! I fear the desert, after a week or two, makes one like that. The ablution business had been a trial for the ladies and nice-minded gents all along, as there is little or no cover on the desert and one, of necessity, gets a bit blasé! Particularly with dysentery about ! The people of El Golea let us pick their fruit—mostly oranges. They charged us little for them and that fruit was the juiciest, sweetest fruit I have yet tasted. The place is a bright, well-watered oasis with huge plantations of fruit, and the houses are fairly buried in the palm trees. We enjoyed a few days here, while the lorry was repaired, and dined regally each night at the S.A.T.T. (Société Africaine des Transports Tropicaux) Hotel. These hotels are maintained by the S.A.T.T. to house passengers on their buses from Algiers to Zinder—1,800–2,000 miles ! At El Golea we started a system of trading our old, worn garments for fruit and food and did very well. I received fifteen oranges and fifteen eggs for one old undervest ! My wife was successful in exchanging an unwanted tweed coat for 300 francs, three dozen eggs and oranges and lemons ad lib ! We hated leaving this hospitable place where money is of little value indeed.

Departing from El Golea the following cold morning we set out for Fort Miribel, reaching there at 3 p.m. and stayed the night. The country we went through that day was almost too sterile and forbidding to describe—just a sandy, sepia-coloured terrain, as flat as a billiard table for a hundred miles either way, with huge spirals of loose sand driving at one all the time and the shade heat now 112°F.! It was almost unbearable for the women and children and the worst experience of this sort I can recall. Our misery was just too perfect. But on reaching Fort Miribel a rather fine vista opened out with a brackish stream and a pale green valley with some gazelle in it in the foreground. The water in the Fort was bad, and we wondered how the Legionnaires survived it during their three months' siege in 1894. P. C. Wren must surely have had this fort in mind, and it was hard to believe that Beau Geste would not hail us from the ramparts !

Leaving Fort Miribel next day, we now came to a most interesting and grand country—still forbidding and merciless, but the earth conformations are remarkably strange. It is called the Tademait Plateau, and is a miniature Arizona with many "Grand Canyons." There are ordinary hills, massive "castles," and immense "cathedrals" of rock—some nearly 1,000 feet in height. It is savage, unfriendly, with no sign of life and the road or track extremely dangerous. We got through safely and reached In Salah after dark. The lorries unfortunately were parked near a wall of the Legion barracks, and this place we discovered in the morning to be little less than a latrine. This was the beginning of serious stomach trouble and dysentery amongst our convoy. A most unfriendly place, with a garrison of smart Legionaires, who amused us with their band and smart uniforms. There is nothing pleasant to be said of this place—it is just a walled town, with one entrance through a guarded portal I That's all we saw of it !

From this point our real trouble began, mostly due I think to lack of sleep, food and good water and bad staff work. We went on again at 5.30 a.m., through most horribly grim country, and reached a water-hole, called Arak, at 5 p.m.—this is a small indentation of verdant green between grotesque battlemented ramparts—very impressive but also unfriendly. In our ignorance we drank huge quantities of tea made from brackish water and several almost died—the writer being one. The next two days were a nightmare ! The writer found himself with severe dysentery in the morning in company with one lady, two children and a driver. It was decided to transfer the sick to one lorry and rush to the nearest town—Tamanrasset, stopping *en route* at a water-hole half-way to that place. We drove all day and night and arrived at the supposed water-hole at 12 noon the next day. But, to our dismay, no water-hole but just a dead Arab covered with a few stones 1 This added to the groans of the sick, who could drink only the doubtful water in our bottles. The desert was grimmer and sandier and the constant mirage of water became very tantalizing and everybody on the lorry became weaker. We decided to push on and, after a most dreadful night, we reached Tamanrasset at 3 a.m. a drive of nearly 400 miles in two days over the Sahara ! Tamanrasset is an attractive little town, with red sandstone buildings and roads buried in trees. It has a large walled barracks and some nice white stone buildings. Also a military airfield. The water was hardly drinkable, but there was plenty of bottled lemonade, which we enjoyed in a garden of flowers and fruit trees.

The other patients and myself were put to bed in the S.A.T.T. hotel, but soon prayed to get away to a more civilized place. The convoy went on without us, as we were too ill to be moved. We felt very forlorn on our own, especially when the Hotelier told us that the hotel closed in a few days. Eventually we left at 3.30 a.m. in the last S.A.T.T. freight lorry of the season. To stay at Tamanrasset would have meant two fresh little graves and we in them, so with severe dysentery on us we chose the freighter and went on at a cost of 23,796 francs and about 4,000 francs bribe!

It was very hot now, registering 110° F. in the shade, but we boarded that freighter and made 200 miles that day-myself sitting au pair with the driver, five others in the seat behind, and four Arabs on top of the freight and two tons of petrol, water and goods. This was a Bedford 3-ton, front- and reardrive, 38 h.p. vehicle and it was " the goods." We drove sometimes at forty miles an hour and rushed the deep sand like a demon and just cleared it every time. We went on day and night through the most extravagant scenery of the Hoggar Mts. (Mt. Taha about 10,000 feet high), and only stopped to sleep when too tired to go further ! We slept in the desert, dog-tired, at 1 a.m. and were off again at 4 a.m. Our dysentry magically disappeared in a day or so, and I never felt better in my life ! The desert, too, near the Hoggar, is fascinating. At one place there was a sheen over a vast surface and I asked to examine it.. It was glass, and in some spots I could see down holes, ten feet deep, filled with it! I wondered what might be at the bottom-perhaps diamonds or other precious stones I There was also soft-rock strata, just like chocolate-cream layer cake (of which I have a sample). There were rocks of the brightest blue, red and green, violet and shot colours. And, marvel of marvels, a few sawn petrified logs lying about ! I wish I could have stayed there some time, but on we had to go and at 7 p.m. reached Argades-that most awful town of dried mud and stinking surface drains-450 miles in sixteen hours! We stayed at Argades two days and lived in mud rooms of the crudest type. The lavatories were crude enough right through this trip but Argades excelled them all. It was beastly with the foul latrines nearer the dining-room than ever. It is all soft sand around this place.

We watched a Senussi band, one twelve-foot black Tuba and four drums, going to meet the French Governor as he left his plane. It was a funny sight, as, although you heard the noise of the band you could see only this huge Tuba bobbing up and down high above the mud houses. It sent out a terrific bray at uneven intervals in a very deep bass note—but music, none at all—yet plenty of rhythm. The temperature here was 115° F. in the shade. It was on this stage into Argades, in a terrible stretch of desert, that we picked up three young English girls with their mother, and took them on with us. The father and his son refused to leave their Dodge bus which had broken down. We left them—through no choice of ours—with little water and food. Fifteen miles further on we found another broken-down Dodge bus with an Englishman, wife and family. He, too, wouldn't leave his bus. We then found a Ford van with a Yankee in it chugging along at about two m.p.h. going our way. He said he had plenty of food but little water. We couldn't help him and left him there. Since he had over 250 miles to go to get to In Guezzan water-hole, he was due to arrive there, at his speed, in 125 hours—by which time, failing help, he would be dead. We sent back help to him from In Guezzan—a fine water-hole where we managed a bath in buckets—second since Algiers—and rushed on again towards Zinder, sleeping out at 10 p.m., to the constant roar of camels, bovines, asses and goats which the French have concentrated in that area and others near it. Literally thousands of these animals in huge camps dotted here and there for a hundred miles or so. We were impressed and wondered what did it all portend! This part of the Sahara is not desert but rich grazing land, as well as desert in patches.

We were off again at 4 a.m. and reached Tanout, without incident, after the hottest drive I have experienced, sitting, as I did, with mylimbs now and then touching the red-hot engine in a temperature of 115° F. in the shade ! Hot wind, roasting lorry and hotter people ! We were again in the terrible desert as barren as the moon and full of mystery—an area that cannot be cultivated. Tanout is just a military post, of importance, I should think, because it controls the huge concentrations of animals I mentioned above.

The roads in this area and right on to the borders of Nigeria, are being given much attention by the French and we therefore made good time and reached Zinder on 6th May, 1947, through patchy, bleak desert and rich areas of bush and grass packed with game. We saw turkeys, geese, partridge, some pheasant-looking birds, Karran fowl and deer—a sportsman's paradise. Zinder in French West Africa is a military town of red sandstone and wide roads with a good hotel, hospital, barracks and several imposing Government buildings.

Leaving Zinder on 7th May, 1947, with a Negro driver in an old Renault lorry—1922 vintage—we took nine most cramped and hot hours to reach Kano, in Nigeria, at 5.15 p.m.—our desert journey over at last.

Our journey onwards from Nigeria through French West and Equitorial Africa, the Belgian Congo, Rhodesia and South Africa was most interesting and full of vicissitudes, but that must be left for another story. We finally reached Cape Town on 23rd July, 1947, just four days under four months from the day we left London. According to the leader's "Adjutant," only seven out of the original fifty-seven members completed the journey in the lorries.

THE CONSTRUCTION OF A MILITARY RAILWAY BRIDGE AT SOUTHAMPTON DOCKS

By MAJOR H. E. WARREN, R.E.

A'I' the Southampton Docks of the Southern Railway there are seven dry docks, six are in the part known as the "old docks" and the seventh, or the "King George V Graving Dock," is situated at the end of the new docks.

The southernmost dry dock in the old docks is known as No. 5 or "Prince of Wales" dry dock, and this is used extensively for the graving of merchant vessels up to about 10,000 tons. The entrance is normally closed by a large iron caisson of original and interesting design. Besides serving as a dock gate, this caisson carries a single track railway leading to the Ocean Quay.

At the end of 1946 it became apparent that the caisson needed extensive repairs, particularly to the timber fenders and track bearers. The difficulty about this was that with the removal of the caisson, the rail track it carried would be cut and it was essential that traffic over this track should be interrupted only for a few days.

The obvious solution to the problem was first to remove the caisson then provide, as quickly as possible, a temporary bridge to carry the rail track.

This project was suitable for the use of military railway bridging equipment and, thanks to the good contacts existing between the Southern Railway and the Transportation Branch of the Royal Engineers, arrangements were soon made for the job to be done by the Bridging Troop of the Transportation Training Centre, R.E., situated at Longmoor.

A preliminary survey was made and the scheme discussed with the Southern Railway Dock's Engineer. A programme was formulated and the completion date fixed.

Due to the fact that the track over the caisson was on a curve of $4\frac{3}{4}$ chains radius, it was necessary to provide a two-span bridge with a pier in the middle of the dock entrance. The clear span was 95 ft. 1 in. and it was decided to cut back the bank scats and use two 50 ft. Unit Construction Railway Bridges, of through type, supported on a central pier built of light steel trestling. The bottom of the dock is of concrete, stepped to allow for a good seal for the caisson. The use of camel's feet in the construction of the pier provided a convenient method of adjusting the length of the columns to fit the steps in the concrete. The pier was 15 ft. by 10 ft. by 35 ft. hig.

The bridging was loaded from Woolmer E.S.D., in the most appalling weather conditions, heavy snow and intense cold, which caused all cranes in the Depot to freeze up in spite of the usual frost precautions, so all loading was carried out by means of a 10 R.B., belonging to the Bridging Troop, which somehow seemed unaffected by the weather. No difficulties in rail transport were encountered.

On 10th February, 1947, the first half of the Bridging Troop, reinforced by about 20 Sappers from the Holding Squadron, moved to Southampton and took residence in Gate 10 Camp which was kindly put at our disposal by the Embarkation Commandant. Again the weather was definitely arctic and to add to the discomfort there was a complete lack of fuel for the hut stoves.



Adjustable " Camels Feet " used for the base of the pier.



The first engine across the completed bridge.

Photo by Southern Neuropapers, Ltd.

Military Railway Bridge at Southampton Docks 2

However, in spite of these discomforts, the morale of the men was extremely high.

The whole of the stores, approximately 100 tons of steel, were unloaded in just over half a day and the erection of the U.C.R.B's. was started with the erection of the trestle. The plan was to build the whole bridge and pier on the dock side and to place them in position by means of the Southern Railway's 150-ton floating crane.

The erection of the two U.C.R.B's. and trestle took three days—which was quite good, as the majority of men employed were quite new to the work. A class of young Officers undergoing Bridging Training also worked on the job and gave an excellent account of themselves.

While this was going on, the Southern Railway Engineers had towed away the caisson and prepared the bank scats. This was quite a difficult job as 2 ft, of hard granite had to be broken through.

The job of placing the pier by means of the floating crane began at 0900 hrs. on 25th February, 1947. The bottom of the dock was covered with about five feet of mud and in order to get a solid bearing the camel's feet had to be driven through the mud until they reached the concrete. This was done by lifting and lowering the pier some 30 times until it had forced its way down.

Mention must be made here of the Southern Railway diver who went down several times in the icy water to check the bearing of the pier. By 1600 hrs. the pier was firmly established and levelled to the required height.

The next morning at 0900 hrs, the first 50 ft. span was placed by means of the crane and the whole operation took less than half an hour. No difficulties whatsoever were experienced and no jacking was necessary.

By lunch time the second span was also in position and by 1600 hrs. the bearing plates were concreted in.

The whole lifting operation proceeded exactly according to plan and was a most interesting experiment as this was the first time that such a heavy pier had been placed by such means, but it is emphasized that in placing camel's feet piers, the greatest care must be taken that all the camel's feet have a bearing and it is advisable to set the top of the pier about $\frac{1}{2}$ in. high to allow for any slight settlement. In this case, however, no settlement whatsoever has yet been recorded.

The laying of the track over the bridge was the responsibility of the Southern Railway, a 7½ ton steam crane being used and on 1st March, 1947, the line was opened. Since then the bridge has successfully carried all the heavy traffic to and from Ocean Quay.

The construction of this bridge has proved to be an excellent example of the economical use of skilled labour—of the 40 men employed, only ten were skilled Steel Erectors, i.e., N.C.Os and men of the Bridging Troop, but the interest taken by the other personnel was no less a contribution to the success of this most interesting job.

THE RIGHT TYPE OF R.E. OFFICER

By "THAT OULD BRIGADER"

THE last of my infrequent visits to town was unusually pleasant and I felt an almost pre-austerity buoyancy; the weather was sunny, the population seemed to have a lower proportion of foreigners, and I went to a function where "glad rags" were worn and I met some old friends. At breakfast at the Club next morning my refusal of a newspaper was rewarded by my neighbour, who recognized me and started to talk. On the strength of my having once taught him—it was so long ago we had both forgotten what—he asked my opinion on a problem now apparently troubling those responsible for Corps policy; as I have retired, I have, of course, no knowledge of exactly what it is, but there was a familiar ring about the phrases I heard.

I will put it as a suspicion that the right type of officer is not coming into the Corps in sufficient numbers and a fear, which may have been only in the mind of my interlocutor, that it would not do to take in willingly men who had the intention of leaving the Corps again as soon as they could find some other employment that suited them better. I did not then, and do not now, think the recruitment problem insoluble and suggested that, if there was a precise definition of the sort of man needed, it might pay to publish it in suitable circles, for I think that direct methods usually pay.

It is not a question to which a quick answer can be given, nor does the title of this paper mean that I can provide the solution to the definition that I asked for; I had no time to delve into fundamentals and was well aware of the feebleness of my contribution; I had to hurry for my train just when ideas began to rise to the surface of my mind from the well of memory. For instance, the city gathering I had enjoyed the night before was essentially civilian; yet was it not only something of a R.E. reunion with representatives from Lieutenant to full General, but in addition some R.E. retired officers were prominent in official, but civilian, positions.

On retirement R.E. officers seem to take up an extraordinary variety of employment, to equal which I believe it would be necessary to group together all the rest of the Army; on this ground alone, quite apart from that series of apparently impossible engineer tasks which the R.E. took in their stride in the last war, I had to admit that, in the past, the Corps did in fact seem to get rather a specially enterprising type of officer. On the other hand I had never seen nor heard of any logical or official proof of the assumption, general within the Corps, that it could not accept the same standard of officer as the rest of the Army; it expected, and generally got, most of the fraction thrown up to the top by the examination system, now so out of favour.

Nowadays the officer is selected for his power of leadership rather than for his education ; I wondered vaguely what other qualities mark off the recruit, who is accepted as an officer, from the next man, who never rises above Corporal. Presumably nearly every man has inherited the germ of these qualities and, if they have not emerged, the fault lies with his environment; if his school years have not brought them out, is it too late to work at them when he joins the service? I remembered my last train journey, when I sat next to an Infantry C.S.M. who told me his age was twenty-one and said he did not enjoy being in the Army; he was quite obviously passing the time writing poetry and handing it to a Parachute Staff-Sergeant opposite for criticism.

At that time I merely noted how the Army was altering and that he was not the type of W.O. I remembered ; now, in relation to the problem in my mind, I had to ask whether he would make a good officer ; to be a C.S.M. at twenty-one he had to be a leader and you could almost see it in his red hair. Was it normal in these days of conscription for a man to make up his mind, before he is called up, what arm and regiment he will ask for, but to accept passively the ruling of higher authority whether he is to be an officer or not ? Is the Army losing valuable material, because men who develop late and have not yet much sign of leadership do not want to waste an expensive education in the ranks ?

My mind was full of this kind of conundrum, when I got into the train again to find an engineering discussion already in full swing in my compartment ; this merely emphasized the immense variety of work for which men called engineers are responsible. The fitter in charge of the machinery in a factory described in detail all his machines and the modern processes for making needles. The man next to me told us how a hole below the water-line in the double bottom of a ship is plugged by the use of an "underwater gun." An elderly man who seemed to be a maker of paper-milling plant said that, when he started his career, his father, then managing-director, made him first go into the stores and learn the names of all the items; when he had achieved this, he was apprenticed to a journeyman-fitter who sent him to the bench to make some of the tools he would have to use.

He also volunteered an old saying that the second son of a farmer made the best engineer, instancing one of his acquaintance who had recently built single-handed from scrap material a heavy farm-trailer, his only tool not in general use being a breast-drill. This saying was new to me, but it also seemed relevant, so I put it away in my mind to be examined when the confused jumble of ideas had sorted itself out somewhat.

It was harvest time and the brain perhaps works slowly, in the open air and the easy rhythm of the real country, but it does its work less painfully than in the average R.E. office. One by one simple ideas came clear and I will set them down as my apology for appearing in print:—

(a) I, at least, had never more than a very woolly idea of what I meant when I talked about the "right type of officer"; there had to be a specification for him before his recruitment could be properly tackled.

(b) To get the best possible answer the ideas of many of the most experienced officers were needed. Formation Commanders to say from the outside aspect what the right type needs, and those responsible for some of the big war jobs to say to what qualities they attributed success.

(c) It is an important subject, even if the impending axe reduces its urgency; our generation has had unequalled experience in two Great Wars of large numbers of officers; its views should be canvassed while fresh in the memory and recorded.

(d) The men whose views will be of most value are retiring rapidly, but most of them get *The R.E. Journal* and an article in it might provoke them to reply.

*

> " such men as had the fear of God before them, as made some conscience of what they did;"

The Corps needs men who set themselves a high standard and do their best to keep to it, who are always where the danger is greatest or the work most difficult or most unpopular ; it should set a high standard, but in this it will be in competition not only with the rest of the army, but also with other professions, for instance, the Church. No profession has an exclusive claim to such men, any more than to hard workers ; if it had, in either case to advertise the need should result in an adequate supply ; that is the result of a high standard.

The Corps does also need hard workers, but at one time there was a tendency to apology for a relative reduction in Corps pay on the grounds that the R.E. worked longer hours than the rest of the Army— as if Corps pay were a sort of overtime rate; the real hard worker likes work and is happier with it than without it, irrespective of his pay. That apology was bad policy, and this definition is also inadequate; for the staff, for instance, also need hard workers and the Corps does not want to lose too many of those it recruits.

The R.E. officer needs to be differentiated from those most like him, those with whom he may be integrated ; they are in three categories :—other Army officers, especially Staff and Technical Corps ; civilian engineers ; and the rank and file of the Corps.

This differentiation raises thorny questions which I can remember being argued off and on all my service. For instance, does the Corps expect its officers to cover too wide a range? Are civilian engineers in fact more specialised? They may be qualified in two branches, but seldom more; whereas an R.E. officer had to be ready to tackle any branch without notice and often several branches simultaneously. The last war has added several new volumes to the library which he is expected to have digested; will this extension of his knowledge continue to grow and, if so, does it provide one of the terms of the definition sought?

Again and related to this, should the R.E. officer be skilled in one or more trades; if he is differentiated from the civilian by his wider scope, then the point made by my train acquaintance, that an executive benefits in civil life from practical experience of the trades under him, may not apply. But it might be said that the right type of Sapper is the "jack of all trades and master of *one*" and of the R.E. N.C.O. the same, with some power to lead and to instruct added; to learn a trade, one must start young, long before one knows whether one will be an officer or not.

These questions emphasize that the ultimate aim should also be defined, because in my opinion specialization or skill in a trade may be useful to an amateur degree ; but driven too deep they are apt to conflict with the wide view which it is necessary that a Chief Engineer, for instance, should take. If the rank and file of the Corps have to reach a professional standard in a trade, I admit that it is undemocratic that those who are to become officers should not ; yet I am afraid that, if the latter had to learn a trade, their chance of becoming Chief Engineers might be reduced. I should be interested to hear what proportion of officers who were given specialist E. & M. training became Chief Engineers ; I suspect that it is appreciably lower than the overall proportion throughout the Corps as a whole.

I expect this will be the Delhi of this campaign, a battlefield as it was in previous campaigns; I may as well confess at once that I am against specialization and for the wide view. In my opinion, when searching for "the right type of officer," the Corps should have in mind one who will make a good C.E.; he should automatically make also a good C.R.E. But I do not think the reverse to be always true. There have been in peace for some time more than one kind of C.R.E. and in the last war the varieties of them increased and many of them were specialists too limited in experience to be fully qualified for the work of a C.E.

There will probably be opposition to this, for the C.R.E. has always been considered the key-man in the organization of the Corps and the new Regimental command must generally enhance his importance ; while the C.E. has normally passed out of the Corps and is a staff officer. But the Corps is judged from day to day by many men of importance on the latter and his staff ; if he is of high quality and has the knack of picking a good staff, it is the Corps that benefits. The C.E. is normally supreme in technical matters in the province of his formation, for there cannot be many Commanders oriental enough to want to handle two C.Es. direct ; he is usually in a much better position than the C.R.E. to move officers round until all the square pegs are in square holes.

I believe that the range of responsibilities of the C.E. is liable to increase rather than be reduced and, if the holder of the appointment possesses the necessary breadth of outlook, his views carry great weight with higher authority, not necessarily military; for instance, when part of a Divisional Engineers is taken from its Division and spread half across a continent, independent of all local formations, a protest by its C.R.E. would be expected and ignored; but a protest by a C.E. might lead to realization that this was perhaps politic, but was not good military organization. Mobilization schemes used to be full of anomalies, of which perhaps, the most prominent was the first line Division which had to borrow Engineer units before it could take the field; I have no doubt that protests by the C.R.E. were legion, but I suspect those by the C.E. were few, or the plans would have been modified.

I intended, when starting this paper, to ask many questions, but to avoid answering them ; having committed myself in this matter of C.E. versus C.R.E., I might as well build up the definition, though the process of differentiation is not yet complete. I am certain that to a C.E. breadth of outlook is as desirable as technical efficiency and I suspect that to a nonspecialist C.R.E. versatility is at least as useful as knowledge of a trade. Since not every officer can expect to rise to C.E. or even to C.R.E., those who find they have the mentality of specialists will continue to gravitate to the specialist branches, such as Survey and Railways, and to pursue their ambition on other lines than high military rank. Their narrower experience may bar them from positions as senior Engineer advisers while others, possibly of lower technical ability, may find it easier to become staff officers.

For I can see little or no difference in essentials between the qualities required in an R.E. officer and those for a staff officer and I take it that the American staff system indicates that they agree. This explains the apparent anomaly that, in an Army in which the percentage of technicians is rising and the proportion of those less gifted, whom my old mathematics master used to call "walking sandbags," is dropping, the higher ranks of the parent technical Corps should become less technical. The senior officers have to deal, and sometimes argue, with more people who do not understand technical language and do not accept unchallenged purely military reasons; moreover relations with new "customers" and other services are apt to be coloured by first impressions and these by ability to grasp quickly a different point of view; since each service speaks a different jargon, it is the use of the common tongue that tells in such cases.

To differentiate the R.E. officer from his equals in other Corps may be a valuable domestic exercise, but I cannot see the result ever receiving official approval and without that it could not be published officially or be of much help in a recruiting campaign. To compare, for example, the Royal Corps of Signals with the Corps seems to me like comparing the G.P.O. with the engineering profession as a whole; many of the personnel are interchangeable, but the responsibilities of one are fairly clearly defined and of the other practically unlimited. The same applies to R.E.M.E. and to accept the quality of versatility in the definition of the R.E. officer would effect the differentiation required.

Next, to differentiate officers-to-be from other ranks within the Corps, there must be a completely fresh mental attitude ; I suspect that in some minds there is still a vague picture of a passing-out list after a stiff examination and "the right type " are the top fraction in the result. Not only has the old examination system with its marks and subjects gone, but also the ability to pass examinations or to cope with higher mathematics are recognized as having little, if any, connexion with subsequent success in the Corps. But, until there is general agreement that what has taken the place of the old examinations is satisfactory to all ranks, the new arrangements must be considered to be fluid.

I remember asking one candidate for a commission, who had had no chance at any time to look at higher mathematics, whether he was ready to take them up, or whether the idea of having to study and use them frightened him; for lack of anything better, I propose to take from this the germ of another part of my definition, which will now read that the right type of R.E. officer, must be versatile, self-confident, always ready to learn and capable of making the most of what he is taught. I am not quite happy about the last clause, but I think that the man who never rises above Corporal is limited either by inability to use what he is taught, or inability to learn to rise higher. When I commanded a unit, the chief ambition of the average Sapper was to learn to drive a lorry, just as the ambition of most drivers was to learn a trade.

It seems therefore as if the right type of R.E. officer who will make a good C.E. is the type that never grow old ; men who retain all their life the interest of the bright schoolchild in new things. Such people usually have a strong sense of religion, though not necessarily "churchy", and I think this connexion is reasonable; for the readiness to learn and to continue to learn all one's life—a deep unalterable feeling that one knows so little, while there is so much more of interest and importance—must be an expression of humility, a facet of the sense of proportion and related to the sense of humour. In part, it seems, there is backing for the old saying about R.E. officers.

To demand this kind of humility and at the same time self-confidence is not, I think, to be contradictory; for it is possible to be confident about what one does know and simultaneously humble about what one does not know; moreover it is good that one should have to be quite clear about how far one's knowledge extends, for it prevents one being that very unreliable specimen, the "flat-catcher." Confidence can be taught to a large extent; were we not told as Y.Os. at the S.M.E. to say "Yes," if asked if we knew how to do something; if we did not know we were only guilty of anticipation, for we had to go straight off and find out. If the germ is there, versatility also will develop with experience, while the ability to absorb what one is taught is a matter of concentration, given average intelligence. It seems to me that only the readiness to learn, or educability, must be inherent, and perhaps experts could even teach that; but I think it is good that the definition does not demand a high proportion of inherent qualities, for it means that the Corps will still be able to accept the great variety that human nature offers and there will be no stereotype. The Royal Engineers will still consist of optimists and pessimists, artists, gamblers, thrusters and the kindly altruist doing "good by stealth"; there will also be "Yes-men" and those rarer, but not less troublesome, "No-men."

To balance the educability and meet the need for R.E. officers to hold their own with confidence against allied commanders, civilian experts, plumbers, and others the Corps must provide the maximum facilities for education at all levels and in all places and seasons ; if the instruction is to be welcomed and not boring, the teachers must be of the best. But, if to have to teach is the best incentive to learn, the good learner must be half-way to being a good teacher ; it is therefore desirable to include in the definition some aptitude for teaching. Then the Corps could provide its own instructors, provided that University courses or equivalent facilities of the highest possible quality are retained or provided for instilling the scientific method in thought and instruction.

Even this last requirement does not differentiate the R.E. type from the purely staff type, since the latter frequently has to instruct "backward boys" and his juniors; but I think I have pursued this definition far enough and therefore offer as a basis for argument that the special attributes of the "right type of R.E. officer" should be :--

- (i) a very high standard of educability
- (ii) versatility above average
- (iii) some aptitude for teaching.

These three qualities will be needed in addition to the normal Army demand for leadership and self-confidence in its officers and I assume that, in spite of the German dictum that clever, lazy men make the best Commanders, Selection Boards still require hard work.

It is quite by chance that the three special attributes are more democratic than the two general Army needs; the Public School education may assist with leadership and self-confidence but the other three are independent of even the positioning of aitches. The requirements do not include any attribute which it would not be reasonable to expect at the age at which candidates appear; for instance, ability to judge other men will develop later with experience; if it does not, the officer will not rise very high.

If my reasoning and definition are anywhere near the mark, the staff officer should have the same qualities as the R.E. officer; it would not be unreasonable, therefore to expect a good deal of transference from the Corps to the staff. I do not know if those who think it undesirable to encourage men to use the Corps as a stepping-stone to other employment include the staff in this last phrase; there being no direct entry into the staff for officers, I do not think the objection would be very firmly held and I expect it would be waived in the case of a man of strong character who might well go higher.

Similarly, even if one recoils on first thoughts from the idea of the Corps being used as a waiting-room for ambitious men whose minds are primarily fixed on their personal interests, some would admit as an exception the man intent on becoming perhaps an M.P. and might even respect him. With these the objection is not so much to the ambition to return to civil life rather than pursue a military career, for its strength seems to vary inversely as the respectability of the proposed employment; once that is admitted, the defence begins to break down, owing to the difficulty of drawing the line. Many of us can think of more than one officer who retired prematurely, but from whom on their return the Corps received reflected glory; it was this thought that made me change my mind.

For instance, I wonder what the late Brigadier Kisch would have said on this subject ; his was a special case, a loss to the Army becoming a gain to the Corps. If he had not retired between the wars and had risen to a higher rank outside the Corps, he could hardly have won more laurels than those who knew him think that he deserved ; remembering him as a junior officer in war and as a much respected civilian in peace, I think it is suitable to have recalled his name, when discussing the right type of R.E. officer. I do nct imagine that he entered the Corps with the avowed intention of leaving it ; but it seems to matter little whether such ambitions are conscious or merely latent and, if there is a conscious intention, surely it is more honest to confess it.

Under my definition such men would seem to be too versatile and to have a thirst for knowledge that cannot be confined to military subjects and embraces a double sphere. In the time of the Army Course at the London School of Economics it used to be argued that an officer was the better for some civilian instruction; certainly a man who has made good in both military and civilian employment should be more welcome in either, since his extra experience will at least have given him more self-confidence and a wider outlook. Of course it is essential that while they are in the Corps, such officers put Service interests first and give no cause for suspicion that their hearts are not in their work; but otherwise it seems to me that the right policy would not discourage them from seeking outside employment, even if it involved retirement.

It may be argued that such an attitude would lead to constant difficulty in keeping the Regular list full; but every man who has served in the Corps and been permitted to retire prematurely without reproaches, in order to take up other work, is our ambassador and will welcome the chance of helping with recruitment and on mobilization or in times of difficulty like the present. Moreover the Retired list gains to the extent that the Active list loses and that may be some slight compensation.

I am not a psychiatrist and do not propose to take up even more space by dealing with the methods of selection of officers ; it may, however, be relevant to draw attention to the opinion of the President of the Psychological Section of the British Association for 1947, that intelligence tests in the Army "were tests of versatility rather than of specific aptitudes"; it would seem that all candidates for the Corps should have I.Qs. above average which is, I hope, already the case

But I cannot justifiably end without reverting to the matter of recruitment of officers which originated this argument. The first source of supply is the sons of present and past officers of the Corps ; if these were forsaking ancient loyalties and entering other units, an obvious remedy would be to circulate their parents and enquire the reason. As a parent of a possible future Sapper, I have not received any such enquiry and I do not therefore think that this can be occurring.

Then there will be those whose choice may depend on the prospects of promotion, such as the sons of the rank and file of the Corps, past and present, and the relations of other service men without strong ties to any particular unit. The Corps can, I believe, offer better prospects than most in the form of the percentage of officers reaching various higher ranks, the ease of transfer to the staff, the variety of work the various branches offer and the exceptional opportunities on retirement.

For the completely unattached youth, who finds the life in the service appeals to him and is open to persuasion, the Corps surely has a case to put before him second to none; if he can be reached by film, lecture, or poster, there are countless compelling illustrations to be drawn from the outstanding feats of the last war and even from earlier history; there are also persuasive pens no doubt ready, if asked, to write up episodes in brief, attractive form. I expect these methods and others are already in use and that the civilian Institutions of the various branches of Engineering with whom the Corps is always in the closest touch have been asked their advice; they have sent us so many indispensable officers on mobilization that they are really a second line to the R.E. and their views would be valuable.

If it is too late to make the appeal after the call-up in the Training Units, as in the case of lads who have already made up their minds, many schools and particularly those patronized by service parents would welcome a good lecture or film on these lines. It may be necessary to find ways of approaching dayboys and others with their parents in their homes and I suggest that every retired officer is a potential recruiting officer for these ; all boys face conscription now and every year many parents must wonder what choice their sons should make ; the number of the latter who would make good R.E. officers is not unlimited, and it might be possible for retired officers to find the time and way to guide them. But I am sure that in all cases it would pay to be direct and publish the qualities needed ; the retired officers must be aware of the official policy, if they are to help.

There is that remark in the train about the farmer's son making the best engineer to be cleared up before I end. I have seen a farmer's son working side by side with two ex-R.E. and admit at once that there is little to choose between them in strength, endurance and versatility, and the former is the more observant. I believe that there is a good deal of truth in the saying ; a farmer may be slow, but a good one will say that he never stops learning ; he is expert in weighing priorities, this year's crop against the long-term rotation, in improvising and in overcoming shortages.

The Economist, however, says that the country's need at the moment is a "programme of posteriorities" and few bodies of men can have had as much experience as R.E. officers with that; it seems to me that the Member of Parliament also requires the same qualities as I have defined; he should not try to be too expert in any subject, for he has all experts at his service; he must always be learning and is the more useful for being versatile. Today, when I am in the middle of typing this, a professor has declared publicly that "only a combination of economists, engineers, and scientists can achieve" the production necessary to pull the country out of the present crisis; the R.E. contribution to this might be that admirable document for a bird's eye view, the "Engineer Appreciation."

These are digressions and this article is already too long. My primary object has been to provoke others into committing their views to paper ; in order that no suspicion of personalities should arise, I have taken the precaution of using a nom-de-plume which will not be recognized outside the R.E. household to which its Irish author belonged. As a target for those with different views, I have tried to set up a composite profile of the R.E. officer of the future ; I hope it does not compete with other Corps and is simple enough to be read out to those for whom it is intended ; and that, if they are of the right type, they will say, "That is what I am going to be."

A SUBALTERN IN THE GILGIT AGENCY

By Major R. M. POWER, R.E.

A FEW years before the last war, I had the good fortune to be appointed A Resident Engineer, P.W.D., in the Gilgit Agency, along the northern frontier of India, where met the three Empires of Britain, China and Russia behind the Himalayas. It was a strange existence of an almost forgotten age, in a land still living in feudal days. There, cinemas, cars, in fact any form of wheeled transport were unknown. It was a life without the present day quest for ever increasing haste, a life far removed from crisises yet with a sufficiency of modern conveniences to temper it to a comfortable standard, provided one could quell any yearnings for the bright lights and a gay time. It certainly was an experience that comes the way of few sapper subalterns and these disconnected jottings may help to convey some impression of it all.

To get to Gilgit, one leaves the railway at Rawalpindi and motors up the 200 odd miles to Srinagar in Kashmir. Thereafter lies another 200 miles of pack road before you arrive. Everything that comes to the Agency must complete this last portion of its journey on its own feet or on the backs of coolies or animals. Many are the peculiar shaped loads that you meet on the road and many a queer tale of adventure could be told by various things now firmly established in the Agency. For instance, the pianos which must have been carried up by coolies, and the numerous wire ropes spanning the many suspension bridges and which must have originally snaked their way up, carried on the shoulders of a long line of coolies, up and down the bridle path, twisting their way round the zigzags and bends.

The route from Kashmir crosses the two passes of the Tragbal and the Burzil, 11,000 and 13,500 ft. high respectively. From about the middle of October to about the middle of June, the Burzil pass is closed to animals on account of the snow, but mailrunners are able to cross throughout the winter, at intervals and with difficulty, so that during these months the link with the outside world through India is limited to this irregular mail service and the telegraph line. The runners, working in relays, took six days to complete this journey in the summer, whilst in the winter letters might take anything up to the same number of weeks or even more during particularly bad times of avalanches and blizzards. Avalanches are the runners' greatest danger on the Burzil, especially in March and April, when rising sun temperatures make the snow on the steep hillsides treacherous. The weather usually gives warning of approaching storms and, even if the runners are caught out in a storm, there are special huts every few miles in which they can take shelter. An avalanche is a very different proposition, it may come unexpectedly and a man caught in one has little chance of survival. In the autumn of 1891, 250 men of the 5th Gurkha Rifles were caught in an unexpected storm on the Burzil on their way to the Hunza-Nagar war and they suffered very severely from frost-bite with many fatal casualties.

It may sound somewhat remote, and certainly many people had queer notions as to what life in Gilgit was really like. Some imagined that it was all very tough, possibly living in tents and eating off tin plates, and it surprised them to learn that it was a family station. Nor during the winters were we completely snowed under, for the town of Gilgit is only just over 4,000 ft. up and the snow rarely lies for any time. The bungalows too, were large and comfortable, agreeably furnished and all possessing large gardens with an



abundance of fruit. There was also a hospital, well staffed and well equipped including an X-ray apparatus worked from a portable generator.

For those who have never visited an area so mountainous it is impossible to portray the vast scale of everything. Giant mountains rising from the valleys to 15,000 ft. and more in a horizontal distance of a few miles. Cliffs with a sheer drop of thousands of feet. Mountain streams at one moment a raging torrent, swollen by snow water melted during the day by the burning rays of the sun at high altitudes, yet in a few hours reduced to a current that is no obstacle to man or beast. The valleys sweltering in the summer heat reflected from the bare rocky walls rising on both sides, yet a few hours journey away high up the side nullahs, you will be thankful for warm clothing and for a fire at night. Journeys that cannot be judged by mileage alone on account of the frequent ups and downs and the state of the route. Of areas carefully guarded by nature, for whose conquest tremendous physical difficulties must be overcome, difficulties of snow, of wind, of the effects of high altitudes on your own endurance besides the actual obstacles of the terrain, its steepness, its rockiness and lastly your dependence on your own initiative and resourcefulness, no shops, no service stations, no organizations to assist you and to attend to your wants. A thing forgotten or a mistake made cannot always, in fact rarely, can be made good. Accidents will happen, misadventures will occur, your kit may be dropped down the hillside by a carcless coolie or go down with an animal, you or your servants may go sick or get hurt when you are literally miles from anywhere and several days journey from help.

This remoteness breeds a local people almost self-sufficient in their wants, though nowadays they are increasingly asking for outside luxuries. Formerly salt was the only outside necessity of life, but each year, as so-called civilization took a firmer grip of these people, they demanded increasing quantities and varieties of goods from India. Chief of these were tea, sugar, oils, boots, clothing and trinklets for their womenfolk. Gone forever are the days when they knew not the things they did not have, and therefore led simple contented lives untroubled by desires and covetousness. In those days their clothes were made solely from the wool from their flocks, spun during the idle winter months into a coarse cloth called puttoo. A little cotton was also grown and made into the occasional shirt for a local plutocrat. Footwear was made from skins, sometimes sewn into the shape of a boot, but more often just wrapped round the feet and legs. Puttees were universally worn, and it is said that the idea of the military puttee originated from these parts. In the remoter valleys and uplands, one still met people living in this manner entirely supported by the products of their fields and of their flocks. To these simple people, money often meant nothing compared with the possession of something tangible, for you can neither eat it nor wear it, the principle requirements of mankind. The value of herds to such people was considerable, for their animals provided not only the occasional meal of meat but the skin was turned to all manner of purposes, besides boots and providing the wool for spinning, such as bags for grain and floats for their rafts.

In this extraordinary country we have massive mountains, rugged and barren at their bases but softening off towards their summits, through pine-clad grassy slopes to the haunts of the ibex, whither the flocks are taken for the summer grazing. The valley sides are too steep and too barren to support vegetation, so cultivation is restricted to alluvial patches alongside the rivers and where the side streams emerge from their precipitous descents from the uplands, bringing the precious water from the melting snow. Here then on the cultivated sites are found the green fields dotted with their orchards and villages, irrigated from man-made water channels and producing such a vivid, cheerful, green patch contrasting sharply with the surrounding brown barrenness, and providing a cool place of rest for the hot, weary and thirsty traveller after traversing the intervening stage from the last village, exposed along the treeless and offtimes waterless road to the full heat of the sun's rays intensified by the reflection from the rocky hillside.

The mountain ranges are as a rule 10,000 to 20,000 ft. high, and contain such well-known ranges as the Karakoram or Mustagh, the Kailas, with Rakaposhi 25,500 ft., and in the south the western extremity of the Himalayas, marked by that famous and as yet unclimbed peak, Nanga Parbat, the scene of several German climbing expeditions. Within sixty-five miles of Gilgit the survey maps show :--eleven peaks 18-20,000 ft.; thirteen peaks 20-24,000 ft.; eight peaks 24-26,000 ft.

Nanga Parbat means naked fairy. Like most hillmen, the local people are firm believers in fairies, so much so that in many of the more secluded nullahs high up in the mountains, no man will venture forth without a companion, because of the numerous legends concerning the unaccountable events of the past. Tradition relates that on the summit of Nanga Parbat there is a tree covered with precious stones and safeguarded by fairies, who protect this tree by bringing down storms and avalanches at will. This explains why the sahibs are so determined to reach the top, for why else do they repeatedly return after the fairies have driven them back with so much loss of life. In the first German expedition several climbers lost their lives when caught in a storm near the summit, whilst in 1937 the whole expedition except for two people in the base camp were killed by an avalanche which carried away their camp during the night.

Though Gilgit lacks modern types of transport for touring, such as cars and trains, it has its landing ground which was frequently visited by the R.A.F. It was in December, 1938, that we had a visit by a bomber transport Valencia from Risalpur, with a very assorted load of passengers with equally varied excuses for their presence on this flight. These visits by the R.A.F. were always popular, they introduced new faces and helped replenish our supply of beer, though this rarely survived the visit. The R.A.F. also welcomed the opportunity during the summer to escape the heat down on the plains. The flight up was always made in the early hours whilst the air in the valleys was still clear and cloudless, then as the clouds began to form up with the rising heat of the day, it took little persuasion on the part of the pilots to decide that it was too chancy to return the same day and that they would have to stay overnight and make an early start on the morrow. We usually made them play football in a match versus the Gilgit Scouts and filled in the between-time with rounds of parties in every house in turn. Sometimes these visits became somewhat too hectic and if they extended over several days, we felt quite relieved at the departure of our guests and the opportunity for a return to our normal life of quiet. On this occasion I had asked for and been granted permission to fly down with my bearer to India in the returning Valencia, and as the passes from Kashmir would be closed by the arrival of winter, I planned to return by the easier but longer route through Chitral over the Lowarai and Shandur passes.

It was certainly a most exhibitrating flight, probably one of the more spectacular ones regularly carried out at that time by the R.A.F. Some 150 miles to Risalpur over some of the most mountainous country in the world, where forced landings are not thought of. In 24 hours we comfortably accomplished a journey which by other means would have taken at the quickest ten days and then only with considerable discomfort. The same day I moved on to Rawalpindi and took great delight in answering people's inquiries as to where I had come from, with a casual "Oh! I left Gilgit this morning."

After two days I had to start back as I had promised to return for Christmas. The first night I reached Malakand by train and mail lorry, and stayed in the fort. Malakand was the scene of desperate fighting when the pass was stormed in 1895 by the Chitral relief force under General Sir Bindon Blood.

The mail lorry in the European mind conjures up visions of a smart red turnout, driven by a uniformed post-office official, but not so the Indian mail lorry. Ours was the usual dilapidated taxi lorry type, an American light lorry chassis with a bazaar-made body designed to carry a maximum of passengers and a goodly load of merchandise on the roof. Our roof was piled to capacity giving a top-heavy appearance and adding a distinct swaying motion to the lorry as we careered round the sharp mountain bends. The insides were similarly crammed to capacity with a motley collection of passengers in varying degrees of unwashed, one of whom carried on his arm a fierce looking hawk, unhooded and very much alive, casting pugnacious and penetrating glances at all and sundry as though not quite decided whom to attack next. The passengers were divided into three classes, the accommodation in each class being much of a muchness but the price slightly enhanced for a considerable diminution of "B.O." First class is next to the driver and from here I escaped the odour of fellow travellers, besides the presence of the hawk who was riding third class aft. Sometimes the first class seats are advertised as "springy seats," a fact of which you become acutely aware when the lack of padding permits physical contact with the springs. As a means of transport for impecunious subalterns these buses were amazingly cheap, though at the cost of some comfort. Their owners were not worried over details such as depreciation, garaging, cleaning or even maintenance provided the bus goes. Unfortunately time means little to the owners ; as Kipling said " You cannot hurry the east," and every journey takes a mythical one to two hours. But whatever time you start, you never seem to reach your destination until nightfall, after allowing stops for the passengers to drink innumerable cups of tea, the driver to say his prayers, if he is a devout Mohammedan, and even delays whilst the cleaner is sent to tout for fares when there is room to squeeze in a few more passengers. The driving technique can also be somewhat unnerving, especially on mountain roads, the horn taking precedence over the brakes or action at the steering wheel when a crash appears imminent. In many ways there is some logic in this peculiarity of the east, as the opposing driver may be in a state of oriental mental stupor, and it is better to wake him up, rather than risk scraping past with the danger that he might come to at a critical moment and do something rash. Another exasperating trick is to economize petrol by free-wheeling whenever possible. When the slope is not sufficient to free-wheel the whole time, progress is by a series of mad rushes whilst the driver works his crazy vehicle up to maximum speed, then switches off his engine and careers along with the minimum use of brakes, scraping round corners and past vehicles until his speed has dropped to a mere crawl, when with a crunch the gear lever is forced in, the engine starts and you are off again to repeat the cycle. It makes you wonder whether special gear-boxes are provided for Oriental buses,

Next day leaving behind the memory of a very hospitable evening with the Gurkha battalion stationed in the fort, I continued my journey by mail lorry to Dir at the foot of the Lowarai pass. The first part of the journey was across the fertile plain of Swat, where the inhabitants, under the skilful if somewhat vigorous policy of the Wali, their chief, had truly forsaken the sword for the ploughshare. Everywhere there were fields and signs of intensive cultivation, but after crossing the river at Chakdara, we entered more mountainous country where the road twisted and turned, ascending and descending over an increasingly desolate country the further we advanced into it. As the miles rolled by, the villages became fewer, the land more barren, the hills steeper and larger, and the top of every rise revealed more and more hills. We eventually reached our destination, Dir, just as it was getting dark. I stayed that night in the Levy Post, a miniature "Beau Geste" type fort with a small courtyard about the size of a rackets court. The chowkidar insisted in providing breakfast and produced a most succulent dish of scrambled eggs on a chuppatti.

The next morning we rose early to cross the Lowarai pass. From the Levy Post we rode on borrowed ponies to within a mile of the pass, up a good pony track, well surfaced with a steady uphill grade. It was a glorious day, a clear blue sky, quite warm in the sun, but near the top we were greeted by a cold biting wind blowing from the north. On the south side there was no snow until near the summit, but on the pass itself and the north side there was some six to nine inches of snow. The top was like most Himalayan passes, a steep final ascent and descent over a narrow col about 5 yds. wide between two hills. On the Chitral side there was a magnificent view looking across a series of wooded ridges to the snow hills in the distance, giving you the feeling of being on top of the world as you gazed away into the distance over row after row of mountain tops.

The descent on the far side was steep and slippery where the snow had been compressed on the path. Under the shade of the trees it was cold and the wind's chilly blast reminded you that it was winter and not a pleasant spring day at home. We reached the foot of the pass by evening and were met by a car which carried us rapidly to Drosh, in time for dinner. It seemed an uncanny contrast from walking over the pass with its feeling of being on top of the world, miles from anywhere, to this sudden rushing along in the gathering twilight. Perhaps it was because, during my six months in Gilgit, I could not bring myself to associate a car with these mountains, their solitude and their grandeur. Somehow it seemed all wrong to me, but nevertheless I welcomed it as it saved me a night in another Levy Post, and before long I was wallowing in the luxury of the Garrison Engineer's bath with unlimited hot water, and what a bath !

Cars and lorries had become an established necessity to life in Chitral. They were manhandled over the Lowarai Pass and thence a road extended from the foot of the pass to the capital at Chitral itself. Motor cycles have been ridden further afield to Laspur on the Gilgit boundary at the foot of the Shandur Pass. In Gilgit we had never risen to such modern fancies, in fact wheeled transport was practically unknown. There was one bicycle in Gilgit itself which made the owner, the son of a shop keeper, universally unpopular, as the local ponies never took to the idea. A French expedition once carried a car up from Kashmir under the misguided impression of meeting another party that had set forth from Peking. Having carried the car the best part of 200 miles, they assembled it outside Gilgit and drove in the last mile or so, but then wisdom prevailed when they learnt that the worst part of their journey still lay ahead of them and they called the expedition off, expending the balance of their exceedingly well equipped rations in a series of parties when the champagne flowed and helped to wash down many French delicatesses.

Drosh, where I halted, was the headquarters of the Chitral Force consisting of an Indian infantry battalion and supporting arms including a Sapper and Miner section. I stayed there two nights. It was not a camp like so many frontier stations, but was divided into Upper and Lower Drosh. Upper Drosh with the battalion in a fort and Lower Drosh a collection of huts with no surrounding wall nor fence. The valley here was not unlike the Gilgit valley except that it was wider and if anything the hills were greener and did not give one the impression of being so hemmed in. The next morning being a Sunday, I had hoped for a "European" morning with a long lie in bed, but instead I was dragged out in the dark to gallop to a chikor shoot. It was very cold and the darkness did not combine to make me feel any the better until the shoot was over and we sat down to a very enjoyable breakfast in the pleasant warmth of the early morning sun. As a shoot it did not come up to our Gilgit standards but perhaps the birds were also a little off colour. Seven guns got seven brace between them, whereas my Gilgit game book records an average of 5¹/₂ guns and twenty-two brace over twenty-one shoots.

My next stage was Chitral itself, the capital of the state, where was also stationed a company from the battalion at Drosh. One of the Chitral lorries ran a mail service between Chitral and Drosh, and I arranged with the owner to travel up in his lorry, but he drove a harder bargain by sending his lorry a day earlier without letting me know so that I had to hire his car. It was another of those fine spring-like days with the sun adding its pleasant warmth to an otherwise nippy atmosphere. The valley along this route is quite broad, a matter of some miles, and though the trees were leafless and the fields were barren, the bright clear air and the mountains combined with the cumulus clouds to give a great feeling of exuberance. It was a good road with a very fine suspension bridge which we crossed to enter the fort of Chitral. We saw several other fine bridges, mostly suspension, and all made by the Sappers and Miners from Drosh. Generally these bridges were far more substantially made than ours in Gilgit.

Chitral had recently suffered an earthquake and the fort was badly cracked. Some walls had had to be pulled down and many parts were supported by a forest of props and struts. The same evening it clouded over bringing to an end the spell of fine weather. For the remainder of my journey it was to remain clouded and miserable. It is amazing what a difference the sun can make to one's life. In the plains of India during the hot weather, one curses the sun and its heat, and prays for clouds and rain, but in the cold weather and in the hills, what is a pleasant warm day instantly becomes bleak and miserable as soon as the clouds cover the sun. Gilgit was particularly bad in this respect. In the winter, you would scarcely see the sun for weeks on end, and even on sunny days it did not appear over the hills till after 9 o'clock in the morning, and as it disappeared back behind the mountains about 3 o'clock, you could feel yourself chilling all over and in a few minutes would be thankful for all the warm clothing you could lay your hands on. In one particular valley which ran east and west, the inhabitants on the south side received no sun at all during the winter, and in contrast to their more fortunate neighbours on the north side, they were a miserable lot who looked permanently depressed and tired of life. The motor road ended at Chitral so I now had to take to animal transport. I was kindly lent a pony to ride and hired transport for my bearer and kit from a contractor.

The next few days were an uneventful journey with cold miserable weather, through a series of gorges following the Mastuj river and every now and then opening out on to clusters of villages and fields. The country looked barren and inhospitable, the inhabitants cold and dejected. The poor wretches looked as though they had not enough to eat nor fuel to keep themselves warm. I suppose that they were going through a state of semi-hibernation just keeping body and soul together until the time came to prepare for the spring sowing. The first night I stayed at the village school of Barennes. It at least had a roof and walls, and one deck chair with a negligible safety factor. Evening classes were in progress when I arrived, the master muttering away to himself, the boys writing on their boards with their pens of softened sticks dipped in mud. They did not seem to be learning much but I supposed it kept them out of mischief. The lambardar, or village headman, a venerable old man clad in a fur-lined coat and an astrakhan hat, regaled me with lurid stories of the siege of Chitral from way back in the last century, He claimed to have been twelve years old at the time and amongst those besieging the British garrison inside the fort. Indeed it was down this route up which I was now travelling, that many stirring incidents took place during the advance of a relief column from Gilgit, at the same time as the force under Sir Bindon Blood advanced from the direction of Malakand. A favourite method of attacking columns moving down these valleys was to hold up the advance at a pre-selected place by building a wall, called a darband, across the road, then whilst the column was halted in the gorge below, men would start land-slides by running across loose shale slopes up the hillsides and the unfortunate enemy would be showered upon with stones. This method of attack could be carried out at many places as such loose slopes are a common feature in these parts. Rain alone will start many of these slopes running and at bad places a slight shower will carry away the whole road.

At Mastuj my transport, which consisted of donkeys, were showing signs of exhaustion which was not surprising as we were averaging about twentyfive miles a day. Though I had been promised mules, I had been given donkeys, and as I had not been able to attend the loading on the first morning, I did not discover the substitution until I overtook my baggage several miles out from Chitral, too late to do anything except curse the contractor. The wretched donkeys took anything up to twelve hours to complete a day's march, so I decided to dispense with them and engaged local men to carry my kit.

Mastuj looked bleak and miserable. There was some snow about, the clouds were down below the surrounding hills, so heavy and overcast that one forgot the sun's existence. There was a fort there, belonging to the local governor, situated in the middle of a large area of cultivation, probably a delightful place in the summer with the fruit trees in blossom and the fields under crops. Just before reaching Mastuj the road climbed up across the face of a very high and steep cliff. It rose steadily, zigzagging backwards and forwards to gain the necessary height. I was paying no particular attention to anything till we reached near the top, when I glanced down into the river gorge below and got such a nasty shock. The cliff convexed out so that one could not even see the river several hundreds of feet down, and from my pony's back, my foot was lined up with the far bank pier of a suspension bridge. To make matters worse, there was no parapet along the edge of the road, and my pony, like all hill ponies, was walking along the outer edge of the road. It gave me a nasty fright for a moment and seemed to exert a queer fascination that required quite an effort to take my eyes away from the dizzy depths below, unpleasant though the height was.

The next stage was to Laspur, the last important village in Chitral before crossing the Shandur pass into the Gilgit Agency. We were now up 10,000 ft. in the middle of winter with not a ray of sunshine to cheer us or to add to our joys. It snowed during this stage. The pack road up to here was maintained by the Government P.W.D. and it was in excellent condition, better than ours in Gilgit, and had even been traversed by motor cycles. There were always arguments about whether cars and motor cycles should be encouraged or even allowed in Gilgit. Most people's immediate reaction on hearing that we had to ride everywhere were to ask "Can't you take a motor-bike along your pack roads?" But such juggernauts of this modern age would only tend to spoil the beauty and charm of life in these unspoiled places, not to mention the consternation they would produce amongst pack animals on a narrow mountain path with a precipice on one side and a cliff on the other. It takes a little time to adjust your tempo from mechanized to animal speeds and to think of journeys in terms of days in place of hours, but once adjusted you soon learn to appreciate the slower and more leisured speed of life in general. Motor transport has its right place, but to introduce it to these delightful backwoods would spoil their whole beauty, much in the same manner as so many of Englands beauty spots have been ruined by their commercialization with ice-cream barrows and repulsive tea shacks.

Laspur was cold and bleak. I stayed in the official state rest house, not a very salubrious building. It possessed an adequate roof, walls but no windows, and only apologies for doors. The window openings were there but either blocked up with stones or left exposed to the elements; the doors had rough timber panels without means of fastening nor hinges, the latter being replaced by short projections from the panels fitting into holes in the doorframe. Of furniture there was none, but, urged on by the foghorn-like voice of the lambardar, a charpoy, fuel and supplies were soon forthcoming. This unexpected arrival of a British officer in the midst of winter must have caused some excitement at a time when everywhere was under snow, and there was nothing to do except keep warm and await the spring. Even an English novel was produced, left behind by some traveller in the past and I did likewise the next morning, hoping that it might help another to pass the time as well as it served me.

The rooms had fireplaces, more ornamental than useful so that mine rapidly filled with smoke that escaped between the gaps in my stone-filled window, but I found that when sitting on the floor or lying flat on the charpoy, I was just below "smoke level." However, I was tired and it was bitterly cold outside, so I was only too thankful for any kind of shelter and these inconveniences were hardly noticeable at the time. My pony occupied the suite next to mine.

The following morning we crossed the Shandur pass on foot, the pony returning to his master in Drosh. It was still snowing slightly when we set off, the clouds were lower than ever and visibility reduced to about 50 yds. It seemed a tiring, long climb up to the pass though the grade was anything but steep. The pass itself is unlike most of the passes in this area as it is a long valley about five miles in length with comparatively low hills rising on both sides, though their tops are in the region of 15,000 ft. I was rather surprised at the number of people I met crossing it. I was told that it is not regarded as a difficult pass as it gets comparatively little snow compared with the passes further to the south, and that it is regularly used until as late as the month of March. During the relief of Chitral, Colonel Kelly's force coming from Gilgit crossed in April, the worst month in the year. They took twelve hours to cross and the pack guns had to be manhandled as the mules floundered in the deep snow.

I had camped on this pass the previous summer when the Assistant Political Agents from Chitral and Gilgit held a polo tournament there. Then the pass was bathed in glorious sunshine with the wonderful clear mountain air, the lovely luscious green grass and the delightful mountain flowers of all shades, such as one only finds at high altitudes. We stayed three nights on top and



A Subaltern In The Gilgit Agency



Gilgit Bridge.



Gakuch Bridge.



Gilgit Aerodrome.

A Subaltern In The Gilgit Agency 2

played on the polo ground made by one of the Mehtar's of Chitral, the title of the ruler. It was a good ground with a nice thick layer of grass. This particular Mehtar was a most enthusiastic player and at any place that took his fancy, he would order a ground to be prepared and he would remain there playing polo with his retainers and the locals. In the A.P.A's game we only played two chukkers of twenty minutes each, quite enough for ponies at this altitude of 12,250 ft. Even then the Gilgiti members in our team objected to this limitation as they claimed that it conferred an unfair advantage to the Chitrali ponies, who were used to playing such short chukkers which was their local rule, whilst the Gilgiti ponies were accustomed to no time limit, the game continuing until one side scored nine goals, so the ponies would naturally conserve their energies.

Gilgit and Chitral polo is a unique game of its own, somewhat different from the more recognized form as known to Europeans. It is the life and soul of the local people, so much so that every village of any importance has its own ground, usually where the road broadens out in the middle of the village, and every man who can beg, borrow or even steal a pony and a stick takes part, whilst his less fortunate brethren line the walls to watch the play. There are practically no rules except for starting the game, scoring goals and for the length of play. Crossing, foul hooking, dangerous play are not catered for, anything is allowed except deliberately hitting your opponent. You can even pull him off his horse if he catches the ball, when the game becomes a form of mounted rugger and the ball can be passed by hand, a goal being scored by either throwing the ball between the posts or riding through with it. At one time a goal only counted if the scorer could touch down after hitting the ball through the posts and before it was knocked back across the line. Meantime the scorer was fair game for all and sundry, but the casualty rate was so high that the touch down rule was abolished by common consent. Following a goal the game is restarted by a "tambuk." The scorer gallops down the field with the ball in his hand and at the half-way mark, he throws it up in the air taking it full toss with his stick. The crowd judge the results more by the height to which the ball rises rather than by its direction, and though good players do sometimes score goals from a "tambuk," more often than not it is just a "six" in the neighbouring fields.

As important as the players is the band. No band, no polo, and every village with any claim to importance will have its own band, hereditary musicians, consisting of a "dhol" drummer, a kettle drummer and two or three "sunais," a kind of chanter. They play continuously throughout the game, varying their tempo according to the play, sometimes slow, sometimes fast and especially during a "tambuk" they work themselves up to a crescendo finishing with the crowd's "ah!" or "ugh!" according as to whether it was a good or bad shot. So important a position does polo hold that polo balls are a recognized gift to the local chiefs. For sticks, willow shafts with mulberry heads are used, the heads frequently working loose, then flying off with a nasty whistling sound as they pass your ear. There was a delightful story concerning a newly arrived British officer, full of enthusiasm for polo and looking forward eagerly to his first game, only to have his ardour somewhat damped when his pony was knocked out by a smart blow between the eyes from a head that had parted company with its shaft.

To return to our travels. At the foot of the Shandur pass I met my own ponies that had come out the 115 miles from Gilgit, and we soon completed the remaining ten miles to the Agency Rest House at Teru. That afternoon it began to snow in earnest, but it was cosy and warm inside by a roaring log fire and working through many weeks accumulation of mail. In the Agency, the P.W.D. maintained rest houses for the use of officers on tour, and as we had to do a good deal of touring, a special effort was made to make them as comfertable as possible and to provide for all the traveller's wants so that he had the wherewithal to eat, sleep and rest in comfort. It certainly added to the enjoyment of touring besides reducing the amount of baggage that had to be carried around, and to a large extent made one independent of your baggage, as servants could always prepare meals without waiting for your kit. My bearer, a local man from Nagar, always accompanied me on tour, riding his own pony. In the morning, as soon as I got up, he rolled up my beddingroll and got the baggage away before preparing breakfast. After breakfast he dashed off on his pony, usually arriving before me as I might have some work to inspect on the way, and I would be greeted with a hot lunch or meal on arrival, the baggage not coming in until some hours later. We reckoned on averaging six miles an hour riding, whilst one's baggage on pack transport would with luck do two-and-a-half miles per hour. Baggage was the criterion as to length of a day's march and not you or your pony.

I now felt that the major part of my journey was over. Henceforth all was plain sailing with my own ponies, good transport animals, good servants and well-equipped rest houses. Our pack animals were supplied by a contractor, mules if you were lucky as they were hardier and faster walkers than ponies. Off the properly maintained P.W.D. roads, it was usually a case of coolies for baggage, as the paths were too steep and too rough for animals. Coolies introduced their own peculiar problems, chief of which was that they disliked going further than the next village, as the further they went, the further they had to come back, and again though the young men might not want to carry loads, they would prefer to do so rather than allow others to invade their domain, consequently one lost a lot of time changing loads at every village and in collecting new coolies. Good riding ponies were of course indispensible to comfortable touring. We all kept our own, mostly from across the border, either from Badakshan in Afghanistan or from Turkestan. They got good food, plenty of regular exercise and attention, and proper rest between tours. The locals on the other hand consistently overworked and neglected their ponies. Often at polo they would play the same pony throughout the afternoon in a succession of games, the players passing it on as they retired for a rest. One of the local chiefs acquired a new pony from across the horder and each son tried it out in turn, but there were too many sons and the wretched animal eventually dropped down dead.

From Teru I had another four days travelling. The cloudless cold spell continued with a very occasional welcomed glimpse of the sun. When the sun did shine it was pleasant, the sun temperature being enough to make gloves unnecessary, but even then the foot on the shady side of the horse soon became numb with the cold at 10,000 ft. Alas ! Gilgit boots were the answer, those long thick nummah boots with thick leather soles, but strange to say quite unobtainable in the land that gave them their name.

My route followed the Gilgit river, here called in its upper reaches the Ghizar river. These upper reaches were beautiful clear water with excellent trout fishing, fished at the most by two or three rods in the year for a few days on tour. Parts run through flat valleys a mile or so across with pleasant grass meadows on both sides, the river meandering sluggishly down the centre, all rather reminiscent of the Thames in Oxfordshire except for the hills rising to craggy heights on either side. It was a change from the rest of the Agency, where, in the valleys, one was always hemmed in by mountains and could never escape the ceaseless roar of the rivers, as their waters sped down in a series of rapids leaping from boulder to boulder. Here was quiet and in the summer the flocks grazed peacefully on the meadows whilst in the pools and sidestreams there were plenty of fish. One could ride along rod in hand, dismounting here and there to try a few casts. In this way I once killed eighty-two fish in seven days during a tour to these parts with a polo team to play a team from Chitral. One particular sidestream was always good for some large fish. There the water ran fairly fast and furious providing plenty of exciting sport, and there two of us killed twelve fish averaging two pounds in a little over two hours. The lower reaches of the Gilgit river are muddy and dirty from snow water, and here trout are only found in the occasional clear sidestream. From Gilgit itself one had to ride out three miles to the Kargah nullah where a two-pound fish was a very good size. The Kargah was overstocked for the feeding value obtainable and the fish ran too numerous and very small.

I never found out how trout originally came to Gilgit. Possibly snow trout are indigenous in these parts, one sometimes caught them in the Ghizar river, but the brown trout must have been imported and presumably they were carried up by road from the Gurais valley a hundred miles to the south in Kashmir, the nearest trout stream. We tried stocking a stream about thirty miles from the Kargah and had an elaborate organization with relays of coolies, changes of water and bicycle pumps to aerate the water, but I never stayed long enough to learn whether this was successful. A more ambitious scheme, carried out a few years before I went to the Agency, involved flying the trout in a R.A.F. acroplane from Gilgit down the Indus to the emergency landing ground at Chilas and putting them in yet another sidestream, but no fish were ever caught there. A possible risk in these stocking experiments is that the heavy summer spates wash away the few fish before they are well established. Even the clear watered Kargah after a few days of brilliant summer sunshine rapidly turned into a raging torrent, in which it seemed impossible that any fish could survive as the water cascaded down in one continuous roar, which made conversation almost impossible in the narrow gorge. But here the fish were well established and overstocked, and perhaps these spates were not enough.

And so my adventures in this strange land came to an end, for the while anyway. I reached Gilgit doing the last thirty-six miles in one day with a change of ponies half-way, where I met a fresh pony sent out to meet me. As promised before I left, I returned in time for the start of the Christmas festivities and so to bed at three o'clock in the morning. We were a very happy family in Gilgit, so happy that rarely have I been so exhausted when Christmas was finally over and parties finished for the time anyway.

BOOK REVIEWS

ELEMENTS OF CITIZENSHIP By H. W. HAWKINS

(Published by Hiorns & Miller, Devonport, price 2s. 6d.)

This book was originally intended for the use of Members of H.M. Forces undergoing educational courses, but is now on sale to the public.

In a small space of sixty pages an endeavour has been made to cover the whole system of Parliamentary Government, Local Government and Empire and Colonial Government, as well as special chapters dealing with the Defence Forces, Education and the Press. As might be expected in such a very condensed form there is much that could be criticized, but on the whole the book does set out the main principles of government and administration in a brief and very concise manner.

The book deals briefly with the powers of the King, the Commons and the Lords; explains the formation of a Government and the duties of the various ministers; details the process of passing bills and the difference between the various readings, report and committee stages.

The different forms of local Government, ranging from the Parish Meeting to the County Council, are described, as well as short notes on the different forms of rates and taxes.

There is a chapter on the Defence Forces, but this perhaps suffers even more than the others from condensation and gives very little idea of the functions of the three services. The same might be said about the Chapters on Education and the Press.

The average citizen will, however, by reading this little book be able in half an hour to considerably increase his knowledge of the working of our general system of Government.

C.C.P.

HOW TO SAIL BY CARL D. LANE

(PUTNAM & CO., LTD., 18/-)

The detail below the title on the first page of this book says "A complete handbook of the art of sailing for the novice and the old hand." This is a good description of this very comprehensive work.

The author has, however, fallen into the usual trough of all writers on sailing —assisting the novice in buying a boat. In Chapter I he helps the novice achieve his objective before telling him how to sail. A novice should get competent at sailing before experimenting and learning the hard way on his own: The motorist does not buy a car and drive it away without first learning to drive.

The important thing for the novice is to go out with an experienced yachtsman. He will very soon learn to make himself useful—it is a pity this excellent book of Carl D. Lanc's does not bring out this point strongly. The basic requirements of the learner—how to pull a rope and make it fast to a cleat are poorly described in Chapter III. His description of the few knots is good. but I do not agree with his decrying belaying to a cleat. If a half-hitch is put on correctly it will come off when required—it is most annoying to have your main halyard adrift on a dark windy night.

His salty vocabulary of 30 pages in Chapter II is well put together. The diagrams being very clear. It has got items not in common use in the British Isles and a few interpretations which are at variance with ours. A yachtsman could certainly call himself an old hand if he knew all the items listed and how to apply them.

The explanation of sail power, careful use of sails, spars, rigging and working out of sail handling problems is adequately covered in six chapters. "A perfectly sound reason for heeding the lessons of this chapter, though you may think them merely making a fetish of a simple pleasure, is the crass use of maintaining the value of your boat."

Carrying and care of sails is very well dealt with in the three following chapters. One chapter deals with Navigation as far as coastal work, but readers must remember that the symbols described are American and not the Lateral and Cardinal systems. The British Isles adopted the Lateral system in 1936 and is modifying its buoyage accordingly. The rules of the road are clearly described—the simple diagrams bring out the salient points very well.

The useful points in the last two chapters on how to become unstuck could be learnt with advantage by the not so novice a sailor who only too often does not know how to use them efficiently.

Altogether a delightful book for yachtsmen and novice yachtsmen to read. It should be in every ships library and be known and understood before the owner buys his first boat.

J.C.F.MacC.-M.

INDUSTRIAL ELECTRIC MOTORS

(BY HIGGS MOTORS LTD., WITTON, BIRMINGHAM. Price 1/-)

Although this book is an advertisement for Higgs Motors Ltd., it does contain a great deal of useful and practical information in a concise and handy form, and is recommended for use by all E. & M. Officers, Is.R.E.M., Mechanists and Maintenance Electricians. It will prove of great use to them when carrying out the installation or maintenance of most types of electric motors or starters.

The installation of electric motors and starters is covered by concise useful notes, tables and diagrams under such headings as:—Types of motors and starters for various installations: The I.E.E. Regulations which are applicable to the installation of motors: The handling of motors in transit: The fitting of pulleys and lining up of belts: General instructions for the running and maintenance of new and old motors: Fault location: The cause and remedies of faults.

The tables cover such items as:—Current carrying capacity of cables: Full load current of motors: Sizes of fuses and fusing currents: Capacity of conduit: Minimum pulley diameters. There are also several very clear diagrams showing the various motor and starter connexions.

Altogether this appears to be a most useful little book, strongly bound, of a convenient size for the pocket and well worth the reasonable price of one shilling.

N.C.

ASSAULT DIVISION

By NORMAN SCARFE

(Published by Collins, London. Price 12s. 6d.)

This is a history of the 3 Division during the preparation and execution of the North-West European Campaign 1944-45.

The Division is unique in two respects. It took a leading part in all three of the operations described by the Supreme Commander as being the most decisive of the campaign, the assault on the beaches of Normandy, the sealing of the Falaise pocket, and the clearance of the left bank of the Rhine. It also, unfortunately, suffered more casualties than any other division during the first six months of operations. Its problems and achievements are the more presentable therefore to the curious and to the student of war alike.

But the book is written for a wider public than the soldier. The author succeeds, with remarkable skill, in so interleaving a full factual account with stories of the human outlook and with earlier historical references, that the book can be read almost as a novel. There is no need for close study of plans, diagrams, maps and the like (although very adequate maps are included) and the reader is left entirely to his own conclusions. However little the ordinary reader knows of the N.W. Europe campaign he will emerge from reading the book to discover that he has been given also a very good idea of the operations of the British Second and Canadian First Armies.

The Author was a Gunner Officer in one of the Field Regiments of the Division. He makes no bones about it. Nevertheless he has steered a very proper course, despite threat or temptation, and, quite rightly, the dominant bearing is the infantry one.

Considerable space is devoted to the aspects of morale, not only in the creation of the magnificent spirit of the soldiers of all ranks and all arms who landed in Normandy initially, but also in the preservation of the standard as the infantry rifle company casualties grew and grew and the knowledge gained ground in men's minds that the war was all but over. The examples the Author quotes of the offensive spirit of the Division during its last battles in the suburbs of Bremen are eloquent and inspiring.

Some who served with the Division may feel that scant reference has been made to the very large "Army" that was either intimately concerned with, or under command of, the Division for the sea assault portion of the story notably the Royal Naval Force "S," 101 Sub-area Beach, 27th Armoured Brigade and other special armoured and Engineer units. It would, however, be a very large book indeed that could do justice to the many with whom the Division fought. Although the author has paid reasonable tribute to those associated with the subject of his book, old members of co-operating units and formations must not look here for great detail of their past achievements.

From the engineering point of view the book is primarily of importance in that it gives a very good idea of the speed and scope of Infantry Division operations, under conditions of heavy resistance on the one hand and lavish support on the other. The Engineer implications in the realms of mine warfare, movement of heavy columns, and of engineer deployment in the fast changing battles, although not picked out by the author, are there for the discerning eye. At the other end of the scale the young Engineer Officer will get an excellent idea from the many personal narratives quoted of the manner in which the infantryman works and of the conditions under which field engineer tasks and reconnaissances had to be undertaken during World War II in Europe. R.W.U.

TECHNICAL NOTES

STEREOSCOPIC CINEMA

The British Journal of Photography in its number of 7th November, 1947, has a short article on "The Stereoscopic Cinema in Russia." The Russians have shown to the public a full-length stereoscopic film using a special screen made up of conical lenses 4 to 5 microns thick, mounted on plate glass, thus getting away from the anaglyph principle. Two separate films are used, taken by synchronized cameras and projected simultaneously on to one screen. Seating in the cinema is specially arranged, being restricted in this case to about 200. The inventor, Ivanoff, is working on a more elaborate screen which will present more than 1,000 separate images, which should give a realistic effect from any point in a hall of normal size.

"SHORAN" FOR SURVEYING

"Surveying and Mapping," the publication of the American Congress on Surveying and Mapping, contains in its number for January-June, 1947, two articles on the use of "Shoran" for surveying. "Shoran" is a radio aid similar to British "Gee." The first article is entitled "Shoran investigations for triangulation" and gives the results of tests observing triangles with sides ranging from 148 miles to over 300. The worst ratio of accuracy was I part in I13,350. The second article describes the application of "Shoran" to Hydrographic surveying over ranges up to 50 miles. The military application of this, other than Survey, would be the determination of position of forces in featureless desert or steppe.

SURVEYING FROM PHOTOGRAPHS FIXED BY REMOTE RADAR CONTROL

The Empire Survey Review for April, 1947, has a paper by Professor Hart of University College, London, on "Surveying from air photographs fixed by remote radar control," the radar being British "Gee." This article goes into far more detail than the American article on "Shoran" surveying referred to above. The claims for accuracy of British "Gee" are considerably lower than those made for Shoran but the British equipment was working on wave lengths of the order of a few metres whereas "Shoran" used centrimetric wares. The subject has also been dealt with fully in War Office Air Survey Research Paper No. 19 "Mapping by remote control with the aid of radar."

ENGINEERING ECONOMICS

An Introduction to Engineering Economics for Civil Engineering Students, London Institution of Civil Engineers. Price 1s. 0d.

This handbook describes the financial aspects of civil engineering works which have to be considered by the promoter of a civil engineering project before proceeding with the work.

Such matters are very often of the utmost concern to the engineer and he should be familiar with the financial rocks which may impede or wreck a project and which can often be avoided by skilled pilotage.

The reasons for the handbook can best be summed up in the words of the authors, "Many an instance can be cited where the lack of, or undue haste in, economic consideration has led to wasteful purchases of land, materials and machinery, and to the diversion of engineering services and labour from worthier objects."

Its interest for R.E. will be apparent to all who have had to pilot a project through the various stages of financial approval. Although Engineers for generations have applied to their work the considerations now embraced by "Economics" there is still a reluctance to embark on a thorough financial appreciation of a scheme and its alternatives. If this be shirked financial approvals will be slow in materializing.

A study of this pamphlet is recommended to all who are concerned with the sponsorship of Works projects.

DEFECTS IN CONCRETE ROADS

Some Defects in Concrete Roads. Causes and Remedies, by F. N. Sparkes, M.Sc.,-M.I.C.E. of the R.R.L.; being Road Paper No. 23, and discussed by the Road Engineering Division of the Institution of Civil Engineers on 4th March, 1947, and described by one authority as a vade-mecum for all connected with the construction of concrete roads, presents the result of much research during the war years in a form readily applicable by any executive engineer.

The subject matter is arranged under types of defects; defects due to faulty design; inadequate foundations; differential settlement; local settlement; the use of mud-jacking; general subgrade failure; spacing of joints; defects due to faulty materials and workmanship; defects due to natural agencies and exceptional conditions (forward area and tank traffic), Many excellent photographs are included.

On the subject of expansion joints, the following suggestions are made by Mr. Sparkes :---

- (i) Joints should be reduced as much as possible to facilitate construction of the road.
- (ii) The temperature at which the concrete is laid has a predominating influence on the spacing of the joints.
- (iii) For concrete laid on very hot days expansion joints may be omitted and dummy joints placed at 15 ft. centres.
- (iv) For concrete laid at moderate temperatures expansion joints may be placed at intervals of from 100 ft. to 200 ft. and dummy joints at 15 ft. centres.
- (v) For concrete laid during cold weather expansion joints should be spaced at from 40 ft. to 100 ft. and dummy joints at 15 ft. centres.
- (vi) When reinforcement is used the dummy joint spacing may be increased.

PISÉ DE TERRE HOUSING IN RHODESIA

(The Surveyor dated 1st September, 1947.)

The Rhodesian Government are crecting 500 Pisé de Terre houses as part of their temporary housing programmes.

CONSTRUCTION

The foundation consists of a 14 in. wide concrete band averaging 14 in. deep, under external walls only, the area enclosed being filled with earth well rammed, and a 3 in. concrete slab laid over the site.

A 12 in. wide upstand, 3 in. deep, is then laid in concrete to take all walls. (This prevents the wetting of the Pisé walls when the floors are washed.)

SHUTTERING

A complete set of timber shuttering 2 ft. 6 in. high is used for one house, and for all walls.

The shuttering consists of 11 in. dressed boards fixed with bolted battens, and made in sections with standard external and internal angles. Loose timber distance pieces are used and the whole tightened up with $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. steel flat bars, slotted at each end, and fixed with wedges. Tightening by nuts was found to be unsatisfactory.

The earth is mixed to the correct consistency in a concrete mixer, and after being placed in the shuttering is rammed with pneumatic rammers. Seven rammers are used, and mixing, placing, and ramming for each lift takes 41 hours.

Striking and lifting the shuttering takes $7\frac{1}{2}$ hours. These operations are repeated until a height of 9 ft. is obtained.

WALL FINISH

The wall finish inside and out is a very thin wash of weak lime, sand and cement mix, applied sufficiently thickly to cover the colour of the earth wall. The walls are then finally limewashed.

FLOORS

The floors are $\frac{1}{2}$ in. red granolithic with 3 in. skirtings coved on the 3 in. upstand previously mentioned, this facilitates floor washing without danger to the pisé.

ROOF

The majority of the houses will be thatched, but a few may be roofed in corrugated asbestos.

PROGRESS

With six sets of shuttering it is hoped to achieve an output of the walls for 41 houses every 24 hours.

GERMAN PORTABLE DIESEL PILE DRIVERS

(Railway Gazette, dated 10th October, 1947)

During the War the Germans produced two diesel pile drivers.

Both are single acting and the weight of rams varies between 10 cwt. for the smaller size and 36 cwt. for the bigger.

Before the start of driving, the ram, in both types, is lifted by winch and tackle. Then in falling freely, it simultaneously :- /

- (a) Compresses air in a closed cylinder.
- (b) Actuates a cam, which causes fuel oil to be injected into the highly compressed air in the cylinder and

(c) Closes the fuel inlet from the tank. The resulting ignition and explosion forces the ram up again through a height depending on the intensity of the explosion which is governed by acontrol valve.

Each type has a special rig designed for easy portability and erection.

GLUED LAMINATED MEMBERS FOR BRIDGES (Railway Age, dated 4th October, 1947)

There is a growing scarcity of large solid timber and since an enormous amount of repair timber is required to maintain the timber trestles in use on American Railways, a committee has been formed to examine the question of using glued laminated members.

The relative strengths of laminated members are essentially the same as those of solid wood and if laminated timbers are well constructed, it has been found that their strength properties are normally more uniform, and they are less apt to change shape with variations in moisture content.

Laminated members have been installed in bridges on a number of U.S. railways.

RECONSTRUCTION IN THE PORT OF CALAIS (Modern Transport, Issue 23rd August, 1947.)

This article describes in some detail the work carried out by Port Construction and Repair units of the Royal Engineers in the reconstruction of the Port of Calais.

The first task to be taken in hand was the construction of a train ferry terminal which was completed in twenty-one days and the first ferry vessel berthed fifty-one days after the capitulation.

In the construction of hards for L.S.T.s, a number of obstacles were encountered; the largest of these, an enemy gun emplacement of massive reinforced concrete construction, was demolished by a single charge of 8,000 lb. of explosive.

PRE-CAST PRE-STRESSED CONCRETE RAIL BRIDGE (The Engineer, Issue 4th July, 1947.)

For some years the L.M.S. Rly. have, where possible, carried out bridge reconstruction in pre-cast reinforced concrete in preference to steel. Advantages are reduced maintenance, ease in manufacture and crection (units can be produced in the company's works throughout the year and erected with a minimum of traffic delays), low cost, and the ability to provide a continuous roadbed instead of timber decking. The article describes the experience of reconstructing the Adam Viaduct which carries the railway Manchester-Liverpool.

FENDERS AND JETTIES By R. R. MINIKIN

(The Dock and Harbour Authority, Issue June, 1947.)

Mr. Minikin explains factors to be taken into consideration in the construction of fenders and jetties under varying conditions. The article describes in some detail a suspended type of fendering designed for use at the Verdon Pier at the Port of Bordeaux, where the swell entering the estuary, may reach an amplitude of no less than 10 ft.

RAIL GUIDED VEHICLES ON CONCRETE TRACK

(Railway Gazette, Issue 29th August, 1947.)

A successful attempt has apparently been made in Khambalia, a village in Jamnagar State, India, in solving the feeder-line problem, by the use of a nine mile Guideways Track carrying pneumatic-tyred passenger and goods vehicles. The track consists of a 3-ft. wide and 6-in. to 9-in. deep continuous lime-concrete slab having a central guide rail to prevent vehicles leaving the track. The vehicles which can be used on a metalled road for rail-head work, correspond in dimensions to Indian 2-ft. gauge stock. The locomotive is diesel driven.
CORRESPONDENCE

BACKGROUND TO THE PALESTINE PROBLEM

41, Queen's Road, Richmond, Surrey. 19th December, 1947.

To the Editor, The Royal Engineers Journal.

Sir,

As one who served in Palestine and Transjordan during the recent war, may I be allowed to comment on Brigadier A. J. Knott's article entitled "Background to the Palestine Problem" in the December, 1947, issue.

A careful study of this article makes it hard to resist the conclusion that the author has avoided few of the pitfalls that beset any student of this complicated question who attempt, to writes about it. It has been said that in a controversial issue it is not always possible to find an "expert" so detached that his sympathies are engaged by neither side. Nor is it necessary. For ability to present the whole situation fairly and sympathetically is what distinguishes the expert from the mere propagandist.

The pity of Brigadier Knott's article is not that his sympathies lie so conspicuously with the Arabs, but that he has allowed predilection to obscure accuracy and permitted his prejudices—however sincerely felt—to intrude upon what might fairly have been expected to be an historical and objective mood. Thus he concludes his article by inquiring whether proposals by the United Nations will be any more acceptable to the "peace-loving but determined Arabs" or to the "powerful and unscrupulous Jews" than British efforts have been. The juxtaposition is significant ; it can hardly be inadvertent. It may be doubted whether prejudice of this kind is what is required in an article purporting to explain the background of the Palestine question.

Space considerations must limit discussion to the following points.

I. THE BALFOUR DECLARATION AND PLEDGES TO THE ARABS

Brigadier Knott writes :----

"When post-war settlements were being discussed the Zionists pinned their faith to the Balfour Declaration, which undertook that there should be founded a National Home for the Jews in Palestine. Unfortunately the difference between this and the conversion of the whole of Palestine into a National Home, which was what the Zionists wanted, was apparent from the start, and has been at the root of much of the trouble ever since."

This statement of the position would be irreproachable if the truth were unknown. But the facts are readily ascertainable—and have been on record these past ten years. The Palestine Royal Commission plainly indicates in its Report (1937) that the Balfour Declaration envisaged a Jewish State. The Report observes :—

"It is obvious in any case that His Majesty's Government could not commit itself to the establishment of a Jewish State. It could undertake to facilitate the growth of a Home. It would depend mainly on the zeal and enterprise of the Jews whether the Home would grow big enough to become a State." (p. 24).

The Commissioners add :---

"Thus His Majesty's Government evidently realized that a Jewish State might in course of time be established, but it was not in a position to say that this would happen, still less to bring it about of its own motion. The Zionist leaders, for their part, recognized that an ultimate Jewish State was not precluded by the terms of the Declaration, and so it was understood elsewhere. ... General Smuts, who had been a member of the Imperial War Cabinet when the Declaration was published . . . foretold an increasing stream of Jewish immigration into Palestine, and ' in generations to come a great Jewish State arising there once more '. . . Lord Robert Cecil in 1917 . . . and Mr. Winston Churchill in 1920, spoke or wrote in terms that could only mean that they contemplated the eventual establishment of a Jewish State. Leading British newspapers were equally explicit in their comments on the Declaration." (p. 25).

(The Report makes clear, too, that both Palestine and Transjordan came within the ambit of the Balfour Declaration when issued in 1917.)

Additional evidence that the Jews are not claiming something from the Declaration to which they are not entitled may be seen in the following statement by Mr. Philip Noel Baker, who was intimately concerned with the making of the Mandate directly after the 1914–1918 war. Speaking on behalf of the Labour Party in the House of Commons on 22nd May, 1939, he affirmed that :---

"In 1922, as in 1919, we meant to create a Commonwealth in Palestine in which Jews and Arabs would have common democratic rights and freedom but in which the Jews would predominate in numbers. But for that the experiment of the National Home would never have been attempted."

Had these facts been given in the article, in addition to Brigadier Knott's *beliefs* on this point, the reader would have been provided with the opportunity of assessing the rights and wrongs of this particular and not unimportant aspect.

The article says that on the Arab side much was made of promises given "or alleged to have been given to them by Lawrence and others" in efforts to secure their co-operation in winning the war. Why not quote Lawrence's own view on the subject—a surely not irrelevant view? In a letter to Professor William Yale on 22nd October, 1929, Lawrence wrote :---

"It is my deliberate opinion that the Winston Churchill settlement of 1921-22 (in which I shared) honourably fulfils the whole of the promises we made to the Arabs, in so far as the so-called British spheres are concerned."

II. THE 1939 WHITE PAPER

The article discusses the Arab rebellion of 1936, the Royal and Woodhead Commissions and then—after an amazing black-out—passes straight to the second world war. It is difficult to understand how anybody writing about the background to the Palestine problem can omit reference to the White Paper of 1939. (One wonders if Brigadier Knott, writing about Britain's war effort, would somehow overlook Mr. Churchill—or even the Royal Engineers.) No hint is given the reader that serious misgivings about this policy were expressed in Parliament, that Mr. Churchill condemned it as "a plain breach of a solemn obligation" to the Jews, that Mr. Herbert Morrison characterized it as "a cynical breach of pledges given to the Jews and the world including America." Moreover, a majority of the Permanent Mandates Commission judged the White Paper contrary to the Mandate and thus to international law. These facts ought surely have found their way into an article supposedly balanced and objective.

Further, no article on the background to the Palestine problem can be considered complete without reference to the Labour Party's oft repeated pledges to the Jews. For without such reference, and the subsequent betrayal of those pledges by the Labour Party, the history of Palestine since July, 1945, becomes almost meaningless. It is all very well for the article to refer to "kidnappings, shootings, and violent lawlessness" continuing with alarming frequency, but to fail to explain to the reader the fundamental cause of those happenings is absurd and helps nobody. A short extract from the Anglo-American Committee's Report summarizes the position :---

"They (i.e., the Jews) were with Britain in the fight against Fascism ; they were against Britain in the struggle against the White Paper, which they now felt was not only unjust but totally inhuman as preventing the escape to Palestine of men, women and children in imminent danger of death in Nazi Germany and Nazi-controlled Europe. When the war ended and the Labour Government came to power, the White Paper still remained in force. The Jews who had expected an immediate fulfilment by a Labour Government of the Labour Party programme with regard to Zionism, felt a sense of outrage when no change of policy occurred. The bitterness reached a new peak of intensity, and the position of the moderates became almost impossible."

III. ARAB AND JEWISH WAR EFFORTS

Discussing the war effort of both Arab and Jews, the article strives to give the impression that it was similar on both sides. For example, "members of both races joined the forces and the Jews went a step further and introduced their own national service." "Both contributed to the development of some 400 new undertakings which had the effect of transforming Palestine from an agricultural to a largely industrial country." The reader would have to be clairvoyant, however, to appreciate the true position. The Anglo-American Committee's Report observes that the Arab community in Palestine showed itself "largely indifferent" to the outcome of the war—a statement not altogether without special interest to readers of a military journal. "Out of a population twice as large as the Jewish only 12,445 persons were recruited for military service, a figure of less than half the Jewish total. The flight of the Mufti to Italy and Germany and his active support of the Axis, did not lose for him his following." As for the Palestine Jews the British Information Services to the United States, an agency of the British Government, in their Bulletin of March, 1944, recorded the following tribute :—

"The Jews of Palestine are playing a fighting and invaluable part in the war. They are serving in armed military and police formations, the great proportion in special Jewish units. The contribution that they are making to the supply position through the remarkable achievements of Jewish industry and agriculture in Palestine has been of a critical character to the Middle East military command."

Of Hagana, the Jewish Defence Force, all Brigadier Knott says is that it was declared illegal. One is compelled to assume that the part played in the war effort by the Hagana, in close concord with the British Military Command in Palestine, is entirely unknown to him.

IV. " UNFAIRNESS " TO THE ARABS

The article states that the British Government has admitted in its report on its trusteeship to the United Nations that the Mandate was unfair to the Arab race. One would have expected to find an actual reference cited from the relevant document; but no such reference is to be found. The truth, however, appears to be that no such admission has been made by H.M.G. in that document. Close scrutiny of the 41 page document, entitled "The Political History of Palestine under British Administration" (Memorandum by H.M.G. to the United Nations Special Committee on Palestine, July, 1947), does not bear out Brigadier Knott's assertion. On the other hand, a balanced and objective article might usefully have given readers a chance to study the views of a man well acquainted with the Arab world and who can in no way be considered hostile. In the Commons on 23rd May, 1939, Mr. Churchill, discussing the Mandate and Lawrence and the Arabs, declared :---

"... we also showed ourselves continually resolved to close no door upon the ultimate development of a Jewish National Home, fed by continual Jewish immigration into Palestine. Colonel Lawrence thought this was fair then. Why should it be pretended that it is unfair now ?"

On 1st August, 1946, Mr. Churchill again referred to this matter in the following terms :----

" I will not have it that the way we treated this matter was inconsiderate to the Arabs. On the contrary, I think that they have had a very fair deal from Great Britain. With all those countries which are given to their power and control, in every way they have had a very fair deal. It was little enough, indeed, that we had asked for the Jews—a natural home in their historic Holy Land, on which they might have the power and virtue to confer many blessings for enjoyment, both of Arab and Jew."

Yours faithfully,

R. S. DOUGAN.

N.A.F.F.I. IN PALESTINE

Captain M. J. Pitt, the N.A.A.F.I. senior District Officer in Palestine, has been twice shot and wounded in the last six weeks.

Mr. Fuad Azar, the Arab Manager of the N.A.A.F.I. Canteen on Mount Scopus, Jerusalem, was shot dead while walking from the bus to his office.

The Grocery Shop and Canteen at Peninsula Barracks, Haifa, were completely wrecked by an explosion, which destroyed $\pounds 12,000$ worth of stock. A temporary canteen was in operation within forty-eight hours.

The N.A.A.F.I. Canteen at Nazareth had to be closed after $\pounds 1,000$ worth of goods had been stolen and the police admitted that the security situation was out of hand.

In spite of these disturbances the N.A.A.F.I. Staff carry on loyally at their work.



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