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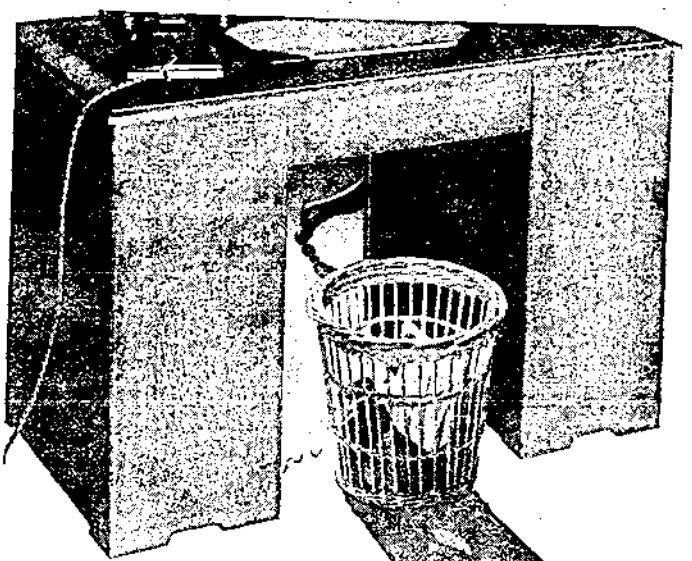

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Photo 1.—Constructing Jeep Track—summer.

Photo 2.—Jeep Track—winter.

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EPISODES FROM KOREA

By MAJOR A. E. YOUNGER, D.S.O., R.E.

ASSAULT CROSSING OF THE IMJIN RIVER
10TH–11TH APRIL, 1951

INTRODUCTION

Enemy

AS our troops closed up to the Imjin and Hantan Gang rivers during the first week of April the enemy withdrew in good order to previously prepared positions on the north bank. Small rearguard parties and mines delayed our advance, but by 7th April the south bank was in our hands.

The enemy used no air or artillery. Furthermore some conveniently placed hills gave our F.O.Os. excellent observation of the north bank and large concentrations of fire were brought to bear on enemy positions which rapidly became untenable.

Own Troops

The over-all Army plan was to swing the force from a line running east and west across the 38th parallel to a line running in a north-east and south-west direction, hinging on the junction of the two rivers mentioned above. In order to protect the hinge for this movement, the high ground round Pt. 194 had to be secured. This feature, although not particularly high in itself, dominated the river junction and gave excellent observation over the lower hills to the north-west.

Object

The plan decided upon was to attack with one battalion (1st Royal Ulster Rifles) on to the objective, supported by one squadron 8th Hussars. The engineer object was to enable the force to cross the river and to maintain itself on the far bank.

SEQUENCE OF EVENTS

Preparatory

The first intimation received by 55 Field Squadron, R.E., that such a crossing was projected was at midday on 7th April. The day given for the crossing was the 10th.

The Squadron was completely extended at the time, improving the exceptionally poor tracks in the Brigade area. The troops were bivouacking independently on the stretches of road assigned to them and were about ten miles south of the river. Some assault boats were being operated for infantry night patrols, but otherwise no bridging material was available.

Preliminary recces had been done of the river bank, but these had all shown that the Imjin was unfordable and that no vehicles could get down to it. However, the recces had been carried out under observation and occasional small arms fire during the day, whilst the confirming patrols at night had found great difficulty in crossing the river due to the current, lack of watermanship experience, and the cliffs.

However, with the knowledge gained from these recces six R.A.S.C. 3-tonners were made available and left at 4 a.m. on the 8th, with Lieutenant Eastgate and a loading party, to fetch as much foot-bridge as possible (100 yds., as it turned out) from the nearest dump. This dump was at Ascom City, about sixty miles away near Inchon. He returned at 6 p.m., a very creditable time of turn-round considering the state of the roads and the traffic.

On the afternoon of the 7th, and throughout the following night, reconnaissance continued to search for a suitable place to cross, without success, but on the afternoon of the 8th one was found outside the Brigade area. It was unsatisfactory for the following reasons :—

(*a*) The home approach for the last mile was a cart track, crossed and recrossed in many places by a fast flowing mountain stream, and impassable to jeeps without work.

(*b*) It was above the junction of the two rivers, so involved crossing both.

(*c*) There was no road or track on the far bank of either river : furthermore there was a steep bluff just to the north of both crossing places, up which it was obviously going to be difficult to drive a road.

(*d*) Due to a low island in mid-stream, the Imjin was constricted and flowed at 4 to 5 knots, a very fast current for a foot-bridge.

(*e*) The width of the Hantan Gang was calculated to be 52 yds. and that of the deep portion of the Imjin as 48 yds. : this left no reserve of footbridge and necessitated wading over the shallow portion of the Imjin.

However, it was the only place that offered any possibility and we were all very relieved to find, as a result of a confirmatory patrol, that the depth of the Hantan Gang was 2 ft. 6 in. to 3 ft. and the Imjin 4 ft., i.e., just within the wading depth of a Centurion and an Oxford carrier.

During the 8th, Squadron H.Q. and 1 Troop moved up to within three miles of the river and established a bridge harbour area. Enough Class 12 assault bridge (American pattern) was available to bridge the Hantan Gang, and this was moved up in American transport. Even if any more had been available for the Imjin we did not, at this stage, know what our requirement would be, as it was still in enemy hands and had not been recced. A request that 300 ft. of Class 12 bridge should be collected for this task was made.

Ten Oxford carriers were borrowed from the other two battalions in the Brigade, as being the only vehicles capable of carrying the stores to the sites and for use as anchors on the sandy far bank.

An armoured dozer of 8th Hussars, the only machine available at the time, was put to work on the home approach on the afternoon of the 8th. On the 9th, 1 Troop (Lieutenant Cadoux-Hudson) with the Squadron D7 and D4 made a very presentable two-way track to within 200 yds. of the river, where it came into view of the enemy.

Also on the 9th, 2 Troop (Captain Page) and 3 Troop (Captain Bayton-Evans, M.C.) finished off their road-making and night patrol activities and moved up. All three troops did a rehearsal on dry land with the bridging expedients, none of which we had seen before.

At this time we had just received 200 South Korean civilian labourers and these were also moved up.

The Operation

The Squadron " O " Group was held at 1800 hrs. on the 9th. All troops had been briefed about their tasks earlier in the day, but there had been no time to put them in the " big " picture.

During the remaining hours of daylight final preparations were made and a hot meal cooked. The men then rested until 0100 hrs. It was a dark night with the temperature about freezing point.

Promptly at 0200 hrs. 2 Troop with their foot-bridge loaded on Oxfords moved out of the Harbour Area, followed 10 minutes later by 1 Troop. As planned they went up to the last corner in the road, out of sight of the enemy and paused there. By this time, 1 Royal Ulster Rifles had put covering parties over the rivers, silently, to give local protection to the Sappers.

No. 2 Troop

At 0255 hrs. 2 Troop moved off and their Oxfords started to ford the Hantan Gang at 0300 hrs. The noise of the engines was covered to a certain extent by an intermittent barrage of artillery and heavy mortars. The Brigade Vickers machine-guns also lent a hand, but the noise made by them, firing directly over the heads of the Sappers, was not popular !

An Oxford was sent over to the Island in the Imjin carrying the standing cable and to act as an anchor. The launching site was a 1 : 1 slope down a 15-ft. bank, which became more and more slippery with use and so made the task a heavy one. However, successive sections of the bridge were built, manhandled down the slope, connected by bridles to the standing cable and launched.

The standing cable was under water for most of its length and, due to the force of the current, was under such tension that the Troop Commander could not tighten it further to take up the slack. To this must be attributed the catastrophe that occurred when the bridge was 75 per cent complete and about fifteen minutes before the infantry were due to cross it. The fast current caused one float with a slack bridle to dip under water, thus twisting a central section of the bridge, and tending to overturn it. Before this could be righted the weak footwalk snapped and the bridge broke into two halves.

The current forced each half of the bridge away at an angle to the other, and considerable difficulty was found in chopping away the broken sections and joining the two halves. However, after much effort, the joint was repaired and the bridge completed by 0645 hrs.

Due to this mishap the waves of attacking infantry could not use the bridge for the assault. The Oxford carriers, which had brought up the bridging stores, were, therefore, lined up at the tank ford and there they carried the infantry over dryshod and to time.

The engineer lessons learnt from this are largely elementary and reduce to accentuating the need for good anchorages, a taut standing cable and bridles of exactly the same length. Above these lessons, however, stands the need for training in bridging under really bad conditions. More will be said later on the use of Oxford carriers for assault crossings.

No. 1 Troop

At the same time as the above, 1 Troop were progressing with their foot-bridge over the Hantan Gang. They had moved up to the banks of the river 10 minutes behind 2 Troop as planned. Also using an Oxford carrier as an anchor, they progressed in a similar fashion to 2 Troop, but without mishap. The current in this river was running at 3 knots, considerably slower than the Imjin but fast enough to necessitate great care.

The width of the river at the selected place turned out to be 63 yds. instead of 52 yds. as previously calculated. Also some of the bridging from this site had to be put in to replace the damaged items on 2 Troop's bridge. In the end 23 yds. of improvised causeway had to be built out from the banks to ensure a dryshod crossing.

The bridge and causeway were completed at 0600 hrs., as planned, and at 0620 hrs. the long line of infantry started to cross.

Photo 3.—First Light, 10th April. The leading tank crosses. A sapper Oxford carrier is in the background.

Photo 4.—First Light, 10th April. The Infantry cross the Hantan river dryshod.

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Photo 5.—0800 hrs., 10th April. Work starting on Cl. 12 Assault Bridge.

Photo 6.—Afternoon 11th April. Semi-improvised bridge across Imjin river. Not footbridge decking upside down on downstream side of bridge.

No. 3 Troop

At 0730 hrs. 3 Troop started on the task of replacing the 1 Troop foot-bridge by a Class 12 assault bridge. This was built by booming out from the home bank. Anchorage was provided by a 3-in. S.W.R. standing cable positioned 4 fathoms up stream of pontoon bows. The cable itself was anchored on the home bank by boring into the cliff face, and on the enemy bank by two buried baulk hold-fasts. Final tensioning on this was achieved by windlassing strops on both banks.

Previously prepared eye-spliced bridles were run on to the standing cable before it was anchored, to allow easy movement along the S.W.R. during booming out. This whole operation went very smoothly and the bridge was completed at 1030 hrs.

The idea behind this American bridge is undoubtedly a good one, but the practical details are so poor that building time could be almost halved if the component parts were properly thought out. When erected the bridge requires a lot of very careful maintenance to keep it in good working condition. It does not, in its present design, compare favourably with the British Class 12 equipment.

No. 1 Troop

Promptly at 1030 hrs. 1 Troop started to dismantle their foot-bridge, which was completed by noon.

During the whole of this morning the Divisional Engineer, 3rd U.S. Division had been attempting to find enough additional Class 12 equipment to bridge the Imjin itself, an estimated gap of 100 yds. In addition Lieutenant Eastgate was searching the bank with the leading tanks to try and find a suitable bridge site. By 1300 hrs. it was clear that bridging was not available anywhere in the Corps area, so an improvisation would be necessary. To make matters worse Lieutenant Eastgate reported that there was no suitable site as far as the Brigade boundary to the north.

The only hope was to bridge near the existing foot-bridge. This had the advantage of a narrow gap, but the disadvantage of a rapid current, bearing in mind that the bridge would be improvised.

During the afternoon our D7 dozer waded the first river and started work on the home approach. At the same time some tracking, previously spotted in a railway yard in Seoul, was collected.

At 1700 hrs., as a result of the energy of the Divisional Engineer, stores started to arrive at the site. By spacing the boats at 10 ft. centres, instead of the normal 6 ft., there were sufficient to cross the 50-yd. stream to the island. For decking we found we had enough Treadway to deck one side but none for the other side. However, sufficient foot-bridge walk was found to provide another tread. In

an attempt to strengthen this, walks were roped "back-to-back," also providing ribands for wheels. A simple experiment soon proved that the walks would take a jeep, but broke under a 15-cwt.

The improvisations necessary, the current and the fact that the men had had little rest during the previous 36 hours made this job slow. However a lot of preliminary work was done on the approaches during the evening. The Troop did exceptionally well to open the bridge and approaches for traffic by 1400 hrs. on the following day, 11th April.

General

This completed the work of the Squadron for the assault. 2 Troop dismantled their foot-bridge without major incident, and next day more Treadways and boats were obtained to bring the Imjin bridge up to Class 8. 2 Troop worked continuously for a week on jeep roads over the completely trackless country west of the rivers.

Conclusions

Training

This operation emphasized at every stage the need for realistic training on really difficult sites. It might be worth considering bridging at the worst possible sites, instead of the best possible, during advanced training in assault crossing in U.K.

Oxford Carriers

Although it was well known that an Oxford carrier could wade in about 4 ft. of water the true significance of this fact had not been fully appreciated. In Korea, as in most hilly countries, virtually all rivers and streams had a sand and shingle bottom capable of taking heavy traffic. With these two facts, the importance as obstacles of rivers less than 4 ft. deep and no matter how wide, decreased enormously. After a little engineer work on approaches, our infantry were able to cross and recross otherwise formidable obstacles without any outside assistance. Battalions could, in fact, maintain themselves completely in isolated positions and, if necessary, could carry a whole company dryshod in one lift, an important point when temperatures drop below freezing.

In addition, in suitable rivers, the Oxford provides the quickest and simplest answer to the old engineeer problem of how to put a cable over a fast-flowing stream and to anchor it temporarily on the enemy bank.

The Oxford carrier is a well-powered and most useful machine and, whilst it can never replace an L.V.T., its use in assault crossings is worth special study.

A CHINESE ATTACK AS SEEN BY 55 FIELD SQUADRON
22ND–25TH APRIL, 1951

INTRODUCTION

During the month of March the U.N. Army in Korea advanced against light but stubborn Chinese rearguards to the 38th Parallel. On the left our troops halted when they reached the Imjin River, which provided formidable bridging problems, whilst across the whole of the rest of the peninsula to the east the divisions pressed slowly forward.

29 Brigade, under command of 3 U.S. Division, were allotted a sector about six miles wide, through which the Imjin River passed, with 1 ROK Division on our left and 3 U.S. Division on our right.

The Belgian Battalion, permanently under command of 29 Brigade, was in a bridgehead on the north bank in a loop of the river. It was supplied over twin Class 12 bridges, built by the Squadron, and about five miles of road recently driven through the hills by us.

To the left rear of the Belgians, and on the home bank, the 1st Northumberland Fusiliers held about three miles of river, and to their left again 1 Glosters held a similar stretch. The reserve battalion, 1 Royal Ulster Rifles, were concentrated about four miles behind the Fusiliers.

The only roads in the area were mountain tracks. One led to the Glosters and another to the remaining battalions, both these roads converging at a point six miles south of the river. There was one lateral road leading east from this convergence to the main north–south supply route. The only other lateral ran roughly along the river bank.

Extensive and deep patrolling was carried out by columns containing all arms, to a depth of ten to fifteen miles into the area north of the river. Only small bands of the enemy were found, so there was, in effect, an extensive no-man's-land over which our troops roamed at will.

The Field Squadron was fully extended in reconnoitring routes and providing mine parties for these patrols, in bridge and route maintenance, in construction of separate tank routes and in several smaller jobs, such as the brigade water point.

Individual troops were spread out in suitable paddy fields, each, of course, with its own defensive perimeter.

Little was known of enemy intentions and still less of their dispositions on the ground. The whole countryside was a maze of trenches, but observation of these from the air proved nothing as the camouflage discipline of the enemy was virtually perfect.

However, on Sunday, 22nd April, at about midday isolated reports of enemy movement in no-man's-land started to come in. One of the first of these was from the pilot of a light aircraft who was fired on whilst taking the Squadron Commander on a route recce.

By nightfall there was a certain tension in the air as the artillery fire increased, but there was still no definite indication of what was to come.

Night of 22nd/23rd April

The H.Q. Officer, Lieutenant Eastgate, took a message at 2230 hrs. that the Belgians were being attacked and wanted protection for their bridges. This was arranged with the Ulster Rifles who sent an officer and fifty men, with Lieutenant Eastgate as a guide, to the bridges. The Glosters and Northumberlands were also being attacked at this time, but not heavily and the artillery were firing continuously on DF tasks.

The bridge protection party crossed both bridges but were ambushed on the far side by some enemy who had infiltrated behind the Belgians. Twenty-seven of them got back with ten wounded, and they, Lieutenant Eastgate and the Sappers of the bridge parties took up a defensive position on the home bank.

As this was progressing a straggler from the Ulsters was seen to try and return by fording the swift-flowing river. Lieutenant Eastgate went off down stream intending to dive in and save the man. He was not seen again.

The Chinese, however, had crossed the river further up stream and soon brought fire to bear on the small party of Ulsters and Sappers from both front and rear. The party then withdrew over the hills and all the Sappers (fourteen of them) returned safely.

As a sequel to this incident, Captain Craig of the Ulsters, who had been missing since the ambush, returned over the hills to our lines about thirty-six hours later. He said that he, with nine survivors of his party, and Lieutenant Eastgate had been taken prisoner by the Chinese. Next morning there had been an American air strike with rockets and napalm on the area. The Chinese appeared to go wild after this and opened up with "Burp" guns on the prisoners, starting from one end. Craig, at the other end, sprinted down the hillside and was lucky enough to get away. He could hold out little hope of any chance of survival for Keith Eastgate, a very tragic end to a most promising and popular officer.

During this time the remainder of the squadron was standing to as the small arms fire got closer. Just before dawn the hill overlooking 3 Troop location was occupied by enemy who had come through the Northumberland's line. This particular hill overlooked the whole of the gun area and the tank harbour area. Immediately

Photo 7.—The Imjin River seen from the Belgian positions. The river is 100 yards wide in the foreground.

Photo 8.—Patrol fording the Hantan River.

Photo 9.—Centurion tank knocked out by Chinese hand-placed charges.

Photo 10.—Some of the ROK Troop.

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he realized the position, Captain Bayton-Evans, M.C., and Lieutenant Lamble with 3 Troop started to attack up the hill. With supporting fire from their own Brens and from some L.A.A. Bofors they successfully gained the height, killing twenty Chinese and killing or wounding a further twenty on another hill which they overlooked from their own. They had called for help over the wireless and Captain Page with 2 Troop followed them up and assisted in securing the feature together with 4 Fusiliers from their area. Our own casualties in this were three wounded.

By this time one company of the Northumberlands had been overrun, and the Belgians and Glosters were surrounded. Also the gun area was virtually untenable, so the Brigade Commander decided to withdraw his H.Q. with the Gunners and Sappers about five miles. A company of Northumberlands took over the responsibility of the " Sapper hill " and the squadron withdrew in small parties. By about 1400 hrs. slit trenches had been dug in the foothills overlooking the new Brigade H.Q. area, and the men were able to rest.

Night 23rd/24th April

At 1830 hrs. the squadron was ordered to attempt to retrieve the Imjin River floating bridges. A tank and infantry force left with Captain Holmes and 1 Troop to attempt this. It was realized from the start that this was likely to be an abortive effort as the bridges were already about two miles behind the enemy lines. At 2315 hrs. the force returned as it was unable to break through the lines. Artillery was put on to the bridges breaking one up completely and severely damaging the other.

An American force coming down from the north-east at the same time held a stretch of the river long enough for the Belgians to pass through them, to everyone's relief as their position had been very exposed. However, attacks continued on the Northumberlands and Glosters, particularly the latter, also on the Ulsters, three companies of which had been put into the line near the Northumberlands.

The squadron was not troubled by the enemy during the night, but sleep was virtually impossible as three regiments of artillery were firing over our heads. Our own Field Regiment alone fired 5,000 rounds that night.

By this time it was obvious that the Chinese had no new tricks for this offensive. We had been warned that they would use air and artillery. The first of these never materialized and, as regards the second, although we did not know it at the time, twenty horse-drawn 75-mm. guns had been knocked out by our own artillery, between the Gloster position and the Imjin river.

The enemy successes were being achieved by a mass of infantry some of whom had no rifles but only grenades, and who surged like a wave in the general direction indicated to them. Wherever they

bumped into opposition that did not give way in front of them they surrounded it, brought mortar and small arms fire on to it, and subjected it to attack after attack during the hours of darkness.

DAY, 24TH APRIL

At 0730 hrs. the squadron was warned to prepare to lay a "very extensive anti-personnel and tank mine belt." Nothing further was known about this but preparations were made to carry it out immediately details were available. The project was cancelled at 1100 hrs.

A very tense situation developed in the Gloster area during the day. The battalion had been heavily attacked during the night and suffered severe casualties, particularly in officers. They had closed in to both sides of a ridge and were surrounded by a very large number of Chinese (later estimated at two brigades). A force of one squadron of 8 Hussars and a battalion of Phillipine infantry was sent to relieve them. This force started out at 0530 hrs. Against considerable opposition they gradually fought their way up the long mountain track towards the Glosters. The infantry found the going very slow and at about 1430 hrs. the 8 Hussars abandoned them and pushed on unsupported. However, at about 1530 hrs. a new situation developed. The Divisional Commander of 3 U.S. Division ordered the Glosters to remain in their positions for a further night pending an attack to restore the situation by an American tank battalion and two infantry battalions. At about the same time the leading tank in the relieving force was "brewed up"—blocking the road.

The position of the Glosters was very serious by then. They were short of food, water, arms, ammunition and wireless batteries. Also an attempt to get helicopters to them for evacuating wounded had failed. An air drop could not be arranged until the next morning. In an attempt to alleviate their position Captains Holmes and Bayton-Evans from the squadron contacted their second-in-command and, with him arranged for light aircraft to "free drop" some of their needs. Five trips were made but, due to the steepness of the ridge they were on, only one was successful. This success was due to Sapper Fairway, an ex-R.A.S.C. air-drop expert who travelled with one plane and managed to hit the target.

On the same day an American Regimental Combat Team (R.C.T.), three battalions with full supporting arms, moved in on the exposed right flank of the Ulsters to thicken up the front in that area. During the evening another R.C.T. started to move into the Brigade H.Q. area in preparation for restoring the Glosters' stretch of the front next day. The 8 Hussars and Philippines also withdrew to the Brigade H.Q. area and the Belgian battalion came back there too.

NIGHT 24TH/25TH APRIL

All the battalions above, and the R.C.Ts., were attacked during the night. The situation began to get very confused with S.A. fire all round and flares and artillery fire continuing throughout the night. The squadron had a 50-per cent stand to at 0205 hrs. and 100 per cent at 0300 hrs. The situation was obviously getting out of control so all vehicles were loaded. The unit heavy equipment, i.e., Park Troop, less one dozer, had been sent south to Yondung-Po the previous day.

The road to the Northumberlands and Ulsters was cut during the night. A force of 8 Hussars was warned to break through this block starting at 0530 hrs. However, all the infantry were engaged so the only support available was from ourselves. 1 Troop under Captain Holmes, was warned for this and Lieutenant Swinbanks, the Park Troop Officer, voluntarily attached himself to the force, as the second officer of the troop was on leave.

This force succeeded in clearing the ground on either side of the road up to a gorge which dominated most of the road. At 0700 hrs. Lieutenant Swinbanks took the men of one of the sections and put them in position on either side of the high ground overlooking the road. At 1230 hrs. these positions came under attack but managed to hold their own, largely due to the efforts of Lieutenant Swinbanks who personally led three men up to a machine-gun post that was causing most of the trouble and silenced it.

At 1400 hrs. the Northumberlands and Ulsters had withdrawn through the gorge and Captain Holmes, from the tank in which he was travelling, was able to call in his men. He and Lieutenant Swinbanks went round the detachments and passed on the order. All this took place under fire. The men then climbed on to the tanks and were carried back, under heavy fire, out of the area. Lieutenant Swinbanks was hit by a bullet and mortally wounded. The total Sapper casualties in this action were three killed, four missing, and fourteen wounded.

The job done by these men played a considerable part in enabling the two battalions to pass back down this road.

By this time the remaining troops of the squadron had been withdrawn to carry out demolitions on the road back to Seoul. This was cancelled the same afternoon, however, and the Troops put on to preparing the bridges over the River Han below Seoul instead.

One final detachment of the Squadron is worthy of special mention. This was known as the ROK Troop and consisted of 150 South Korean civilian labourers. These men were medical rejects from the conscripted South Korean Army. They were unpaid, clothed with the cast-off clothing of the squadron, but fed daily by us with

rice and dried fish. They were billeted in a village right up in the front line and daily, under 2nd Lieutenant Smith R.E., they were put to work on the roads and tracks made by us. Around midnight this village came under small arms fire and a few minutes later the first element of the Chinese came into the village. They did not spare our Koreans and any caught were shot down without mercy.

Their leader, by the name of Oom, rallied his men, however, and, during a lull whilst it was still dark, led them out into the hills.

Two days later they rejoined us, fifty-nine strong, after a hazardous march across the hills and through both lines, having suffered many casualties en route. This was a good effort on their part as they could easily have disappeared and hidden till all the trouble had finished.

By the late afternoon of 25th the battle was finished. On our left 1 ROK Division had withdrawn under heavy pressure to the outskirts of Seoul. On our right, and down the same road as ourselves, 3 U.S. Division withdrew to the same area. In 29 Brigade, 8 Hussars, inflicting terrific slaughter on the Chinese, withdrew slowly to the south, the backs of their tanks loaded high with Sappers, Fusiliers and Riflemen many of whom were wounded. Sergeant Orton, R.E., of 1 Troop, commanded one of these tanks when the commander was knocked out, directing the fire of the turret Besa to excellent effect. By then the Chinese were literally everywhere, amongst the rocks and bushes flanking the main valley, in the hills overlooking the valley and in the paddy and on the road in the valley itself.

The Chinese carried pole charges and anti-tank grenades and succeeded in knocking out six tanks and numerous smaller vehicles with these, but at a prodigious cost in life to themselves. They would have done a great deal more damage if it had not been for the superb discipline and training of the 8 Hussars, who remained completely unperturbed with enemy swarming all round and even on top of their tanks.

About five miles to the west of this the last act of the Glosters was being played out. The C.O. of the battalion was told that there was no hope of relieving him, so he ordered his companies to break out to the south. He himself, with his M.O. and R.S.M., stayed behind with the 200-odd wounded. The fate of only one company is known. This one had been on the northern edge of the perimeter and struck out north with the 90 remaining men from its original 120. Swinging west and then south the party eventually returned to our lines thirty-nine strong.

It is still not known how many of the enemy actually attacked the brigade, but it is estimated at two Chinese armies (equivalent to a Corps), or more than 20,000 men. Some idea of the fierceness of the

action can be gauged from the casualties suffered by other units in the brigade. These were :—

Infantry, 150 ; 1 R.U.R., 214 ; 1 Glosters, 612 ; Belgian Bn., 67 ; R.A. (including one complete troop of 140 Mortar Battery lost with 1 Glosters), 53 ; others (including 8 Hussars), 40.

Conclusions

There are no real conclusions that can be drawn from such a period as that described above. It was after all, a straight defensive battle with vast superiority in fire power on one side, and what proved to be overwhelming numbers on the other. From the general aspect one point emerged, namely that no force too small to be able to defend a D.Z. should be left in a position where it may be cut off.

From the Engineer point of view the need for a sound basic knowledge of infantry tactics was underlined. Such points as the siting of positions, depth of slit trenches and the ability to shoot straight and hold fire were overriding. These things cannot be learned overnight, but are the result of experience instilled over numerous training periods. Similarly determination and endurance were the qualities required ; again these are learned from a background of hard work over a long period and the Sappers were not found wanting in this respect.

LESSONS LEARNT IN KOREA

Three considerations must be borne in mind when discussing lessons that may be learnt from Korea :—

(*a*) The nature of the country and its total lack of adequate communications for a mechanized army.

(*b*) One field squadron is such a small part of the total engineer effort that it cannot be self-contained from the engineer viewpoint and must of necessity adopt some of the manners and methods of the U.S. Engineers.

(*c*) During really cold weather every aspect of an engineer's work is affected more or less fundamentally.

Communications

In spite of echeloning of transport and control of movement the U.N. Army is a slave of the roads. The upkeep and improvement of routes has therefore been the squadron's main task.

As far as Sapper knowledge and training is concerned the correct use of picks, shovels and sandbags have proved more valuable than the availability of road rollers, scrapers or tar-sprayers.

Every junior N.C.O. must be capable of supervising the construction of small culverts using any material that is to hand. It is only

by a sound training, cemented with experience that sandbags, revetting, 40 gallon drums, etc., can be used to the best advantage. Weak or shoddy work is soon shown up by the first rainstorm or heavy traffic.

The supply of standard equipment has been limited and all ranks have had to learn the best uses of local materials or improvised equipment.

In addition to the improvement of existing routes, the construction of jeep tracks to forward units has often been required. These are often of a temporary nature, but are usually required at short notice. It is essential that the Officer or N.C.O. i/c construction has a clear idea of the capabilities of a jeep and loaded trailer and bears them in mind throughout the work. Otherwise time is wasted improving ground that is already adequate, or, alternatively, war-worn jeeps are expected to surmount impossible obstacles.

The strengthening or rebuilding of bridges has shown the British sapper to be inexperienced in handling timber for the construction of piers, bents or abutments. This is probably due to our reliance on an adequate supply of Bailey, whereas the U.S. Engineers prefer to use timber and R.S.J. bridges wherever possible.

There is one further point on the subject of communications, which is more a question of morale than of training. The vast majority of a man's time on road-work is spent on such uninteresting occupations as spreading rubble or digging drainage ditches. This work is vital, but it is not easy to make men realize this. There is a very understandable tendency for men to disdain " road-bashing " or " scratching " as a pioneer job and one that they are only given to do to keep them occupied until something more interesting crops up. This is in no way intended as a slur on men who have worked hard and well and in most unpleasant conditions throughout the campaign, but it is important that every sapper is taught that road work is just as much an essential part of the sapper's trade as the more interesting occupations of bridging or demolitions.

Active Service Life

It took the squadron far too long to settle down to the routine of quick and frequent moves and all that implies in the way of proper stowage of stores, taking meals and sleep at odd hours, and making a comfortable " hole " quickly. Luckily we had done a high proportion of this sort of training in England during the three weeks available to us before we sailed for Korea, but the average Sapper's ideas on how to live on his own were almost childishly inadequate.

The reasons for this failing are not difficult to see, being chiefly due to administrative and financial rules, lack of training time and, also, because less than 10 per cent of our reservists were field trained.

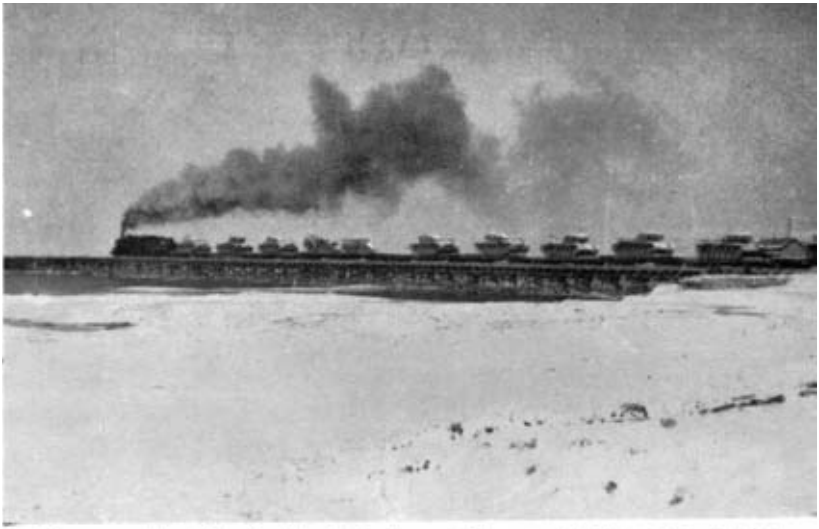


Photo 11.—The "Shoofly" decked railway bridge over the River Han at Seoul.

Photo 12.—"Shoofly" bridge after demolition. The river is now almost completely frozen over.

Photo 13.– Repairing road near Kumsan, A.A. gun for local protection.

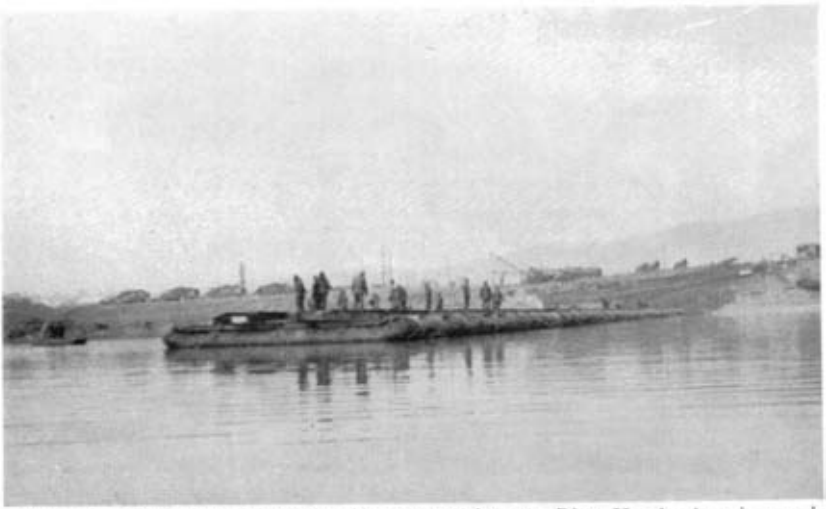


Photo 14.– M2 Treadway Bridge under construction over River Han by American and British Engineers.

Episodes from Korea 13,14

There was a Field Squadron in North Africa last year which went off and lived by itself in the middle of the desert for some weeks. It is just this sort of training that one wants for active service, and is the only way in which one can squeeze the full twenty-four hours of training and experience out of each day. I found that my officers, being keen, were all too ready to go and live really hard, but that is not quite what is wanted. The idea is, of course, to see how comfortably one can live when really left to one's own resources.

Demolitions

The standard of training in demolitions of the British Sapper is considerably higher than that of his American counterpart, but the best use is not always made of explosives in assisting other work. N.C.Os. should be able to estimate quickly the amount of explosive required for blasting road rock and the best way to use it. Also the use of small charges to cut metal roughly when oxy-acetylene is not available requires training.

Everyone knows that, with a really experienced man, the use of explosive becomes as much of an art as a routine science, and more than a little of this art is required in the rush of a modern withdrawal. Quite apart from the economy of explosive aspect, in severe climates the amount of working time spent without gloves must be cut to a minimum. It therefore becomes essential, rather than just desirable, to mass produce made-up charges in a warm place, probably by night, so that they can be quickly and firmly fixed and connected. Such charges are frequently liable to the scouring action of swollen or tidal rivers, so robustness and waterproofing are vital aspects in their design.

Air Recces

It requires considerable practice to judge distances and dimensions from the air, and also to assess just what can be done on an air recce in light aircraft. There is scope for officer training in this which can be of great importance. To quote two practical examples :

(*a*) A British officer (not a Sapper) reported an excellent, undamaged road along a valley where it was proposed to do a long-range penetration action. The road proved to be a footpath.

(*b*) At short notice it was decided to drop an airborne force at Munsani, about twenty miles in front of our forward troops. No air photo facilities existed, but an experienced Engineer officer recce'd the route and reported accurately details of all mines, craters, tank-traps and demolitions on it. The tactics and order of march of the ground forces in linking up with the airborne force were based largely on this report. The operation was completely successful.

In training for air recces a course is not required. What is wanted is a two to three hours flight at the end of which a report on information previously requested by a C.R.E. should be rendered. The officer can soon pick out for himself objects which give away true dimensions on the ground. It should be remembered, however, that behind the enemy lines, when the enemy has air inferiority, the most useful yardsticks, people and vehicles, are not to be seen. In addition all buildings are likely to have been destroyed.

Grenade Throwing

There are types of close country, for instance convex hill tops, where a grenade is the best, if not the only, weapon available to the Sapper in attack or defence. Many Sappers, however, are either frightened of using grenades, or completely ignorant about them.

Wireless Training

Too much emphasis cannot be placed on the need for really good wireless training amongst officers and operators. This particularly applies to units operating with the American Army, where fresh orders, or alterations to existing ones, are issued at alarming speed. Unless a unit is in good communication with its outlying detachments it can be seriously embarrassed by this. Such points as the organizing of battery charging, the proper installation of control and rear link sets in a vehicle which is suppressed, the design of a heated lean-to for operators, and a reasonable knowledge of the working distances of sets, and the screening properties of natural objects are not refinements of training, but the essentials of operating in a modern war.

The basic need in a Squadron H.Q. is for a twenty-four hour rear link and a unit control station operating throughout the daylight hours, and sometimes at night.

Transport and Equipment

The establishment of a field squadron has proved, if any proof were necessary, to be sound, nevertheless a few items require comment :—

(*a*) The universal carriers are definitely the wrong vehicles for Sappers. Mechanically they are troublesome and unsuited to the country. With so many fords to cross, the steering of the average carrier is about 10 per cent efficient. They offer no protection from the weather and are not large enough to carry an effective squad with their kit and even the most basic stores. They are, in fact, more of a nuisance than a help.

(*b*) The tippers are invaluable and have done yeoman work. Nevertheless they are not sturdy enough, especially when filled by mechanical means.

(*c*) Motor cycles were banned from Korean roads and have not been missed, but without them one jeep is not enough for a troop with two officers and two sergeants.

(*d*) Considerable use has been made of improvised stores during the campaign and much useful equipment has been obtained from damaged installations or buildings. For this gas welding gear is invaluable and it is suggested that at least one set of welding gear be held in every squadron in addition to any held in the park increment, or better still, one set per troop.

(*e*) There is a trailer for almost every wheeled vehicle in a field squadron. These vehicles are always going " off the road " but their trailers, usually overloaded, still remain and are a continual headache every time the squadron moves.

(*f*) The increasing weight of tanks and vehicles in modern armies makes engineering work heavier. As a result, existing equipment such as compressors, cranes and D4 dozers, are not large enough.

(*g*) With two officers per troop, are two sergeants really necessary ?

Cold Weather

A lot has been written on life in cold weather and we learned many bitter lessons from our experience. However, I am listing a few points which I have not seen elsewhere.

(*a*) *Tracked Vehicles.*—It is a squadron standing order during cold weather that all carriers are parked on a hard standing overnight, and they carried pieces of corrugated iron for this purpose. Without this, the track becomes frozen to the ground and there is no way of moving it.

(*b*) *Shaving.*—Apart from the morale and smartness aspect, shaving ensures washing, and the sores from dirt and dust are far more serious than the discomfort of cold-weather shaving.

(*c*) *Stoves.*—These are, of course, essentials if only to dry gloves, socks and insoles to prevent frost-bite. But the important point is that it is not only the officer that requires the stove, but the lowliest Sapper, and its transportation and fuel collection becomes no small problem.

(*d*) *Planning.*—At Squadron Commander level and above, a properly heated place for quiet thought is an essential, and it is a false economy to attempt to do without it. In addition, either a " winterized " vehicle or an enormous travelling coat is needed, so that when driving one can take an intelligent interest in one's surroundings, make notes or mark up a map, and not just sit and endure.

(*e*) *Sapper Tasks.*—It must be accepted that the Sapper will have a higher sickness rate due to cold than other arms. He has not the same amount of time available to make himself a warm bivouac as the infantryman out of direct contact with the enemy, and he is the only other man, with the possible exception of the Military Police, whose work keeps him in the open all day and every day. One-third of the Squadron were evacuated to Japan as non-battle casualties during the four winter months, mostly with recurrences of old chest complaints, 'flu and pneumonia. Drivers of vehicles with cabs were hardly affected at all, but, on the other hand, the frost-bite and the worst cases of ear discharges came to drivers and habitual passengers of open scout cars and carriers.

Finally, no report on Korea from the Engineer's aspect would be complete, without a word on our American counterparts. We have learnt a tremendous amount from them, particularly in their use of mechanical equipment and in their development of roads. However, it is their friendliness and generosity that has left the most lasting impression on us. We have had to rely on them for most of our needs, and from the highest to the lowest they have always helped us with every means at their disposal.

Conclusion

I have tried to keep the bulk of this article to lessons which are applicable to all theatres of war, as Korea, with its extremes of heat and cold, its mountains and rivers, and with the Chinese lack of air support and artillery, does not constitute a typical theatre. The whole conduct of the war there is also peculiar. The Chinese operate on a similar " planned wave " strategy to the Russians, so that, between the period of intense danger when each wave breaks, there are long periods of ceaseless toil and watchfulness when the U.N. forces can wrest the advantage.

However, the primitiveness and peculiarity of the conditions there does make Korea, if nothing else, a unique training ground, and a theatre where the characters of junior officers and N.C.Os. can develop under ideal conditions for future army life.

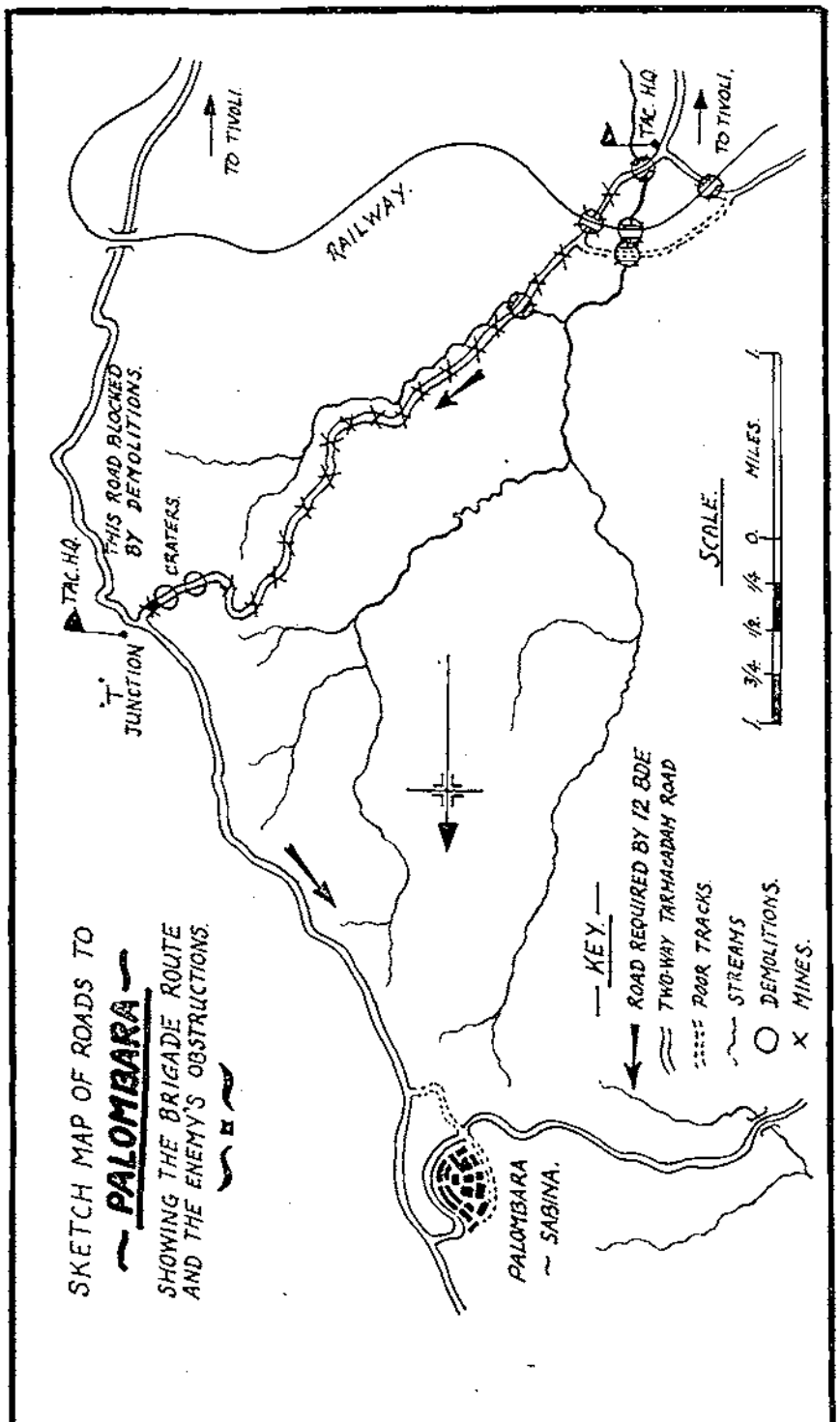
OPENING THE ROAD FROM TIVOLI TO PALOMBARA, JUNE, 1944

By Lieut.-Colonel A. P. de T. Daniell, M.C., T.D., R.E. (T.A.)

THE Germans had been beaten at Cassino in May, 1944, and were in retreat up the leg of Italy pursued by the Allied Army. In the central sector the Americans had captured Rome and on their right the British 4th Division had captured Tivoli.

Early on the afternoon of 7th June the C.R.E. sent for me to give me orders for a special task in support of 12 Infantry Brigade Group. The brigade had followed the retreating enemy as far as Tivoli aerodrome with hardly any resistance, but now the road entered a defile and wound up a twisting valley to the town of Palombara perched on the top of a hill at the head of the valley. This was an important town, as it commanded a large area of the plain below and had, incidentally, been a German Corps Headquarters. However, the enemy had blocked the road with three demolitions and had laid scattered mines in the road surface. The brigade column, which was led by tanks and self-propelled guns, was to proceed up the valley towards Palombara, starting at 0500 hrs. on the morning of 8th June. The C.R.E. gave the company the task of opening this road for the brigade column by 0500 hrs.

Only two platoons of R.E. were available—Lieutenant Chubb's (No. 1 Platoon) and Lieutenant Drummond's (No. 3 Platoon). Lieutenant Notley, with No. 2 Platoon, was already under command of 12th Brigade and in the brigade column and required for work later on. In addition, the C.R.E. put at my disposal a D.7 bulldozer and arranged with the Commander, 12th Brigade, to give me a platoon of the 2nd Battalion Royal Fusiliers as protection. Speed was essential and the company was still twenty miles back. I returned at once and ordered the company to pack up and move forthwith to the area of Tivoli Aerodrome, somewhere on the main road a mile or so short of the first demolition. Lieutenant Simner, with the C.S.M. and a D.R., at once set off with a recce party to find a suitable location for the company. The D.R. was to return to Tivoli Bridge, meet the company and lead them in. Lieutenant Simner subsequently found an excellent hayfield, with plenty of shade and a good entrance, about two miles short of the first demolition.


SKETCH MAP OF ROADS TO
PALOMBARA
SHOWING THE BRIGADE ROUTE AND THE ENEMY'S OBSTRUCTIONS.
TAC. HQ
THIS ROAD BLOCKED BY DEMOLITIONS.
CRATERS.
'T' JUNCTION
TO TIVOLI.
RAILWAY.
TAC. HQ
TO TIVOLI.
PALOMBARA ~ SABINA.
KEY.
ROAD REQUIRED BY 12 BDE
TWO-WAY TARMACADAM ROAD
POOR TRACKS.
STREAMS
DEMOLITIONS.
MINES.
SCALE.
3/4 1/2 1/4 0 MILES.

Having given my orders and got things under way I set off with Chubb and Drummond to have a look at the obstructions. We arrived at the first demolition at about 1800 hrs. It was a demolished bridge over a stream. The stream was dry and the abutments could be bulldozed down quite easily. The second demolition presented rather more difficulty, as it was a partly demolished railway bridge over the road. The roadway was blocked by a mass of rubble containing large blocks of concrete. However, it was again decided that with the help of the bulldozer and a compressor, and perhaps explosives, a way through could quite easily be cleared. Some Teller mines had been laid on the road between these two obstacles, but had been lifted before we arrived. The general road surface was tarmac and the mines had been cunningly laid in the potholes. Curiously enough three had been exploded, when the bridge had been blown, by falling lumps of masonry ; leaving quite sizeable craters in the road surface.

I gave the clearing of these two obstacles to Chubb, who returned to bring up his men. Drummond and I then walked on to the next bridge shown on the map. We stepped carefully, keeping to the tarmac surface, as there were several hastily laid Teller mines in the potholes. These were very obvious as the potholes had the appearance of having been filled with loose stones. Sure enough the next bridge had been blown. But again the demolition had only been partially successful, leaving half the roadway intact. We decided that if this portion was clearly marked with handrails it would take wheeled traffic, while a diversion could be bulldozed down one side and up the other for tanks, the stream being dry. I gave Drummond the task of clearing mines in the road surface and making this tank diversion with the bulldozer, when it had finished working for Chubb. Telegraph poles would serve as handrails and the job seemed straightforward. We didn't go further but returned to the company, Drummond to organize his platoon into mine-sweeping parties, etc., and I to report my plan to the C.R.E.

Chubb, with No. 1 Platoon, arrived on the scene at about 1900 hrs. and immediately made a start on the first demolition with two sections and a compressor. The remaining two sections, with half a dozen Italian workmen attached to the company, started work by hand on clearing the bridge. One of the rails was hanging across the gap and had to be cut with two slabs of guncotton. The bulldozer arrived about 2000 hrs. and immediately got to work on pushing down both abutments of the first demolition. It took one and a half hours to complete this first job, making an easy ramp down and up again. The bulldozer then moved on to the railway bridge. Here quite a lot of work had been done by hand and the larger blocks were now uncovered. It was decided to try and drag these

out of the way with the bulldozer and a cable. This proved most satisfactory and all the big blocks, some weighing several tons, were dragged clear. It was then an easy matter for the bulldozer to clear the small debris and a way was cleared, down to the original road surface, by midnight. The bulldozer then went on to No. 3 Platoon's demolition, and No. 1 Platoon broke off for tea.

Meanwhile Drummond had met the protection party of Fusiliers, which consisted of only two sections under a sergeant, and had brought them up with his platoon. He arranged for one R.E. section to clear mines between the railway bridge and the next demolished bridge, one section to erect two telegraph pole handrails and the remaining two sections, with the protection party, to proceed straight on up the road, clearing mines. The protection party was to proceed in bounds, about a quarter of a mile ahead of the mine-sweeping party, one section leap-frogging the other. All went well so far, the countryside being completely deserted and very quiet. When the bulldozer arrived about midnight at the third demolition the moon was up and it was quite light. By 0100 hrs. both the handrailing and the tank diversion were complete and the mine-sweeping party were getting on to the " T " junction, having found scattered mines all the way. They had lifted about a hundred Teller mines.

Our communications were as follows : I took my Dingo scout car with a No. 21 wireless set up to the first obstacle and was in constant touch with Company H.Q. From there messages were relayed to the C.R.E. by a No. 22 wireless set on the " N " Section Royal Signals net. This channel of communication proved completely satisfactory and I was able to pass hourly reports on the work straight through to the C.R.E. My " Dingo," which was in effect my Tac H.Q., had, necessarily, to remain at the first demolition until this part of the road was opened at about 0100 hrs. We were then able to proceed up the road to the forward mine-lifting party.

During this period of waiting some heavy demolitions were heard and seen away to the right on the parallel road from Tivoli. This meant that the Germans were still blowing demolitions on this road and that we were, therefore, likely to meet them at the " T " junction. The Germans evidently thought we were going to use this road, whereas in fact we were not ; so the more effort they wasted on it the better. I was most anxious to get on up to the " T " junction to find out how things were going.

I drove the " Dingo " myself with some trepidation as the road had been mined spasmodically throughout its length and, although cleared, I was the first British vehicle to drive up that particular stretch. However nothing occurred. I reached Drummond with his men just short of the " T " junction. They were working on two craters which had only been blown by the enemy about half an

hour before. In fact, when the explosion occurred, pieces of earth actually fell near the Sappers who were then working about a quarter of a mile further back. The mines, too, had only just been laid ahead of the Sappers. As Drummond was telling me this an excited group of Sappers arrived with a prisoner. He had apparently been surprised and taken by Sapper Curtis, Drummond's batman. This appeared most satisfactory and I decided to take him back to Brigade H.Q. straight away in the " Dingo " in case he might have some useful information. I ordered Drummond to hold the " T " junction with his protection party until my return. I was anxious to reinforce this party in order to prevent any interference, and, if possible, to prevent any demolitions or mining on the road to Palombara, which appeared to be still open and in use by the enemy.

On the way down I met the bulldozer trundling up the road on its tracks to help No. 3 Platoon if required. I told the driver to stop and wait my return. We got to Brigade H.Q. at about 0200 hrs., where I handed over the prisoner and at the same time told the Intelligence Officer that the Germans were still using the Tivoli—Palombara Road, which meant that it must be still intact. Intelligence Officer, who was on duty in the Command Vehicle, was delighted with this news, and promptly sent for the Brigade Major who arrived a moment later in his pyjamas. The prisoner was then closely questioned by the Intelligence Officer. He was very young, a little frightened, and appeared quite willing to talk. He belonged to No. 3 Company of 1 Paratroop Regiment. The Company was only about sixty strong and was engaged in laying mines and blowing demolitions in order to impede our advance. After which they expected to be withdrawn to the Florence–Pisa line. He was on guard at the " T " junction and had no idea that British Sappers were working on the road. He thought the leading Sappers were Germans returning, as not one was wearing the unmistakable British steel helmet. He stated also that there were about forty of his Company still working on the Tivoli road. This confirmed my desire to reinforce my protection party and I promptly put my request to the Brigade Major. He agreed and ordered the remainder of the company of the Royal Fusiliers to move in transport to the " T " junction, where I would have a guide to meet them. The Paratrooper was handed over to the Military Police and I returned to Drummond, telling the bulldozer on the way to proceed on slowly.

On meeting Drummond at the junction he told me that during my absence two lorry loads of Germans had passed by in the direction of Palombara. The first lorry had passed so quickly that everyone was taken by surprise and no shot was fired. The second, however,

received two Bren magazines and several Tommy-gun bursts. It had not been stopped, but considerable damage must have been done as cries of pain were heard. This presumably accounted for the remaining forty or so paratroops. It was now getting late, being about 0330 hrs., and we still had 6 miles to go before reaching Palombara, and only one and a half hours left. I ordered Drummond to push on with all speed, checking the road for mines.

Almost immediately the company of Royal Fusiliers arrived at the "T" junction, where I had now set up my Tac H.Q. I explained the situation to the Company Commander stressing the importance of pushing on, but at the same time to guard against interference as the enemy now obviously knew our intention. He quickly organized his company into a vanguard and mainguard, with sections on either flank. He himself remained with Drummond and the mine-sweeping party. It was now well after 0400 hrs. and getting light. Chubb, with No. 1 Platoon, had now arrived at the "T" junction together with the bulldozer. I kept them there as a reserve. Meanwhile this force proceeded up the road in the direction of Palombara without interference and without meeting any obstructions or mines.

As it became light several Italian civilians appeared from the direction of Tivoli and with gestures made it quite plain that the Germans had done considerable damage and also apparently laid mines. They added that two Germans had been killed in one of their own explosions.

Just before 0500 hrs. a Sapper came back on a borrowed Italian bicycle to say they were within half a mile of Palombara. I immediately reported this over the air to the C.R.E. The next report I received shortly after 0500 hrs. stated that they had reached the village, but had been fired upon by a Spandau, and had, therefore, taken cover to await the arrival of the tanks. Again I reported this over the air and likewise waited for the head of the Brigade Column which was expected at any moment.

Precisely at 0530 hrs. the Reconnaisance "Honey" tanks leading the Brigade column appeared rounding the corner to the "T" junction. I told the officer in the leading tank the situation and they promptly drove off down the road to Palombara. They drove straight into the village without any further opposition. The Spandau crew obviously did not like the look of them and beat a hasty retreat. The Brigade Column went by and was a most impressive sight. Behind the reconnaisance "Honeys" came Lieutenant E. A. Meldrum, of 59 Company, R.E., in his "Dingo," acting as R.E. Recce Officer. With him were two "Honey" tanks of the Armoured Brigade Sappers. Then followed a squadron of Sherman tanks with a company of the Royal Fusiliers riding on them. That comprised the vanguard which was followed almost immediately by the

advanced guard, led by the Command Group with Gunner O.P. vehicles, a protection troop of anti-tank guns and a troop of self-propelled field guns and then Lieutenant Notley with No. 2 Platoon of 59 Field Company. All told, the vanguard, advanced guard and main guard consisted of some 183 vehicles, representing a very strong force capable of delivering the enemy quite a hard knock.

When Notley reached Palombara he took over the responsibility of the road from Drummond, who returned on foot with his Platoon to the " T " junction. All were a little weary after walking nearly twenty miles. Meanwhile their transport had come up. They piled into trucks and returned to the company location to eat a good breakfast. I reported over the air to the C.R.E. and returned myself, taking Drummond with me. Chubb, with No. 1 Platoon had already returned. It was just on 0800 hrs. by the time we had all arrived back.

The clearing of this road to Palombara was almost a " model " R.E. task. It was scheduled to be completed at a specified time and was, in fact, finished on time. Certain points of interest arise from a study of it. The most important being that the protection party should really have been stronger in the first place ; for, if the paratroops had wanted to, they could very easily have done a lot of damage and seriously impeded the Sappers working both on clearing demolitions and on mine sweeping. Sappers are always few in number and cannot as a rule protect themselves when working on a task. The bulldozer was of immense value and fully justified the use of a D.7. A serious criticism was made that insufficient signs were posted, such as " Mines in verge," " Verges cleared," etc. This was quite true, as in point of fact the verges had not been swept, and later in the morning a 5.5 in. medium gun was blown up by a mine in the verge when passing another vehicle. The verges had later to be properly checked and signposted. But this should have been done in the first instance. However, the task, which was to clear the road to Palombara in time for the Brigade Column to pass through, was successfully completed. The Brigadier congratulated the company and thanked us for the job.

"LOOKING AHEAD"

By "CRYSTAL-GAZER"

"Nescis, mi fili, quantilla prudentia mundus regatur."
(*"Know you not, my son, with how little wisdom the world is governed?"*)
Count Oxenstiern.

IT might be thought presumptuous that one, who has never had the benefit of a Staff College training, should dare to explore the realms of higher stategy, were it not for the fact that our future existence as a nation undoubtedly depends upon a realization of the scope of modern warfare by all those, who may be called upon to bear responsibility in the future.

NEW WEAPONS AND NEW STRATEGY

During the "Kaiser's" war, the British Army, largely due to the initiative of an officer of our Corps, was responsible for the evolution of the greatest modern weapon—the tank. Within twenty years, military thought in this country had retrogressed to such a remarkable extent that not only had we virtually divested ourselves of this vital weapon, but the Germans were able to achieve a great strategic victory by the correct use of the very weapon, which their opponents had invented.

Is there not a similar danger in regard to atomic warfare?

Whilst not wishing to minimize the importance of the Korean campaign, it is admittedly a strategic side-show and is being fought entirely on the lines of the 1939–45 war. This naturally produces a dangerous tendency to imagine that, should a major war break out, it also will be conducted on well-established lines.

Similarly, reports on the state of the Russian forces in Europe indicate that an offensive would be conducted on conventional *blitzkreig* lines. Thus again our attention is focused on the military trends of the present, without giving due consideration to developments of the near future.

Bearing in mind, the time taken to develop the V2 rocket and the atomic bomb, it would appear that provided adequate scientific research, backed by industrial capacity, is made available on a national scale (as is certainly being done to-day in Russia), it should be possible by 1960 to produce radar guided missiles with atomic war heads capable of inter-continental bombardment. When this stage has been reached, it must be accompanied by a corresponding strategical conception, to achieve which the rank and file of the armed forces must be mentally prepared.

Whilst therefore accepting the view that should a major war break out prior to 1960 or thereabout, it may well be fought on

1939–45 lines, we must *now* lay the foundation for the new post-1960 strategy, not only in the field of scientific research and development but in the organization and training of our armed forces. Our Corps has a tradition second to none with regard to its ability to adapt and improvise to meet new conditions ; and must therefore be prepared to give urgent consideration to these new and pressing problems.

If we accept the fact that the guided atomic missile is no longer a fantasy of the future, but a potential weapon now within the grasp of any state with highly developed industrial resources, it is obviously of the first importance to allocate responsibility for its development and use. Firstly let us be quite clear that this is not just a new form of artillery weapon, but in view of the vast range and speeds, of which it is capable, it constitutes in itself a new form of warfare and provides scope for offensive action on a scale previously undreamed of on land, sea and even in the air. The responsibility for its development and use must therefore entail a vast diversion of technical effort and man-power, and must be given the widest scope.

What then should be the division of responsibility between the services ?

The Navy is an obviously unsuitable parent for this new weapon. Apart from the paucity of technical establishments and personnel, long association with that ponderous element the sea, has engendered a frame of mind that regards such new weapons with uneasy misgiving. The Army could stake its claim to parenthood on availability of men and resources—but this would involve the creation of a new Corps at a time when its technical resources are already overstrained and industry can afford little assistance.

What then of the Royal Air Force ? Marshal of the R.A.F. Sir Arthur T. Harris has, in his book *Bomber Offensive*, given his considered opinion that the radar-controlled gun plus the proximity fuse has rendered the bomber obsolescent and this view must find general acceptance to-day in view of the marked efficacy of these devices. Here then, surely, is the missing parent ! With its control of airfields, technical personnel and resources, the R.A.F. is ideally suited for developing the guided missile. A new " Guided Missile " Command should be formed, which would work in close liaison with, and would eventually entirely supersede, Bomber Command. With the disappearance of the bomber, the need for fighter aircraft would be limited to defence against air-borne troops, and Fighter Command could therefore materially contribute to its new little brother.

The Royal Air Force should, therefore, be given responsibility for the development of the guided missile including preparation and protection of launching sites. Their sphere of responsibility would also include development of protective devices.

The Navy would be responsible for the provision and control of

floating launching sites, but the provision and firing of the missiles would remain a R.A.F. commitment—a detachment of R.A.F. personnel being allocated to each "vessel."

The Army would not, therefore, be given any direct responsibility for guided-missile warfare.

Guided-Missile Warfare

I have already stated that the combination of the atomic bomb and the guided long-range rocket projectile places in our hands a weapon of undreamed of power and must inevitably bring with it an entirely new concept of modern war. The first salvo would be capable of destroying all the main centres of industry and would be sufficient to bring an ill-prepared country to her knees.

W. L. Borden in his book, *There Will Be No Time*, points out that the only protection lies not in dispersion, concealment or protective devices, but in a bold policy of counter offensive, the enemy being forced to give prior consideration to knocking out the potential threat to his own cities. Our policy must, therefore, be the provision of a widely dispersed chain of self-contained launching sites, well concealed and protected, capable of instant retaliation against specified targets. The floating launching sites provided by the Navy would play an important part in this organization.

Sites would be supplied with their quota of projectiles which would be housed in underground stores.

The counter-salvoes, when fired, must be of sufficient weight and accuracy to cause the destruction of the enemy's main industrial centres and be sufficiently sustained to destroy his will to continue the struggle.

This could only be achieved by careful planning and co-ordination, the provision of a vast organization of man-power and industrial resources and an enlightened and far-seeing over-all strategy.

The Rôle of the Army

What then is the rôle of the army under these conditions?

Firstly, the conception of a major land offensive, comprising armoured or airborne thrusts backed by a mass of mechanized infantry with all the accompanying panoply of supporting units and formations, must be considered as dead as the proverbial door nail. Any such offensive would be shattered and brought to a standstill by a well directed atomic salvo. On the other hand, there will remain great scope for both comparatively small-scale airborne operations against lightly defended targets and for rapid armoured thrusts into enemy territory—particularly when combined with the disorganization produced by an atomic missile attack. Such thrusts would be conducted with great rapidity and on a comparatively wide front, the object being to destroy industrial potential and to increase chaos and confusion rather than to capture territory.

Supply from the air would enable administrative echelons to be reduced to a minimum.

The defensive rôle would involve the protection of any land or vulnerable sea coast frontiers and of any vital industrial or administrative targets, liable to attack by enemy air-borne forces. This would include anti-aircraft defence, which would be co-ordinated with the anti-guided missile devices manned by the Royal Air Force.

The Army would also be called upon to undertake its share of the responsibility for maintaining essential services of national importance after damage by atomic bombardment, since local authorities would be fully occupied in dealing with casualties and fire fighting. (The R.A.F. being left free of such commitments to conduct the counter offensive measures.)

Lastly the Army must still be prepared to undertake the traditional rôle of occupation of enemy territory—after atomic bombardment has brought about a complete or partial surrender, or a complete breakdown of organized resistance.

The Rôle of Royal Engineers

Lastly, what is the rôle of our own Corps in these conditions? This may be subdivided into four categories :—

(*a*) Offensive.
(*b*) Defensive.
(*c*) Administrative.
(*d*) Civil defence.

Under the category of an offensive rôle, may be listed our traditional duties of bridging, road making, mine lifting, and the clearance of obstacles. Whilst these tasks must inevitably follow well-established principles, equipment and training must be brought into line with the Army's new rôle and the over-all strategical concept. Equipment must be suitable for rapid transportation and erection, men must practice working in areas subject to contamination by radio active particles, the use of small atomic charges for the destruction of obstacles must be studied, and the importance of dispersion and night work must be stressed again and again.

Our defensive rôle includes field defences of all types including mine laying and demolitions, the provision of underground storage and battle headquarters, and the ability of all units to provide their own defence. Atomic explosives must be considered for demolition work. Although I foresee little use for the large-scale semi-permanent type of minefield, we must be prepared to use the mine to counter rapid enemy thrusts by armour or from the air and to do this must press on with the development of light A/P and A/T mines and with rapid minelaying techniques. An A/P mine on the lines of the German Schumine would appear to offer great possibilities.

Whilst it will never be either desirable or practicable to "go underground" on a large scale, we must provide underground storage for our atomic missiles and for control staffs. Experience must be gained in the construction of large underground concrete buildings, and in particular, attention must be paid to making these damp-proof. E. & M. staffs must consider the connected problems of dehumidification and air conditioning. Lastly, units, sub-units and the individual sappers must learn to use their weapons effectively and to be self-reliant and confident under atomic attack.

Under the heading of our administrative rôle, I group transportation, accommodation and water supply. Obviously in any atomic warfare, damage is likely to be on a colossal scale. The effects can be mitigated by widespread dispersion and effective concealment. Repair dumps must be self-contained and organization must be flexible and capable of decentralization. The question of decontamination of water supplies must be examined.

The use of inland waterways in the event of a breakdown of road and rail facilities must be borne in mind.

Finally our rôle in the civil defence organization. It may be assumed that the army will be asked to assume responsibility for certain essential services such as the National Grid system of the B.E.A., certain main road and rail routes and possibly certain telephone and radio installations.

It is obviously very desirable that units, likely to be thus employed, should be given specialist training in their respective rôles. Close liaison with the civil authorities is essential both as regards planning and operations. Responsibilities would presumably be allocated to units on an area basis and this would indicate the employment of Territorial units.

Conclusion

The expert (if he reads this article at all, which I much doubt) will probably give a superior smile and dub it trite (which it may well be) or second-hand nonsense (which it most assuredly is not).

I would remind him that it is written, not for him but for those, who like myself, know nothing of the detailed technicalities, but have given a little thought to the general principles involved.

It certainly requires no justification. Should we, as a nation, fail to appreciate the potentialities of these new weapons, to utilize our industrial skill in their development, and to study their application to modern warfare, then we must inevitably sooner or later abdicate our great position in the world. If, however, we are prepared to make good use of the time granted to us, and to work and plan with minds freed from the study of outdated methods of war—then we can indeed look forward to the future with confidence, with resolution, and with hope.

COMMAND, TRAINING AND MORALE

By " CHILIARCH "

A GREAT deal has been said and written on each of these subjects ; much that my own convictions assure me is right, much that I accept because of the authoritative position of its authors at the level with which they are dealing, and a certain amount that fails to convince me. It is within the realm of Morale that I am most sceptical, and I think that, broadly speaking, there are two reasons for this. In the first place the opinions expressed have been almost entirely those of very senior officers whose current and recent experience has been gained in the higher levels of the military hierarchy. This has not necessarily deterred them from dealing with the subject over the whole range, from their own ceiling right down to ground level, and even if they have become increasingly reticent as they have approached the lower strata this very reticence means that a great deal has been left unsaid at a level where it is vital that there shall be no misunderstanding. In the second place morale has so often been treated as though it were a self-contained subject, passing references being made to the facts that it is affected by, and has its own effect upon, other subjects including Command and Training.

I believe that all three subjects are so closely integrated that it is impossible to deal with any one in detail without applying the same treatment to the other two : that at each level morale is compounded of command and training at that level and of morale at the next lower level. Specialized study of morale seems to me as unreasonable as specialized study of the flight of a cricket ball delivered by a first-class bowler, with a passing reference to the facts that, of course, the bowler must be able to make the delivery and that the object is to defeat the batsman. This is all good so far as it goes, but it is no more than the introduction. It is not worth the trouble taken unless it is followed by a study of the method of producing the delivery and of the precise effect it has upon the batsman.

It seems to me that the essential quality of morale, and therefore of the technique involved, has a different colour and a different texture at each level : that it is comparable to one of those interesting-looking cakes that are made in layers of different materials and colour, and which are equally appetizing whether they are eaten in

vertical or horizontal layers. There may be graduations within each layer, but the purpose of this article is to deal with the layers—and specifically with one layer—and to leave the graduations to suggest themselves to the reader. Interpreting this analogy of the layer cake, I will say at once that I see the problem of morale in his armies, as it presents itself to the C.-in-C., as something quite distinct in texture from the problem as the Regimental Commander sees it. Obviously the C.-in-C. can get nowhere with his problem if the Regimental Commander's problem is not successfully tackled, but direct assistance and guidance to the Regimental Commander must come strictly from within his own layer.

I recollect an article on morale by a high-level senior officer in which he described one of his own actions as a junior subaltern, and from which he drew the conclusion that his action had had a very beneficial effect upon morale. My own assessment of the action, as described, was that of itself it was most unlikely to have had any such effect upon morale. If I give half-a-crown to a hungry beggar his morale will certainly go up, but it would be unwise to deduce from this that it was my action, considered purely by itself, that produced this effect. My good intention will not carry nearly as much weight as will the physical possession of half-a-crown. It is all too easy to work backwards from effect to cause and get the answer wrong, especially when the original deduction was bred of immaturity and inexperience and is subsequently recalled to mind after the lapse of many years. It is even easier to be mistaken, in these circumstances, about the original motive for the things we did. This is of fundamental importance because soundness of motive is, or should be, the essence of every action that improves morale.

I believe that good morale and the ability to influence morale are two distinct qualities that must be developed in that order. Time is an element in both because time means experience. In the raw soldier, officer or other rank, morale is a seed, or at best a seedling. It requires steady and intelligent attention from a skilled man to bring it to the mature and healthy state in which it is able to produce its own seed of potential leadership, which is the short description of the quality of ability to influence morale. This second seed also requires skilled attention in its early stages, but it is far more dependent than was the first seed upon the kind of soil in which it is raised: this soil is the basic character of the man himself.

Consequently I believe that, when the young officer makes contact with his first unit and his first small command, it is the morale of the officer and not that of the unit that is at stake. A great deal of harm can be done which it may take a long time to rectify if this is not realized. Moreover, given a good unit—and the whole edifice collapses if we cannot make this assumption—I am sure that this is a

good thing from every point of view. Responsibility for the personal morale of the young officer can give a tremendous fillip to unit morale.

I remember the occasion when, as a subaltern of four years' service and lately put in charge of the mounted section of my Field Company, the day arrived when the section was to be inspected by my Company Commander. Noticing that I was apprehensive, the mounted sergeant and the mounted corporal severally took me on one side and said "Don't worry, sir, the chaps won't let you down." They did not let me down, or rather I should say, in the light of more mature consideration, they did not show me up. Looking back on the incident I know that my Company Commander was not really inspecting the section. He wanted to assure himself that the section was doing its duty by me and that I was the sort of chap they would not want to see shown up. All through the ages the British soldier's morale seems to have benefited from his tolerantly kindly attitude to the young and the helpless.

Even the dumbest soldier is not a complete fool. Good or bad he is, on the whole, a simple and obvious individual and a thoroughly bad actor. But he is quite remarkably quick to recognize artificiality in others and even to suspect it—often perhaps wrongly—when he can see no obvious explanation for actions which affect himself. Consequently whenever an officer's action directly affects himself he looks for a simple explanation : if he cannot find one he will invent one, and two of his normal guesses can be politely translated as "putting on an act" and "trying to acquire merit." The soldier expects his leaders to organize things properly and to take practical steps to ensure that life shall be no more unbearable at any time than is unavoidable. It does not take him very long to grasp the fact that a leader's contribution is made largely behind the scenes as well as in his more public actions. In his own peculiar way he recognizes the three main responsibilities of any leader to be those of organizing, delegating, and checking performance and results. So long, therefore, as the soldier can detect signs of clear purpose in his leader's actions under one or other of these three heads he will be assured that all is well and his morale will be high. Herein will be found the fundamental responsibility of a leader at any level.

It is, of course, axiomatic that a leader must be prepared at all times to share the discomforts that are bound to befall his men. But in the process of doing so he must be very careful to ensure that there is a "Leader purpose" behind his action that will be obvious to everyone. The apparent purpose must be a sound one : the leader will then be making a positive contribution to morale. To court discomfort for no other apparent reason than that he is unable to remove the cause of the discomfort will not make sense to the

soldier. It may even lower the soldier's morale to discover that his leader has not sufficient sense to "come in out of the rain." The soldier has no great flair for deducing the general from the particular, especially when the particular seems stupid to his simple mind. The three responsibilities for organizing, delegating, and supervising are the visible manifestations of command and training.

Modern science tells us that the behaviour of very small particles of a mass is not always governed by the same set of relative rules as those which determine the behaviour of the mass itself, and it is not necessary to be a psychologist to see how applicable this is to the behaviour of human particles and masses. In the scientific world particles and masses are subjects of separate study, the results of which form the basis of more advanced study by scientists of great eminence. The same is true of the science of human relationships. Command and training are the very essence of morale and they are the function of the expert working within his own orbit. Within this orbit consistency is vital, but consistency does *not* imply rigidity: on the contrary rigidity can be the worst enemy of consistency. There are at least six ways in which command, training, and morale can be combined to show the relationship between each and one of the other two, depending upon which may be said to be providing the "action" at the moment and which the "reaction." This is a matter of simple mathematics. The well-being of a unit may be regarded as a jewel cut with these six primary facets, each of them requiring the same degree of intelligent care in the cutting. On whichever facet work is being concentrated at the moment, there must be consistency of general method even if the tools or the individual workmen may vary from facet to facet. If some jewel expert quarrels with my simile let him imagine that the jewel is being cut from wood, with all its problems of changing grain. In spite of my contention that command, training, and morale are inseparables I have thought it advisable to deal with each as a separate subject within the main subject. It will very quickly be seen that they overlap and merge into one another, so that what is included under one head could as well have been dealt with under one of the others, if not under all three. This of itself confirms their essential inseparability.

Command

Every soldier is rightly encouraged to study the great commanders of his own and other days. Study does *not* mean imitation. How often have I heard it said of some commander "He tried to copy so-and-so." I have never yet heard this said in a complimentary sense: the end of the sentence is usually "and he didn't go down at all well." A man either has qualities that make him potentially great or he has not. Most of us have not. If he has these qualities

he has no need to copy anybody, nor would he, I think, have the seeds of greatness within him if he showed any desire to do so. If he has not got these qualities he will appear, at the best, as a good gramophone and at the worst as an exceedingly bad one. In either event he will appear to have no personality of his own. It is quite another thing to study and to profit from the motives and from what I would describe as the more impersonal techniques of great commanders, with especial emphasis on their motives. And it is important that all their success should not be attributed to their greatness.

General Eisenhower's understanding tolerance of the "naughtiness" of the great General Patton has often been cited as an indication of the greatness of the former as a commander. This disguises the obvious truth that no one can become a great commander unless, in the first place, he is a good commander, and that no one can achieve even this unless he is careful to study motives. What a man says or does is frequently not nearly so important as his reasons for his words or his deeds. The methods and the motives of the great commanders should be studied in the same light as the modern version of the Principles of War. Up to 1936 or so these principles were clothed, in Field Service Regulations, in garments of great sanctity. Faced with this array of principles and the hundred-per-cent inviolability that was apparently accorded to each, I often used to wonder how a commander dared to make a decision at all. Just prior to the 1939–45 war they were rewritten and appeared in their proper guise as factors which must be considered when making an appreciation. So with the deeds of the great commanders I think we need to be severely honest with ourselves in deciding the extent to which their words and deeds are garments that we can wear without making ourselves look ridiculous. This all boils down to the fact that, to his subordinates, a commander must always appear as his genuine and sincere self. He must never "put on an act" however excellent of itself the act may be. Command is a combination of heart and head, the proportions of which change—and the change is a permanent one—as the commander ages in years and experience. The change is not, or should not be, brought about by whittling down the quantity of heart but by adding progressively to the amount of head. It is the very permanency of the change in the compound that makes it so inadvisable for a commander to concern himself in too detailed a manner with a level that he has left behind. At every level there must be a profound determination to understand immediate subordinates, so that the latter may gain the self-confidence and desire to be of service that are the absolute fundamentals of good *personal* morale. Good unit morale cannot be, so to speak, "inserted" at some carefully considered level. It is the integral or sum of the good morale of every

individual in the unit. Once a good basic morale has been established there are all kinds of stimuli that can be applied. But nothing useful can ever result from manuring and watering the soil round a plant of which the root is inherently unhealthy. Morale-raisers of a communal nature are quite useless if they are relied upon to create unit morale.

Training

It is the responsibility of any commander to ensure that, as far as possible, every one of his subordinates really benefits from his training. I know that this sounds like a statement of the obvious, but it is surprising how easily obstacles seem to grow in the path to this seemingly simple objective. For example a course of instruction will have a target which must be based upon the standard presumed in the student before the course begins. But the target must be altered if it transpires that the initial standard is not as high as was expected, or if their capacity for learning the subject is not up to expectations. Otherwise the result will be definitely harmful to the students' morale. It is fatuous for the instructor to take his stand on the infallibility of the syllabus. If it is not possible to complete the full syllabus the harm done will be as nothing compared with the ill effect of talking over the students' heads for the greater part of the course. Some instructors seem to be afraid that non-completion of the syllabus will be regarded as a sign of their own shortcomings as instructors. They should feel that the forcing of more and richer mental food into the minds of students already suffering from mental and technical indigestion is a far more serious sign of incompetence in a teacher. What applies to a course is equally applicable to all forms of training. If an instructor cannot impart his subject at the pre-determined speed he should be scrupulously honest and should say so. He should be able to place complete faith in the ability and the desire of his superior to discover the reason. An instructor who is honest with himself may still have a limited capacity for good, but at least the results of his efforts will all be on the credit side. Once again it all boils down to this question of motive.

I am not at all sure that the mental approach to the technique of teaching in the Army is as universally right as it ought to be. I believe that pure and simple teaching appeals to the student's memory and not to his intellect, and that it is only suitable for the very immature mind. It is rejected by the student who wants to use his intellect and who is consequently left in a vacuum. What is really required is ability to assist the student to learn, which is a very different thing. To begin with it demands an ability to see the picture that is building up in the student's mind. The picture may

be slightly different in each individual mind, and within the whole body of students the extremes may be extravagantly different. A good instructor is able to recognize these pictures from the students' questions, and the first-class instructor is the man who is able to prevent these incorrect pictures from forming. The born instructor is a rarity, and in his absence the best substitute, in my opinion, is the man who has himself experienced difficulty in learning the subject. His quick understanding of a student's problem gives the student the comforting feeling that he is not, after all, utterly subnormal. I remember the great difficulty I experienced in acquiring the most elementary glimmerings of understanding about the nature and workings of shear forces. My eventual partial enlightenment owed nothing to the efforts of those whose official job it was to see that I understood it. In fact my instructor's reaction to my questions was that he did not understand my difficulty. The real tragedy lay not so much in his failure to assist me as in his failure to realize that his inadequacy was far greater than mine, and much more serious. Some years after I had seen something of the light in respect of shear, I was invited to attempt to explain it to a senior officer who made no bones about the fact that it had no meaning whatever for him. Some twenty minutes later he was good enough to say that, for the first time in his service, he was now prepared to admit that such a thing as shear might well exist and that it would account for some of the phenomena he had seen !

I have a vivid recollection of a lecture given many years ago by a well-known lecturer on the English language who laid great emphasis on this matter of the picture building up in the listener's mind. He quoted the case of the history master who told his class that the darkest passage in the reign of King Richard had been the murder of the two young Princes in the Tower. The whole class remembered this dramatic statement when examination time came round. Unfortunately, almost without exception, they recorded the fact that King Richard had murdered the two young Princes in a dark passage in the rain. The moral is simple : if you won't get anywhere by deliberately talking down to your audience neither will you get anywhere by talking over their heads. It is not really all that difficult to be understanding and at the same time remain natural ; provided that there is real determination to be understanding.

It is a cardinal point in the technique of command that a commander should not deal *unnecessarily* with detail. I have italicized the word unnecessarily because, although I believe it to be the operative word in the precept, it is the one word that is normally omitted when the precept is quoted. A commander is responsible for training his subordinates, and this clearly includes responsibility for seeing that they are competent to handle the detail that comes

their way. In normal circumstances of continuity the best way to learn detail is to study the man who is successfully dealing with it. But if this continuity fails, the commander must be prepared to teach the detail himself, not only because of the short-term injury to his command if it is not properly handled, but also because of the long-term injury to a far wider range of units and individuals. In these circumstances—and as a result of six years of war they have been with us since 1945—detail at the commander's level only becomes " unnecessary " when he is quite sure that his subordinates know how to handle it. The feeling among subordinates that they cannot expect their commander, in any circumstances, to teach them anything about the detail of their work can have a most adverse effect on their morale and, through them, upon the morale of a great many other people as well. Of course it means more work for a time for the more senior officers, but it is work that pays one hundred per cent in dividends from every point of view.

A commander should be receptive to the opinions of his subordinates, but for the good of his unit, as well as for their own good, he must be sure that their opinions are founded on a substantial basis of knowledge. It is, therefore, a good thing for a commander to work out, let us say, an administrative system in some detail and to hand it to his subordinates with a clear statement :—

(*a*) explaining what the system is designed to achieve, and
(*b*) inviting suggestions for improvement on the basis of well-informed practical experience of the working of the system as it stands.

The original system may have a number of inherent weaknesses, but at least it is a reasoned system to which everyone is working. A rugby selector's task is made much easier by the knowledge that all the players are playing to the same set of rules.

I have heard people say that the mass of detail with which the Unit Quartermaster has to deal is no concern of anyone but the Quartermaster. I have met a number of Quartermasters who have failed to achieve anything more than basic adequacy, and I believe this to have been due, to a great extent, to lack of attention by the commander in the early days of commissioned responsibility. Through no fault of his own the Quartermaster reaches his position as an officer as the most out-and-out specialist in the unit. As much as anyone else he needs the wise, and sometimes forceful, guidance of the commander to ensure that all his work is truly purposeful and constructive. The commander cannot exercise this control unless he has a reasonably accurate idea of the detail, particularly in its relation to all the agencies outside the unit which no one inside the unit has the power to control. If this is not done

property and *not* their own?" It is difficult, I think, to overrate the good effect of a proper regard for the unit home. Units which pay this regard never seem to have any "Q" worries on active service. Consequently they are always ready for the surprises that "G" inevitably springs upon them.

It is arguable, I think, that the high morale which results from proficiency with the rifle has its roots in self-respect. Every soldier, whatever his arm and his function, is essentially a fighting man. Skill with his personal weapon has been the measure of the value of the fighting man all down the ages, and the measure of his value is the measure of his self-respect. The same applies, to a great extent, to drill and turn-out. This is one of the reasons why I personally dislike the idea, however much circumstances may force one to accept it, of a soldier becoming a N.C.O. who is not at least as smart and as good a performer at his drill as his physique will permit. It is certainly my opinion that no cadre class instructor should ever allow a student to exercise his personality on the class until his own personal performance has reached a high standard.

Whatever responsibilities may be placed upon an Officer, N.C.O., or man it is essential that his current level or standard of training should be known and constantly borne in mind; as also the fact that whatever he may be doing is not merely something that has to be done, but also something from which he can extract a lesson. Success or failure are not, therefore, absolute facts. They must be appraised against the background of current quality, knowledge, skill and self-confidence, and, above all, against the background of motive. A minor failure on the part of one man may well be far more serious than a more spectacular failure on the part of another; a loss or damage with a small financial outcome may be more important than one which occasions greater financial consequences. A commander must have the courage to weigh things up fairly and to stick to his guns if he is convinced that he is right.

Morale

Under the heads of Command and Training I have tried to describe some of the positive "aids," as I see them, that are available to the hand of a unit commander for creating and maintaining a high morale. Most of them are, I think, more a matter of head than of heart. It is far more difficult to write about the more personal influences; they must be so much a matter of one's inmost feelings, so many of which lend themselves so unwillingly to translation into words. I am going to try to put some of my own ideas on paper because I am convinced that so much that influences morale has its origin in the mind and character of the commander.

It is surely the duty of a commander to study his subordinates and to be acutely aware of his responsibilities towards them. If he does this religiously, with a practical and unsentimental regard for their well-being, he is studying the interests of his superiors without necessarily having to bother his head about them.

Neither in the Army nor outside it are there really any such things as "Rights." Every man's so-called rights are the image of his superior's responsibilities seen in the mirror of common sense and common humanity. The apparent effect may be much the same, but the real value of the result must surely be enormously enhanced by this line of approach. There should be no need to "demand" things from subordinates: they should be willingly given in response to the commander's determined efforts to discharge his responsibilities. This is not mere theory. I have personal experience of the most loyal and unselfish hard work on the part of my subordinates, freely given in return for my personal efforts—not invariably successful—to watch over their interests. When a subordinate fails, his commander should consider most carefully who else may be responsible in any degree for the failure. He should start with himself and work down through the chain of command. It is quite wrong, for instance, to punish a driver for failing to maintain his vehicle properly before it has been ascertained whether he really knows what has to be done and whether he has been appropriately supervised. It is unrealistic to imagine that the mere action of putting a youngster into uniform, either with or without a Sam Browne belt, and subjecting him to basic training will convert him overnight into a highly responsible individual who will do all that is expected of him without supervision or further guidance. If anyone disagrees with this I can only say that he must have been a far higher class soldier when he was a youngster than I ever was. The ill-effect on personal morale of even a light punishment for a fault born of ignorance can be very far-reaching. By the time a delinquent soldier appears on a charge before his squadron commander the latter should be in possession of a most detailed story of determined effort at the lower levels to keep him on the straight road. This idea may not occur automatically to subordinates, particularly if they are themselves young and not very experienced or sure of themselves. It must be constantly preached to them by their superiors.

Most of the minor offences committed by soldiers are not of themselves important. It is the motive, or the lack of motive, that matters. If a man has to be punished his squadron commander may or may not be able to find out the real motive for the offence, but he must certainly make every possible effort to do so, because it is his duty to try to understand the real man under the uniform. If he does find the motive he must pass on as much of it as can be

the Quartermaster tends to live in a world of his own, and all kinds of trouble can arise from the simple fact that he does not see himself as the representative of his Commander, not only in everything that he does but also in the way he does it.

A commander who goes out of his way to invite the opinions of his subordinates on matters concerning their responsibilities can not only learn a great deal about the quality of his subordinates and the way things are going, but can also make a big contribution to morale. His subordinates feel that they are partners in the concern and not mere automatons, even when the commander does not agree with their views.

There is an old saying that it is sometimes necessary to be cruel in order to be kind, and this has a bearing on what might be termed "long term morale." I remember, as a subaltern, being called upon by my Company Commander to pay 13s. 6d. for a piece of equipment which I had lost in circumstances that were good enough to warrant a write-off as a charge to public funds. My initial sense of injury soon wore off, and it was not long before I realized the truth of my Company Commander's laconic remark that it was "cheap at the price." The financial aspect of any officer's responsibilities increases with his rank at a rate which is out of all proportion to the increase in his rate of pay, and I have lived to bless him for teaching me my lesson before the price went up.

Believing as I do that good morale has its roots in individual self-respect, I am sure that a decent respect for the unit home is at once a morale-raiser and a measure of current morale. I have met officers who do not subscribe to this view, particularly during the late war, when they considered that it was not compatible with the demands of training. I am glad to say that I have seldom met a Sapper officer who actually disagreed with my view, though I have met some who could have subscribed to it with rather more energy. But the Sapper officer often finds himself in a position of command which is relatively independent in all but name, and in circumstances which make him the most junior of the commanders in his neighbourhood. He may be unwise to argue too strongly in support of his beliefs, but he must have the courage to stick to them and continue to apply them. I have heard it argued that the owners of requisitioned buildings were being amply compensated for any damage done by an occupying unit, and this kind of talk may all too easily influence the young officer who does not want to lag behind others in his energetic conduct of training. I would say to him "Remember always what you are doing to the individual man. How can you reconcile such an attitude with your constant efforts to make your men realize that unit equipment in their charge must be used with reasonable care, because of the very fact that it is unit

conveyed, without betraying a confidence, to the soldier's own superior. A " man-to-man " talk with an unsatisfactory soldier can sometimes work wonders. Even when it has not produced the desired effect I have never yet known it make matters worse, so it is certainly worth trying. I do not believe that it is very good policy to tell a man that he is letting his superior down, and certainly not if the speaker happens to be the superior in question. It is frequently worth telling him that he is letting his unit down. But if there is any fundamental good in a man I think it is far more effective to persuade him to see how badly he is letting himself down.

The conception of Welfare as a specialist unit officer's job has fortunately died—an unlovely child that received no flowers at its funeral. But some of its toys linger on in places. At the risk of uttering a heresy I must record my dislike of the " Request Hour " and all that it implies. There are any number of reasons why a man may want a private talk with his officer. Some of them, and some of the men concerned, are such that they will never appear at a publicly appointed spot at a time that is common knowledge. It should be very easy for a man, in the course of his ordinary contacts with his officer, to ask for an interview. It is then a simple matter for the officer to arrange a suitable place and time. The relevant fact is that when a man seeks a private interview with an officer it *is* a private talk, and there should be nothing official about it from start to finish.

A unit should learn, from its commander himself, that it is a team of which he is the captain. The Englishman who does not know what this means has yet to be born. They must be given to understand that the difference in the contribution expected from each individual member of the team is one of degree only. Success, well-being, enjoyment of life all depend upon the extent to which everyone does his appointed share, and perhaps a bit over for good measure. If they do this they will inevitably reap good results : if they do not they will equally inevitably reap unpleasant results. Neither good results nor bad results are determined by the whim or the mood of the commander : they are as inevitable as night following day.

What the commander must ensure, and must be prepared to fight for if necessary, is that bad results are not reaped as a matter of course by men who have earned good results. Men must be allowed to enjoy the results of good discipline just as they must suffer for bad discipline. The Army sometimes has a trick of being unintentionally sweeping in its application of bans and restrictions. The nice tidy staff solution can be conveyed in one line without its writer having to exercise himself about minorities, but it is as well to remember that many a useful majority owes its existence to the right kind of encouragement when it was a minority.

I believe that misunderstanding of the old adage "never ask a man to do something that you would not be prepared to do yourself" can give rise to something like an inferiority complex in a keen potential leader. I would prefer to see this saying broken down into the two precepts which I believe that it embraces—"Never allot a task to a subordinate without understanding what you are requiring of him and without ensuring that he is as fully equipped for it, in every respect, as you can make him" and "Never allot to a subordinate a task which it is your manifest duty to perform yourself." Some tasks would never be performed at all if the precept, as it stands, were to be rigidly applied. Sapper leaders are not specialists commanding their own peculiar brand of specialists. They are commanders who must have a clear idea of what may fairly be expected of all kinds of specialists. On them lies the responsibility for seeing that men and their tasks are suitably matched: that the task is not made too heavy, either through ignorance or through failure to realize that what is a piece of cake to themselves may be very heavy dough to the men concerned.

A commander is responsible for selecting a suitable subordinate to take charge of a task. When things go wrong, therefore, it is only reasonable and fair that his immediate reaction should not be condemnation of the subordinate. His appearance on the site will be of enormous benefit if it is abundantly clear that he has come, *not* to take over and still less to conduct a witch hunt, but to cheer people up and to find out what he can best do to assist. It is only when this has been done, and things are going smoothly again, that a post-mortem and inquest can be held. The commander's helpful attitude on the site in no way prejudices his duty or his ability to speak very bluntly and baldly if the findings eventually show that this is necessary. It should hardly be necessary to say that the commander who appears on the site with the primary intention of ventilating the effect on himself of his subordinate's failure is not merely damaging morale: he is demolishing it. It is not only the unforgivable but also the unforgiving sin.

Assurance that a subordinate is fully equipped for a task implies an understanding of the task itself. This sounds childishly obvious, but it is not infrequently disregarded. We have many of us received instructions which have sent us hot-foot to the telephone to ask just what is meant or involved. We have many of us received the answer "I haven't a notion: I hoped you might know." Admittedly this answer is generally given by a staff officer and not by his commander, but the recipient of the order may be forgiven for regarding the staff officer as the product of his environment. If things have to be "tried on the dog" the most suitable dog is also the nearest one, the staff officer's own commander.

Quietness in command, both of voice and of manner, enhances the moral effect of the raised voice and the deliberate display of energy when the occasion clearly demands them. The unit whose commander never appears to be in a tearing hurry, who is never too busy to see his subordinates when they seek his advice, and who never gives the quite erroneous impression that the whole outfit depends entirely upon himself, is almost sure to have a good morale. This leads one to the conclusion that a notable flair for issuing orders is not of necessity the same thing as a flair for commanding men. Orders should be issued only when a new set of circumstances have arisen, or when it is necessary to invent a new set of circumstances in order to get people on to their toes. It is very uncomfortable to have to stand perpetually on one's toes.

A deliberate display of faith in his subordinates may sometimes cause a commander to feel qualms, which he will keep to himself, but its long-term effect upon morale will repay him handsomely. The late Field-Marshal Sir Claud Jacob once told me that, when the battalion he commanded was to be inspected, he used to send for his Company Commanders, tell them the points that he considered required particular attention, and then go off on leave until the day prior to the inspection. The result, he said, was invariably a happy one. Even if it is not always possible or advisable to go away on leave, the principle remains. The Field-Marshal had the reputation of being a very good commander before he became a great one.

Unit morale has potential enemies that will assail it from without. One of these is the apparent absence of reason for some decisions made at a level above that of the commander whose subordinates are affected. There are occasions when the bald decision is not enough: the reason for it must be explained to the man. The commander has only three alternatives open to him—to explain, in simple terms, the reason that has been quoted to him; to explain the reason, from within his own knowledge, if no reason has been quoted; or to tell the man that no reason has been given and that he is therefore unable to explain. In the circumstances I have quoted the last of these alternatives will not do. The first two, however, are entirely dependent upon the commander's own clear understanding of what has to be explained to the man. No subordinate commander should be called upon to do the best he can with a seemingly unsound or unguessable reason. His own morale is likely to suffer almost as much as that of the man most nearly concerned.

Conclusion

Morale is the comforting warmth whose source is the fire of leadership. It is a properly balanced warmth: there must not be excessive heat in one place and a lack of heat elsewhere. The most

powerful source of heat known to us is the Sun, but it is a very long way off and its direct rays are not always sufficient to sustain us. We are intensely dependent upon fires that are less magnificent but very much closer at hand. The fuels we employ owe their heat-giving properties to the long-term work of the Sun, but before they reach our fireplaces they have to pass through many human hands to make them available to us in suitable form. Even then they are still only potential sources of heat. Someone who lives with us has to make up the fire with a suitable combination of fuels. Someone must apply the match and see that further fuel is added, in acceptable quantities, and when necessary.

When we warm ourselves in front of the fire it does not take us long to realize how dependent we are upon the good work of the man who always seems to know, and to be on hand, when more fuel is required : who always seems to know just how much is required and how best to apply it to obtain maximum effect. After a bit we get around to helping him by carrying the fuel, and even to putting it on the fire under his watchful eye. Eventually we find that we can keep the fire going without his direction, even if we are still not very sure of our ability to start it from scratch. We find that the work makes us warm without the good offices of the fire, and a permanent seat by the fireside is no longer essential to us. One day we surrender our seat to the miserable wretch who has been sitting apart from the fire, perhaps even outside the building, under the mistaken impression that the Sun will notice his sad plight and defy all the laws of nature to take pity on him. We shall have broken the ice.

So it is, I think, with Command, Training and Morale. The share taken by the top level commanders can only be indirect so far as the man is concerned, and much of it was done in the past when they were themselves regimental leaders. A good regimental commander will always be better, at his level, than a good ex-regimental commander. The morale of a regiment springs from the morale of its commander. The state of the commander's morale is governed by the manner in which he, and not his regiment, is handled by his formation commander. The same principle applies all down the chain of command in the regiment, down to the most newly-joined officer or other rank.

There are no golden rules or short cuts to successful command and good morale : only golden motives made manifest through the agencies of patience, understanding, energy, and a sense of perspective.

GOODWILL

By " DRAGON "

A VERY old lady, mother and grandmother of soldiers, said to me many years ago, " I can't think why you military men are always so rude to each other." The rasping peremptory command, the harsh voice on the drill-square, the " rockets and raspberries "—these are still regular features of the military life. And it looks as if they will continue if we don't do something about it, even though they may be the greatest single cause of bad recruiting—even if they kill the Service whose discipline they are designed to uphold.

It is my belief, now that " National Service " enables, indeed compels, nearly all our citizens to see the army from the inside, as it were, that we lose our potential Regulars more through our faults in manner than from any dissatisfaction with the pay or other conditions of service. People are much more sensitive than is generally realized. What can we do about it?

Generally speaking, it may be accepted that civilian business leaders, being unprovided with disciplinary weapons, achieve results by persuasion and encouragement, rather than by coercion, veiled or open. This is becoming more and more the case, as any business-man will tell you, due to transatlantic influences. Indeed many of the larger companies put the happiness, by which I mean the day-to-day psychological reactions of their workers, in the forefront of their policy programme. They know that happy staffs have a bigger output and they tackle seriously the problem of keeping them happy. Goodwill is everything in business.

We, in the army, also talk of " welfare." But don't we tend to limit our study to feet and kit inspections, and photographic clubs, and forget the fact that an ordinary hour-to-hour happy relationship with his boss matters much more to a man than a well-equipped camp cinema?

Looking back on your service, perhaps you can, like me, recall a gloriously happy year in, say, Catterick, under the most discouraging physical conditions. Hard work, uncomfortable billets, not much recreation—all these are forgotten except that somehow you " liked Catterick." Whereas, of Malta, maybe, you have the unhappiest recollections. An excellent house, good sailing facilities,

pleasant subordinates, all these did not somehow make up for the fact that your boss did not treat you as you would like to be treated.

Now in which of the above two stations did you, yourself, put more heart in your work? Catterick, surely. Multiply that by 800, and you've a good battalion, don't you think?

Thinking on the above lines, over a number of years, I have jotted down a few hints of things that I have found conducive to "goodwill." They are imperfect. Some may dispute them. On active service, harsher methods are necessary. These suggestions involve no amendments to the *Manual of Military Law* or *King's Regulations*. They refer only to the manner of their enforcement. And if this article serves to focus attention on the problem, and to provoke thought, it will not have been written in vain.

Sense of Proprietorship.—Herein lies the secret of output. Any man will work on his own car. Dig his own garden. Feed his own child. If only it is possible to make each individual think of one section of the work as his own personal responsibility and property, his interest is kindled and surprising results are achieved. As an example, I once jestingly caused the board showing our decrepit vehicles to be headed "The Smith and Jones Transport Company," Smith and Jones being the names of the Transport Officer and Sergeant respectively. In ten days all vehicles were on the road. Paintwork was cleaned. Mechanical repairs magically completed. Morale rose. All because Smith and Jones were allowed to think of those cars as their own. (Some civilian firms give the cars they have been using to their travellers after five years' service. Imagine what we could save on "maintenance," if it were possible for us to do that.)

Vehicles are easy. But, with thought, the principle can be much more widely applied than is at first apparent. For instance, see Robinson's reactions to the hint that Robinson's target, the centre target on X range, is always a little slow. Proprietorship established, even though it may be a little inconvenient to detail Robinson always to the same target, that target will never stick again.

The commander's task, then, is to see that a definite responsibility is delegated down the chain right down to the very lowest rank. How easily written! How seldom effectively carried out! It follows, too, that Sapper Pick or newly-joined Lieutenant Shovel must be left alone, to learn by their own mistakes. Are we prepared to do that? It will pay hand over fist in the long run.

It is my belief that "private enterprise" within the "nationalized" framework is our country's greatest political hope, too. But this is not a political article.

Prevention of misunderstandings.—Quite a lot of goodwill is lost, and friction generated, I am convinced, through genuine misunderstandings. By virtue of senior rank, alone, we tend to shout down

objections to one proposition, and to insist on another. A subordinate, uncertain what he is to do, and frightened to ask, will make blunders through sheer nerves. How can this be prevented?

(*a*) By a sympathetic attitude, invite questions. Ask Brown if he really understands. Have patience in explaining to him.

(*b*) Give it in writing. This should be a normal routine, not a last resort, when relations are already strained. Carry round a loose-leaf, carbon interleaved, writing-pad and indelible pencil. This works wonders. Even for a simple thing like telling a car-driver to meet you at the barrack-gate at six o'clock. Is it a.m. or p.m.? Wednesday or Thursday, which is his normal maintenance day anyway? His written instructions, even if they are a little more trouble to you, will put him right with the Transport Sergeant, clarify his mind, and prevent him being thrown into that state of anxiety that may be spoiling his army life, and making him join the host of others who are mainly occupied in reckoning up their release dates.

This is harder. If the recipient of your instructions has the very slightest doubt of your meaning, encourage him to say, "I'd like to have that in writing, sir." Suppress the natural reply—I've often had it—"Don't I speak clearly enough boy?" If goodwill is already there, he won't be frightened to ask you. Indeed, he may even deliberately pander to your known fad. In any case, it is worth it. Imagine what a happy condition would result, if everybody really knew fully what they were trying to do before they started it.

(*c*) I am not writing about relationships "upwards" just now. Many senior officers might regard a request for written orders as somehow insulting. But experience has taught me the answer to this difficulty. As soon as the boss's back is turned, write him a memo, "At our Conference to-day, it was decided that . . ." It is a little more trouble, but it still will prevent the possibility of misunderstanding.

Technical Advice.—The man who knows the best jointing material to use in mending a tap is the working plumber, and not anyone else in the chain up to the Chief Engineer. This is obvious. But is its application universal? By no means. The suggestion is, then, that tradesmen and technicians should be given much more latitude and freedom of speech than we normally accord to them. The element of rank should rule in matters of policy only. Never in technical details. Search your conscience, now. Do you always observe this?

Rebukes.—Despite everything we may do to prevent them, these will still sometimes be necessary. They should always be signed by the boss himself, never by a staff officer. Taking it a step further, all letters or orders which contain the very faintest sniff of rebuke or

controversy may well be signed by the boss. Otherwise experience has shown that the recipient will tend to query them, resulting in possible friction and ill-will all down the line.

Time.—In peace, at any rate, the lower down the chain the busier people should be. In a " works " outfit, does not the Clerk of Works have less leisure than almost anyone else? And yet inspecting officers will rarely regard his convenience in examining his work. Conferences of all Clerks of Works are commonly called, when perhaps half of them are unaffected by the matter in hand. In any case, it is nearly always better to meet subordinates on the job, than to call them in to a central, and perhaps distant, point. Better still, plan out a definite weekly routine and stick to it. The knowledge that Tuesday morning is the Major's morning for Mons Barracks enables everyone to do something to plan his week. Consideration for a subordinate's time, even at inconvenience to your own, is as good a rule as any.

Hard work never kills, they say. Anxiety does. Anything we can do to relieve the unnecessary strains resulting from a too-harsh discipline, anything we can do to make life pleasanter for our National Service men, anything that will kill the out-of-date martinet tradition, any of these things is worthy of our support. Do the above suggestions help?

SAMCOL

By A.C.M.

OPERATIONS OF 69 FIELD COMPANY, Q.V.O. MADRAS SAPPERS AND MINERS, IN THE ARAB REBELLION, MESOPOTAMIA, 1920

(See folding map at end of article.)

THE recent war gave us " Crocodiles," " Tigers," and other fearsome monsters of mechanization, but as a change from all that let us glance back at the Army mule and at a little-known side-show in which he played his gallant part. It is thirty-one years since " Samcol " happened—part of the operations arising out of the 1920 Arab Rebellion in Mesopotamia—and a new generation has grown up since then. It hardly knows the mule or good old " Mespots."

The Arabs of Mesopotamia had been loosely ruled by the Turk for centuries and had not particularly objected. Then along came the British with quite different methods. We were too energetic

and full of ideas and, amongst other things, we built a railway along the Euphrates between Basra and Baghdad. One might have thought that the Arab would have appreciated this, as bringing him many advantages. Not a bit of it: the railway was an intrusion on his desert preserve and he only saw that it brought him the over-industrious British Political Officer to places where few Turks had ever been. So he hated it and determined to make trouble. In this, he was no doubt encouraged by the general unrest prevalent throughout the Middle East and helped by the considerable quantities of arms he had stolen, quite impartially, from both sides during the war. Rebellion therefore flared up in July, 1920, along the Middle Euphrates and quickly spread northwards. Small British garrisons were isolated and in some cases overwhelmed, and, except for the tenuous steamer route along the Tigris, British authority in the country was cut in two. But a division was hurriedly got together in India and began to reach Basra in August. Meanwhile, small operations had been undertaken to clear the area round Baghdad: Hilla stood firm and a column had operated as far south as Rumaitha. That column, under Brigadier-General Coningham, had been so short of transport that it had had to use the railway for its bulk stores; but it was also so short of railway material and protective troops that it could not repair and hold the line as it went. It had to take up the line behind it each day and lay it ahead for each short advance. Then, having brought away the Rumaitha garrison, it returned to Hilla in similar fashion. Between Hilla in the north and Nasiriya in the south, however, there was a stretch of some 200 miles entirely under Arab rebel control, but with British garrisons at places like Samawa completely cut off from immediate support. Efforts had been made to reach Samawa by armoured train and river gunboat, but these had latterly failed and it was evident that operations on a considerable scale would be necessary to re-establish British authority in the area. These operations would be mostly undertaken from the south, where reinforcements and stores were beginning to arrive: Basra would be the main base, but Nasiriya, about 140 miles north-west of it, was still in our hands as a possible railhead and advanced base. The first essential was therefore, to ensure the local security of Nasiriya and its communications, since sections of the Muntafik tribe in that area were restless. Nasiriya defences had, therefore, to be developed and the entire railway line back to Basra protected by blockhouses.

The 69 Field Company, 2nd (Q.V.O.) Sappers and Miners, was amongst the early arrivals from India. It moved up to Nasiriya on 27th August and for a month was busy on these two defence tasks. The Nasiriya defences were in a very poor state and had to be entirely reorganized to cover sectors on both banks of the Euphrates.

Stores were scarce and this at first delayed the work. The heat was at times terrific, the working hours long and every day a full working day: but the men worked splendidly. Railway blockhousing was mostly undertaken from the base, but half 69 Company took on a sector about Laqait. A blockhouse train took parties of Sappers and Labour Corps along the line each morning, dropping them with their stores every half-mile. Blockhouses were either of circular construction in sandbags or else square in corrugated iron with earth filling, close to the line and on alternate sides of it. Each was completely wired in and roofed, whilst stations had two blockhouses and all-round wire. A party of a dozen Sappers and forty Labour Corps could complete one in about six hours. In the afternoon the train returned, dropped the infantry section garrisons with their stores and a week's water and rations and picked up the construction parties. Thereafter, blockhouses were watered and rationed weekly and their garrisons changed at intervals. On the whole there was little interference from the tribes, either in Nasiriya or along the railway, except for spasmodic sniping and the cutting of telegraph lines. The local Arab Levies remained loyal, and on the one or two occasions when the Nasiriya gunners got on to good rebel targets their fire had a most salutary effect—thanks to a high O.P. the Sappers built for them.

"Samcol" was the code name for the Samawa Relief Column and the beginning of October saw it ready to move out from Nasiriya. It was commanded by Brigadier-General Coningham and in composition was about half a division, of about 5,000 men and 2,700 animals. It was on an entirely animal transport basis, pack and wheel, with "hard scale" of kit and practically no tents. Its task was to relieve Samawa, about sixty miles to the north-west, then continue northwards to link up with a column coming south from Hilla. It would follow and repair the railway as it went, and for this purpose would be accompanied by a railway construction train. Its progress would be, in fact, limited by the speed of railway construction, but as the line as far as Samawa was mainly over open desert, without major river crossings, it was estimated that the relief move would take less than three weeks. 69 Company was its only Sapper field unit. As the column advanced, other troops would blockhouse and protect the repaired line behind it, so that supplies, railway construction material and, above all, water could come forward as necessary. For there were stretches where "Samcol" would be operating at a distance from the Euphrates or local water supplies and entirely dependent upon train-borne water for every man and beast. Insurgent strength in front of the column was estimated at 1,000 mounted and 8,000 dismounted men, all with modern rifles and a few automatic weapons.

Moving to Ur of the Chaldees on 1st October, 1920, and then turning north-west, "Samcol" met little resistance for the first day or so. There was a small Arab attack at Batha on the 3rd, a skirmish with some 300 mounted Arabs next day, but otherwise the main handicaps were heat and dust. Normal march formation was a loose diamond astride the railway, with guns, a mass of transport, an infantry reserve and the construction train in the centre. Indian cavalry and Arab Mounted Levies formed a mobile screen ahead, and it soon became the practice for a Sapper Section to move close behind this screen, so as to get an early start on any work of ramping nalas or making culverts across watercuts. As soon as the railway construction people decided how far their work could go for the day, bivouac was formed. This was again generally a diamond or square, with a few perimeter piquets: the Arab was to prove a most unenterprising enemy, as he never attempted to attack at night. As soon as camp was established the railway construction people would run their train on to a spur, the water train would come forward from Nasiriya and the Sappers would start water issue, about 25,000 gallons. This was amongst their hardest tasks and often kept them busy until late. Canvas tanks would be pitched alongside the line, filled from the water train and chlorinated. At the men's drinking water point, units would line up their pakhals (8-gallon metal containers for pack transport) and these—over a thousand in all—would be checked against known ration strength, as the issue when watering from the train was strictly 2 gallons a man a day. The animal water point was first surrounded by a barbed wire fence outside which units formed up their animals in successive lines. This fence was absolutely necessary as, when away from the river, animals would be watered only once in twenty-four hours, and at the smell of water they would try to rush the troughs. This traffic control at the water point, properly no part of the Sappers' duties, was, in fact, often their biggest task, until later when water point police were provided. Maintenance of water gear was another problem. It was in short supply: all was in use until late every evening and then loaded early next morning on the water train. The animals certainly suffered considerably on parts of this march for, although the Sappers always tried to arrange a second watering next morning whenever supplies allowed, the early start often made animals unwilling to drink. What with great heat, limited water and the heavy going through the sand, animals quickly lost condition and became casualties at an alarming rate.

Approaching Khidr on 6th October, the column found a moderate-sized Arab force barring its way and had its first opportunity to administer a lesson. A small British post and armoured train had been wiped out at Khidr. The Sappers, moving out before daylight,

had made fifteen ramp crossings over the Nahr-as-Gulaidh nala by 0700 hrs., when the infantry moved up and attacked Abu Rishah Station, just south of Khidr. Soon after 1100 hrs. the Arabs began to retire, some eastwards through the date groves and across the river, others along the railway where they were dealt with by Indian cavalry. Parts of Abu Rishah and Khidr were set on fire and remained burning till next day, but the infantry soon established themselves on the right bank of the Euphrates north of the villages. In this, however, as in most of the actions which followed, the problem was how to pin the enemy so as to thrash him, how to prevent him from slipping away before the column could get to grips. He nearly always occupied positions with one flank on the river and, when pressed, would slip off through the date groves and across the river in his ballams (canoes) or mahailahs (about the size of a North Sea fishing boat).

A river gunboat, *Greenfly*, in trying to get through to Samawa, had grounded on a sandbank near Bab, a little north of Khidr. Its garrison had held out for a time, but had eventually been overwhelmed. Just what had happened nobody was quite sure, but it was decided to visit the site and, if necessary, make an example of the four villages nearest the vessel, whose inhabitants had also murdered two airmen shot down whilst trying to drop food on *Greenfly*. The villages were found almost empty, but the column could see the last of their inhabitants hurrying away north and east across the river with their flocks : all that could, therefore, be done was to destroy the villages and leave it to the Political Officer to exact a fine later. Cavalry swung round each side and on beyond : infantry combed through for snipers and ringed in the whole area : Sappers got to work on destruction. All livestock that had been left was collected, also grain, stolen railway sleepers and other government property, though these things were often cleverly hidden. Selected houses were filled with straw or camel thorn, and their doors and shutters added to the pile since wooden and metal articles were difficult for the Arab to replace. Meanwhile, other parties destroyed wells or irrigation channels. These preparations completed, the covering troops were warned, burning was started and the column withdrew : for a small village they took about three hours on the job. Returning to camp, most unit mules were carrying extra haynets full of live chickens. 69 Company picked up a cow that was to provide fresh milk for several months, also " George," a gander who was to become an excellent mess mascot and watchman. There were odd sheep and goats which would provide a change of diet. The troops were in happy mood. Meanwhile, *Greenfly* had been examined and one mutilated body found, out of the original British and Indian garrison of fifty men.

The railway ahead of Khidr was completely destroyed and a few days halt was necessary. It was decided to send part of the column over to the left bank to deal with troublesome villages there. The Sappers rigged up a flying ferry of eleven mahailahs, capable of taking half a battalion at a trip, and on the 8th put two battalions across in seventy-five minutes. There was little resistance and few Arabs about. Most of the population had departed with their flocks ; but others, hiding their arms and tucking up their skirts, were going through all the motions of peaceful cultivators digging their fields. Of war and revolt and the wholesale murder of the *Greenfly* garrison they pretended to know nothing. But a few villages were burnt and a handful of prisoners brought in to be grilled by the Politicals.

The next fight came on 12th and 13th October in front of Samawa, where the Arabs were in their greatest strength yet. Samawa was a place of some importance and had evidently been reinforced from outside : many banners were seen and the Arabs seemed all worked up for a hearty fight. All the better as it meant all the bigger thrashing. On the 12th the first opposition was met at Khudaiyir, about six miles south of Samawa, but by afternoon this had been cleared and the column halted for the night. Next morning's advance quickly found the Arab still in fighting fettle and on a wide front from the river to well south of the railway, where some old trenches and brick kilns lent him considerable support. South of the railway, however, he was soon forced back, but the date groves, walls and houses along the river-bank made progress there much slower. The column's casualties were, in fact, considerable, but the Arabs must have suffered very heavily as the Gunners got some excellent targets. Samawa was not reached, and the column camped some two miles south of the town. But these two days had been enough for the Arabs and when the advance began again on the 14th leading troops scarcely fired a shot. So slight was the resistance, in fact, that two Sapper subalterns, with no real business to be there except the magic formula " engineer reconnaissance," were amongst the first to reach Samawa Station and very definitely the first to relieve the besieged garrison. Samawa camp lay beyond the walled town and its garrison had been out of touch with the battle. As the two subalterns approached its perimeter wire they were hailed from a trench. " Hallo ! Have you chaps come up by 'plane ? " " No ! We've walked every something yard from Nasiriya." " Well, come in through that gap. You're the first we've seen, so welcome to Samawa." And the event was soon being celebrated over mugs of neat whisky, the garrison explaining that they had long ago run out of soda. But as the party warmed up there was a stir and the garrison officers disappeared. In a few moments one returned to say : " Your General is just arriving to make his official entry :

you two had better keep out of sight." So from a near-by trench the two Sappers watched General Coningham and his Sapper Brigade Major[1] officially relieve Samawa. Not till later did they tell the Brigade Major that they had beaten him by an hour.

The remains of the armoured train at Samawa Station did not make a pleasant sight. It had been derailed and the Arabs, crawling up at night, had lit fires under each of the trucks, with the result that the train garrison were roasted alive or killed as they jumped out and tried to fight their way through a mob of frenzied Arabs. We hoped we would be able to burn Samawa as a punishment but this was not allowed.

The Sappers were immediately busy in the Samawa area. Part of the column was to be moved to the left bank of the river and for this 69 Company had to organize a ferry, prepare landing stages and ramp through the high, steep river banks. Defensive posts had to be wired in, a loading ramp constructed at the station. Just north-west of Samawa the railway had crossed the Euphrates by the long Barbuti Bridge, but most of its wooden trestles were now burnt. Until railway construction work had dealt with the extensively damaged line up to the bridge its permanent repair could not be undertaken, but 69 Company was given the task of temporary repair to make the bridge fit for guns and transport.

Several minor operations were also carried out against villages in the Samawa area, and some Sappers always accompanied the column on these as the country was very cut up by dry nalas, water channels and arms of the main river. In fact, the Sappers worked much harder in the month following the capture of Samawa than in the initial advance from Nasiriya. The column operated against Ruhm, Dabbus, Khunaniya and other places, destroying houses and blowing up towers. In most cases the Arab resistance was slight, but they generally followed up the rearguard when the column withdrew. On 20th October the column reconnoitred Imam Abdulla, a few miles north of Samawa, where there was the next big railway bridge. This had been burnt in the same way as Barbuti Bridge and the Arabs were in considerable strength on the far bank. Proper repair work could not be undertaken until the construction train could approach the site and this had to await completion of the Barbuti Bridge repairs, but the damage was examined and a few shots exchanged with the Arabs. It was not until 11th November that the column again moved up to Imam Abdulla, intending to take and hold it. The Arab was again in strength and resistance was fierce until a ford was found and a battalion of Sikhs got over to the north bank. Even so, there was still stiff fighting until the Sikhs put in an effective bayonet charge. The Sappers got a flying ferry into

[1] Now Major-General F. V. B. Witts, C.B., C.B.E., D.S.O., M.C.

action by the afternoon and later, with more equipment arriving, constructed a 230-ft. pontoon and trestle bridge. But although the north bank in the immediate vicinity of the bridge had been cleared, some Arabs still held out on the right, in an area of marsh and water channels which was difficult to clear. From there they continued to snipe the ford and ferry, and the river bank was somewhat "unhealthy." It took several days to clear the Imam Abdulla area properly and to organize its solid defence. The outpost position on the north bank was completely wired in by 69 Company, various villages burnt and towers blown up. But after the first day's fighting there was little effective resistance.

The severe thrashings they had received at Samawa and Imam Abdulla, together with the destruction of several of their villages in these areas were having their effect on the Arabs. There was also the winter season to be considered: already it was bitterly cold at nights with ice on the water troughs, and the Arab perhaps did not look forward to taking to the open desert for the next few months. Since their first small successes at the beginning of the rebellion they had consistently failed and their losses had been heavy. Several sections now put out feelers for peace and were given until the end of November to accept the terms, which included the surrender of 4,000 rifles and 400,000 rounds of ammunition. Meanwhile, there would be a "standfast" in operations, but railway construction would continue and the column would ultimately advance north of Rumaitha to link up with the Hilla column. The terms were generally accepted. On 1st December the advance to Rumaitha began but progress was at first slow as the ground north of Imam Abdulla was marshy and very cut up with water channels: in places there was even flooding. Many railway culverts and small bridges had to be replaced and the pace of railway reconstruction was therefore slow. The next major task, of course, was the crossing at Rumaitha, where there was another big bridge. 69 Company and the railway people agreed that a preview of this might save a lot of time, so, on 4th December, when the column moved to Gatta, a few miles south of Rumaitha, three British officers (including a Sapper subaltern) and two Arab Levies unobtrusively moved ahead of the advanced guard and reached Rumaitha without meeting a soul. The bridge there was a large swing type and was found in the "open" (up and down stream) position. Its central pier looked intact but the two timber abutments had been burnt. A few Arabs were seen on the far bank and the Levy Officer, by a mixture of bluff and blasphemy, induced one of them to come across in his ballam: in this the three officers crossed the river, leaving their horses with the two levies. Rumaitha town was only a few hundred yards away on the farther bank and already the party's arrival was

creating something of a stir: the inhabitants began to stream out towards the river. Would they be hostile? It was not long since their brothers to the south had been anything but friendly, and the British officers had but a revolver apiece and a wide river at their backs. But again bluff and blasphemy succeeded, for the Levy Officer harangued the crowd in no uncertain terms as to their wickedness, the immediate approach of an all-powerful army and the certainty that their town would be utterly destroyed if there was the slightest treachery. Rumaitha was told that by next day it would return to the bridge site every sleeper or railway store it had stolen, neatly stacked, half on each bank: for the moment it would be sufficient to bring the party food and allow the officers to walk through the town. Altogether, it was a pretty tall order, for it had been at Rumaitha that the rebellion had started in July. But it succeeded, probably because the back of the rebellion was broken and most of the tribes were ready for peace. The town was visited, the bridge more carefully examined, some food eaten and the party returned to its horses. The value of the reconnaissance was quickly shown: special stores for the temporary repair of the bridge were got up and early on the 6th the Sappers moved out from Gatta camp ahead of the advanced guard. At Rumaitha they found that the townsfolk had played their part and considerable quantities of sleepers lay at either end of the bridge. The swing span was hauled round into its traffic position, the burnt-out abutments built up with sleeper cribs and the bridge chessed down. When the advanced guard infantry arrived it was able to cross almost without a pause. Of course, there were questions afterwards which had to be laughed off as the whole affair had been kept a secret, but it was stoutly maintained that the end had justified the means.

Railway reconstruction continued and the link up with the Hilla column at Imam Hamza was soon effected. The rebellion was over and British authority once more established throughout the country. But a few outlying villages or nomad tribes had not yet officially made terms or handed in their fine of rifles, and it was to two of these —the Barkat and Safran, lying south-east of Rumaitha—that the Political Officer decided to pay a visit. It would be a mission of peace and he would go unarmed with only a small Levy escort, but an Engineer officer might as well go along, too, to look at the country. If these tribes were difficult it might be necessary to send the column against them. Little was known of the area, but it was reported difficult and much intersected by rivers and water cuts.

Thus, on 17th December, a small party rode out from Rumaitha—the Political Officer, a British Levy Officer, a Sapper subaltern, two Arab Levies and a friendly Sheik. It was not long before the difficulties of the country became apparent, for the party had to swim

their horses over several deep rivers up to a hundred feet wide, besides negotiating countless minor water channels and swampy areas. For a column to move over this ground, even on a pack basis, would entail a great deal of work and progress would be extremely slow. Moving generally south-east along the Majina River, the party visited several small villages, all friendly but all very poor. By early evening they reached Antar where they halted for the night. First they partook of ceremonial tea with the sheik but later came a meal with some of the local notables. The whole party sat in a circle on the floor of a small reed hut and had in their midst a large wicker platter with boiled rice and chicken. Boarding house manners quickly prevailed and each man stretched an arm for a handful of rice or the more succulent morsels of a scraggy village hen. No plates or implements, of course, but the proceedings were soon friendly and informal. The Political Officer had his talk with the Sheik and matters were evidently quickly arranged for the surrender of so many rifles. The guests were then bidden to sleep where they had dined and were soon curled up in the corners of the hut. But they had come with no more kit than they could wear : it was a bitterly frosty night and a mere British warm was none too much cover. Their horses, too, had but their saddle blankets and a small nosebag feed : Antar was too poor to produce anything else.

The party was off early next morning with a fresh guide and followed the Majina River as far as Mansur. There the guide left them : the tribes on the other side were less friendly, he said, and he politely declined to be further involved in the business. Again the country was difficult and opposite Kardus the river was wide and deep. Considerable numbers of Arabs could be seen with their flocks on the far side, and they collected in bands as the party approached but sent no one forward to parley or offer welcome. Horses were swum over, however, and the party rode up to a group of small villages. There were Arabs about but they kept silent and it was soon evident that the town band and red carpet were not being turned out for the occasion. Conditions hardly seemed propitious, in fact, when the Political Officer began to explain the purpose of this visit. Tension continued for some time whilst the village elders debated amongst themselves. A small section of the younger men were for refusing to make terms and there was even talk of killing this small handful of British. Meanwhile the party had no food or drink except a few hard biscuits and a small bottle of whisky which the Sapper had thoughtfully slipped into his pocket. But, as the elders debated, curiosity gradually got the better of some of the inhabitants, who, remember, had for the most part probably never seen a white man before. The horses, of course, seemed huge beside the small Arab ponies, and their saddlery was an object of wonder.

Brass buttons on a tunic were exciting and some had to go as souvenirs. There was distrust of a camera but the Sapper managed to get a few snaps, almost certainly the first photographs ever taken in these parts.

The elders eventually decided to make peace, being swayed in this decision, it seemed, by an impassioned harangue from a mullah who told them what he had seen of the British at Khidr and Samawa. Next day the horses were given back and a rather frigid farewell taken on the river bank. "We'll cross in two parties: it's safer." said the Political Officer. "And when you chaps get to the far bank, halt and face this way while I cross." Fears may have been exaggerated for the crossing was effected without incident, but it was better to be safe than sorry and a row of British backs in mid-stream might have been too much of a temptation for some of these armed Arabs. On the far bank there was a gentle slope to a slight ridge. "We'll still face them for a bit and back away slowly." ordered the Political Officer, but the horses were cold, restive and very difficult. The Arabs meanwhile stood watching in silence but the atmosphere was tense. Then the party turned and galloped over the ridge—and kept on galloping for some time. To get warm, they told themselves, but all felt much better when they had put a reasonable distance between themselves and their late hosts. A different route was taken for the return journey in the hope of finding better going, and after a long ride the party reached Rumaitha that evening. The Sapper's later reconnaissance report was hardly encouraging and eventually another brigade carried out a small operation towards the area from Samawa: it rounded up a few sheep and goats.

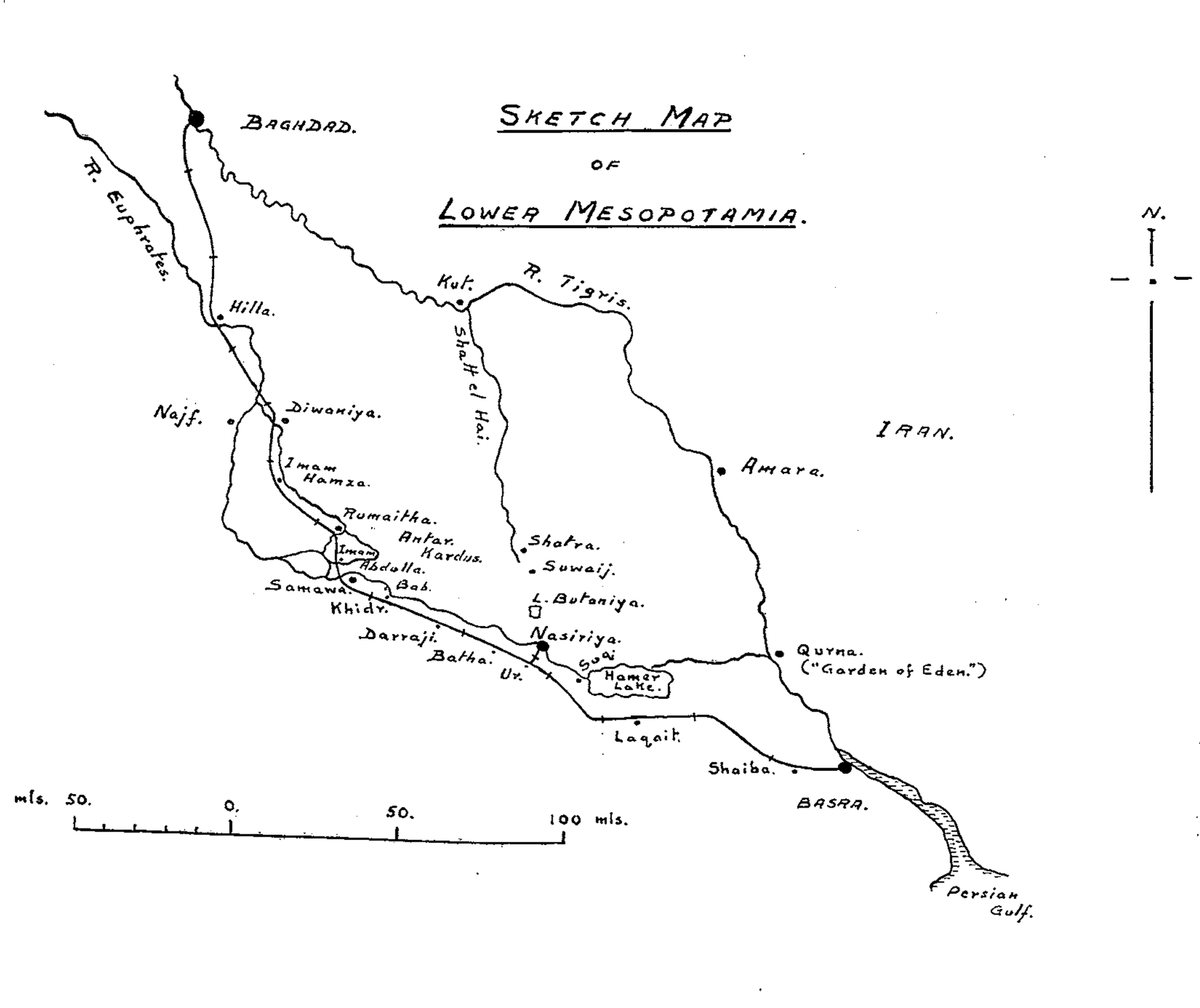
Soon after this 69 Company returned to Samawa and the camp at Rumaitha was gradually broken up. But it was decided still to "show the flag" in two other areas, northwards from Nasiriya along the Shatt-el-Hai and southwards to Suq-ash-Shuyukh on the Hamar Lake. Half 69 Company moved to Nasiriya and on 15th January, 1921, marched out with a column along the Shatt-el-Hai to meet another column coming south from Kut. There was no fighting but the Sappers had a great deal of difficult work over water supply, first at the salty Butaniya Lake and then at Suwaij and Shatra: the weather was also bitterly cold, with some rain. Returning to Nasiriya on the 30th, officers attended a grand farewell "Samcol" Dinner. Then, on 3rd February, the column moved to Suq-ash-Shuyukh. The first day's march, to Muftul Khanzir, was easy and the Sappers had only three small crossings to put in over water cuts. The 4th, however, was one of the hardest days the company ever had. The country was very cut up and in some places deliberately flooded: seven separate bridges had to be made before

reaching Suq and maintenance parties left at each site until the column had passed. Most of the company was strung out along the whole line of march and only a handful was available at Suq to tackle the problem of the day's water supply. Returning on the 7th, it was found that the Arabs had stripped timber, sandbags and sheeting from every one of the crossings, so that most of the work had to be done again. That was another very heavy day for the Sappers but the men worked excellently.

The column finally broke up after this, and on 4th March, 69 Company moved to Shaiba, near Basra, where it was to work on the new R.A.F. cantonments. "Samcol" was over but it had been a happy little war.

These seven months made a very pleasant memory. The time had not been idle and it had held variety and new experience. The company had travelled over 1,000 miles in Mesopotamia. The operations could hardly be called war by modern standards, but they were most excellent tactical training. "Samcol" was of a size, and its terrain of a type, which let one see the whole picture all the time. It was a life-size sand model, in fact, on which one could get a realistic idea of battle, with its frontages, distances, the speed and time factors. More so than is usual in war, the problems were administrative rather than tactical, so that the Sappers were kept busy. It was more an affair of the desert and of rivers than of the enemy; of movement and water supply; of extemporization and makeshift with no Engineer dump or ample transport at call. So it was excellent engineer training as well. 69 Company had worked well and it came away confident that it could tackle any field company job on earth—which was as it should be.

This story started with the Army mule, and here's the reason why. "Samcol" could get anywhere and not take too long about it: moreover, it got there with an astonishing economy of effort and horsepower. Yet its only mechanical vehicle was an ambulance. Mechanization is essential to modern war, but, before we who knew him entirely forget him, let us pay a tribute to the splendid Army mule, which in his hundreds of thousands has helped the British Army to so many of its past victories.


SKETCH MAP
OF
LOWER MESOPOTAMIA.
BAGHDAD.
R. Euphrates.
Hilla.
Kut.
R. Tigris.
Shatt el Hai.
Najf.
Diwaniya.
IRAN.
Imam Hamza.
Amara.
Rumaitha.
Antar.
Kardus.
Shatra.
Imam Abdulla.
Suwaij.
Samawa.
Bab.
L. Butaniya.
Khidr.
Darraji.
Nasiriya.
Batha.
Ur.
Qurna.
("Garden of Eden.")
Hamer Lake.
Laqait.
Shaiba.
BASRA.
Persian Gulf.
N.
mls. 50. 0. 50. 100 mls.

THE WAR-TIME TRAINING OF SAPPER AND MINER RECRUITS

By LIEUT.-COLONEL H. E. M. NEWMAN, R.E.

THE article which follows is based on nearly a year in command of one of the three training battalions that trained recruits for the Q.V.O. Madras Sappers and Miners during World War II. Although, alas, officers of the Royal Engineers no longer have the honour of serving with these splendid troops, analagous situations with similar problems to be solved may still arise elsewhere.

RAW MATERIAL

Pre-war, the Madras Sappers and Miners had a virtual monopoly over recruitment in the Madras Presidency. Recruiting days once a month brought eager candidates, some two hundred for the usual twenty or so vacancies. The Corps picked and chose, took none with a "murky" eye, none who muffed the obstacle course, and, except in the case of a student or two, none whose soft hands betokened a "townee" background. Furthermore, there was strict conformity with a traditional caste proportion. The war changed all that. The Corps required recruits at between twenty and thirty times the peace-time speed, and every arm of the service was calling for comparably heavy numbers. To meet these demands a big recruiting organization with ramifications throughout the Presidency and Madras States collected and distributed the volunteers.

Psychiatry was not practised in India to select men for the various arms. Methods remained rough and ready. Governing considerations, in so far as there were any, comprised : civil occupation, literacy, physique, age, inclination—the last sometimes seeming hardly to have counted. Battalions were empowered to make local enlistments, but these amounted to few, usually stray relatives of serving men brought in by leave parties.

ORGANIZATION AND ADMINISTRATION

The number of recruits fluctuated with the army expansion programme. They rose at one period to about 200 a week, each of the three battalions recruiting up to that quantity every third week, to be formed into one party commanded by a jemadar. The party was divided into two sections each under a havildar, and further into subsections about fifteen strong each under a naik or lance-naik. These party V.C.Os. and N.C.Os. would be general duty men, and they would, ideally, though rarely in practice, stay as

a team with that party throughout its training, administering it, and instructing it under the supervision of specialists trained in army schools or in local cadre classes. This organization provided more sketchy supervision than was desirable, but coats had to be cut to the available cloth.

Skilled and experienced men became scarce as the army expanded, and it was a maxim in the battalion under review to keep the companies as large as manageable, thereby keeping the number of self-administering units to a minimum. There were three training companies each containing up to four parties, and there was, in addition,a Headquarter Company which comprised all the headquarter administrative and specialist training staff, the demonstration squads, cadre classes, and all men retained from parties for higher trades training.

It is axiomatic that good training is founded on sound administration. Without it the commander is constantly distracted from his job ; and the men likewise, worried by major and minor upsets in their welfare and routine, cannot concentrate on theirs. Moreover, Training Battalion administration in India remained largely on a peace-time footing, and learning it contributed little to the efficiency of officers destined shortly for service units. Administration was, therefore, as far as possible simplified, centralized, and supervised.

Pay, Records, and Quartermastering were centralized under Battalion Headquarters. Clerks were allocated to companies for Pay and Records duties, but they worked in teams in special offices under the supervision of an expert in each subject ; Pay controlled by the Second-in-Command, Records by the Adjutant. This arrangement also countered the tendency to chaos due to the rawness of the clerks. For instance, the only time the Company Commander used his pay and mess book and company savings bank book was on the monthly pay day when he paid his men and explained their accounts to them. All casual payments were made by the Second-in-Command who kept the one and only cash book in the battalion, and who insisted upon a V.C.O's. identification of all payees before paying them.

The Second-in-Command's and Adjutant's duties were heavy, but the appointments were comparatively stable. They were unable to get out and about on training as much as their peace-time counterparts, but in compensation, company commanders had fewer office duties, and there were, in addition, officers who had specialized in, e.g., field engineering, weapon training, etc., constantly supervising the training. Several of them were ex-V.C.Os. promoted to Indian commissioned officer rank and posted for this purpose, which proved an excellent arrangement.

We compiled very full administrative instructions for the company commanders to be hung in company offices. Each month, on a set day, to a regular programme, one company was scrutinized book by book, and form by form, in detail. These inspections did not take long, and enabled the unit to undertake many a stitch in time.

Training Programmes

The programme evolved gradually. The time permitted for training depended on the speed of expansion, but it became stabilized for the majority of the recruits in a Training Battalion at thirty-four weeks. Several tentative divisions of this period were tried and discarded, and each change upset efficiency for quite a while. To make a new programme occupied days of the Adjutant's time juggling with periods and subjects to ensure that staff, equipment and accommodation availed to cover in each period the number of parties to be taught. Specialist officers had to squeeze or inflate their subjects to fit the new allotment of periods. Every party under training suffered to a greater or less degree from the upheaval, as was patent when parties passed out. It is much less disruptive to transform a syllabus than to amend a programme.

A reduction in training time from twenty-one months, as in peace, to thirty-four weeks had two effects. The number of subjects did not diminish. They had to be pared to the essentials. Training became strictly individual training, and, as service units were formed for widely diverse functions, it became logical that training battalions should leave to them the training in team-work.

The traditional Indian Army Thursday holiday was early abolished, and working hours had, in addition, to be extended. The week became so full that the recruit had no moment to himself even on Sundays, when he was occupied with kit inspections, arms inspections, ablutions and mending: so much so that he began to consider gaol-birds better off. Then one half holiday was reinstituted and the only occupation required of a recruit on Sundays was a mending parade, which lasted till his kit was passed as serviceable.

The thirty-four weeks were divided like this :—

	Week No.
Ma-Bap (literally mother-father) ...	1
Handyman training	2–3
Basic training and field engineering	4–15
Basic training and trades training ...	16–26
Range firing	27
Field craft	28–29
Field engineering revision	30–31
Leave	32–34

Attestation took place at the end of the thirty-first week, a bara tamasha, with the Band and half the battalion paraded for ceremonial.

The above subjects will be treated in more detail, but beforehand it is necessary to explain the running concurrently of basic training with field engineering, and later with trades training. It is not the ideal solution and was born of necessity. Field engineering equipment and, more particularly workshop equipment and accommodation, were insufficient to cope with the numbers involved unless they worked in two shifts. Otherwise trades training would have consisted of a very short period of long single shifts, and the shorter period, so it was assumed, would have imparted a thinner trade veneer. It was so organized, therefore, that a party worked five periods on basic training in a morning from 0730 to 1215 hrs., then went to field engineering or workshops in the afternoon from 1330 to 1800 hrs. Next day the morning shift would be field engineering or workshops, and the afternoon shift, until 1615 hrs., three periods of basic training followed by one for games ; and so on, excepting for the morning of the half holiday when there was only basic training.

The syllabus, beginning at week No. 2, consisted of :—

		¾-hour periods
Basic Training	Handyman training ...	20
	Education	193
	Drill	102
	P.T.	128
	Weapon training ...	124*
	Anti-gas	45
	Current affairs	23
	Field craft	40*
	Field engineering ...	349
	Workshops	291

*Each excluding one week in camp.

Ma-Bap

After the loss of Burma and the East Indies the importing of rice into India stopped, and though actual famine conditions did not prevail, there was less to eat in the villages, and recruits arrived with less stamina. The normal full ration barely sufficed to satisfy them to begin with. There was a marked incidence of sickness among the newly joined, and it was represented by the doctors that we should bring recruits more gradually into full work.

The recruiting organization collected their volunteers from districts and classes, many of them not normally recruited by the Corps. They often came saying that they had expected enrolment in another arm. Many of them were shocked by the amount of

work which allegedly exceeded what had been promised them by the recruiting staff. The majority had no village or family connexion with the Corps or any other regiment to counter the pangs of home-sickness. There was, therefore, much absence without leave.

To meet these new contingencies the first week of the programme became Ma-Bap week. Recruits were met on arrival during the week before and were shepherded about the lines by the Ma-Bap staff, which consisted of a jemadar and several old Sappers resplendent in medal ribbons, and chosen for their sympathetic dispositions. They had received a special training in their duties, and their job was to let the recruits down gently, show them all there was to be seen amongst the scattered components of Corps Headquarters, including all the plate and trophies in the officers' mess, take them to an airfield to see aircraft at close quarters, talk to them about the Corps battle honours and traditions, and generally try to engage their lively interest. Some of the programme entailed travelling in M.T., but during the rest of it they were marched about clapping their hands in time and learning to sing the vernacular songs to which the Corps have for long been accustomed to march, thereby unwittingly beginning their training. There was certainly a marked decrease in sickness.

At the end of this week the recruiting staff sent one of their officers who, with the Battalion Commander, inspected the party and arranged for the disposal of one or two of the more obvious misfits, after which the permanent party V.C.Os. and N.C.Os. took charge.

Handyman Training

The handyman training fortnight came into use long before the Ma-Bap week was thought of. It became largely a continuation of it but with a bias towards the ensuing programme. The recruit learned more about army life generally, discipline, sanitation, hygiene, etc., how to darn his socks, put on his boots, and tie his pagri. He began his drill, P.T. and education, was introduced to the tools fundamental to field engineering, essayed his swimming test, and then was passed from shop to shop in workshops, of which more anon.

Basic Training

(a) P.T.

The syllabus followed the teaching of the Army P.T. Schools, and was carried out by the specialist N.C.Os. sufficient for one per subsection, culminating in a competitive run over a pretty stiff obstacle course. There is nothing remarkable in that, but one or two points are worthy of note. It has been said that, pre-war, no recruit was accepted who could not surmount an obstacle course on first arrival. This fastidiousness naturally cut no ice with a recruiting organization dealing in tens of thousands, and even

tendencies towards flat feet and knock knees became no bar. Twenty-eight years, besides, was the limiting age, and it is surprising how weatherbeaten a claimant to that age can look. There were consequently many men who never attained the agility with which the pre-war recruit had to begin his career, but, considering the output from the point of view of practical engineers, the decrease in athleticism counted for less than was feared.

A "land-rowing" machine, outside the official syllabus, was introduced into the curriculum, a brick and plaster affair, two water tanks, one each side of a dummy boat. The Field Engineering staff trained the P.T. staff in technique, and the practice obtained there before the necessarily curtailed watermanship course was undoubtedly beneficial. Rowing became as perfect as any service rowing to be seen at any time anywhere.

(*b*) *Drill*

The recruit has had for some years now, as everyone well knows, a much less formidable drill to master, but it may be news to the British Service that rifle exercises were restricted in the Indian Army to the shoulder, the trail, the examine, the ground arms and, in the man's own time, the fixing and unfixing of bayonets. But other subjects were added to the drill syllabus for a substantial makeweight, and into the drill pass-offs were included intelligence tests, based on a guide in a training manual and calculated to stimulate the recruit's speed of response ; and (as a preliminary to field craft) passing messages, standard methods of crawling, field signals, field formations, and battle drill.

Incidentally, a pass-off parade is an essential climax to each subject in all courses except the trades training course. A contrary idea prevailed for a while and the result was calamitous. Pass-offs are the best means for a commander to assess the efficacy of his training, and to ginger up items which have tended to slacken. They should when possible appear in the programme sufficiently before the end of each course to enable weak items to be repeated. In peace-time it was possible to hold up parties for a week or more, but in the accelerated tempo of war training a tangle of complications would have ensued.

In the unit under review pass-offs did not entail all the men in a party doing the same things. Instead, the subsections drew lots to determine what items from the syllabus each was to perform. This enabled a bigger cross section of the work to be reviewed, and, if any section failed, it was taken for a token that the party was generally weak in the particular item it had failed in, and the entire party was made to repeat it.

(*c*) *Weapon Training*

Some aver that recruits learn things wrongly. They do not. They

learn precisely what they are taught. This was most manifest in weapon training. The forgetfulness of mass-produced and junior N.C.Os. is not surprising, and constant effort was necessary to keep them up to the mark. Where recruits were found to be shaky in any T.O.E.T. a quick test of the N.C.O. concerned invariably demonstrated the cause.

Time was too short to put recruits through the L.M.G. course. Instruction in the Bren or V.B.* was reserved in T.Bs. for cadre classes, while for the rest of the men it devolved upon their eventual service units to teach them.

It must have been since the days of Brown Bess that, according to cynics, the C.O. had but to name a minimum standard range score for his unit to achieve it. There are indeed many recipes for the cooking—substitutions, omitting to paste out, deliberately false registers, etc., and the only antidotes are a strong sense of discipline backed by exemplary punishment, and alert and ample supervision. Playing for honesty, it was decided not to penalize recruits for failing on the long range, but for a failure to make a 4-in. group on the 30-yds. range, which is easier to watch. Failing once dropped a man to the next junior party, and a second failure was justification for recommending him to the Recruiting Officer for transfer to a non-combatant arm. An occasional rupee for a champion score, and the eventual prospect of earning proficiency pay, Part II, stimulated interest in open-range shooting. Party averages fell, but how clear the consciences.

To acquaint them with the noise of bullets, parties were lined up in front of the target gallery, and selected shots fired rapid from 200 yds. over their heads into the butt behind, parties were grouped upon the stop butt while from various directions and distances in the scrub beside the firing points came stray shots into the butt to either hand, in order to train them to spot the firer's positions. But field firing was relegated to the training in service units.

(*d*) *Anti-Gas*

Of necessity anti-gas was taught mainly in the form of theory (the more's the pity). Recruits certainly learned what they were taught, which was the official school syllabus, but to what extent their imaginary and actual chemical warfare coincided it was impossible to assess.

(*e*) *Current Affairs*

Current affairs discussions were the Indian version of A.B.C.A. Both aimed at producing better citizens, but the conditions East and West made for very different types of discussion. In both hemispheres the onus of leading discussions was officially put upon the platoon or equivalent commander, but in a training battalion

* Special Indian type of L.M.G.

this could not be. A normal platoon is twenty-odd strong, the equivalent of about a naik's command. Apart from their scarcity, and apart from the fact that most knew little at first-hand about village life and organization, British officers were not fluent enough in any of the vernaculars to handle such subjects convincingly. The Roman Urdu version of the issued pamphlets was likewise of little use. The outcome was that discussion devolved upon the V.C.Os., and the discussion unit was the party, too cumbersome by intended standards, but the best compromise under the circumstances. To assist them the English version was translated into Tamil and read to the V.C.Os. who took notes for their own guidance.

Current affairs pamphlets arrived weekly like recruit parties, but whereas the pamphlets formed a progressive series, the recruit parties all had to start from the same scratch. To meet the resulting anomaly it was proposed to issue a permanent handbook for the use of recruits to introduce them to the current affairs which they would later discuss in service units. But the handbook was still pending when I left the unit.

(*f*) *Education*

The Sappers were required to accept a very high proportion of illiterates. This proportion was not always reached, but at the best it was difficult to find men suitably educated to fill the higher group trades: surveyor, draughtsman, electrician, as well as all the vacancies in cadre classes, because it was impolitic to make N.C.Os. from these few selected trades only.

In the first week of training recuits were given a literacy test. At one time this alone was taken to allocate recruits to classes. But literacy depends to some extent on opportunity. There are stupid literates and some bright illiterates who have lived remote from a school. The final allocation was therefore postponed for a week or two to enable the teachers, almost entirely civilian munshis, to observe the recruits under tuition. They were grouped as A. B. and C., in order of decreasing brilliance, each class remaining with one teacher throughout its whole course, or until men passed their examinations and were raised; and the teachers were held responsible that their pupils passed their examinations at the appointed moments. These moments were for :—

Group "A"	Recruit Test Part I in	9 weeks
	Recruit Test Part II in	12 weeks
	3rd Class I.A. Certificate in	30 weeks
Group "B"	Recruit Test Part I in	12 weeks
	Recruit Test Part II in	18 weeks
Group "C"	Recruit Test Part I in	15 weeks
	Recruit Test Part II in	20 weeks

These times will appear absurdly long to anyone accustomed to natural Urdu speakers.

Owing to the preponderance of illiterates (Group "C" was always much the largest) and the desirability of training men at least to be able to speak with their comrades from other Presidencies, the official Army syllabus was slightly amended. Recruit Test Part I was made entirely oral. The Roman alphabet was not so much as looked at till Part II, and the knowledge of it required to pass then was quite elementary.

As games are officially introduced into P.T. tables to counteract staleness and boredom several were devised unofficially for educational purposes, e.g., housy-housy, dominoes (pictures with Roman Urdu names), but results were disappointing. They did not penetrate the lethargy of the conservative school staff.

One educational period per week was devoted to a general knowledge lecture. British officers produced the series in English; the munshis delivered them in the vernacular. The purpose of these was to get the recruit thinking in terms successively of his District, his Presidency, India, the Empire, the World, and the reasons for his being required to fight. (He had volunteered to fill his belly). He was also given a talk on each of the several arms of the service, also on the Navy and the R.A.F., explaining their functions, and their organization in the most general of terms, and how he as a Sapper might very well encounter them on service. It is possible that the Current Affairs Handbook would, when published, have rendered some of these lectures redundant.

Field Engineering

The old complete field engineering syllabus was covered, and certain items introduced since the war began, such as anti-tank mines and mine detection, were added, but the concentration was on the individual training. To this end the various parts of the syllabus were pared and simplified. Recruits, for instance, learned how to draw timbers together using dogs, rather than to erect trestle bents, how to handle the components of a charge, rather than to apply it to a bridge. The final fortnight's revision was not approved in all quarters, but, in spite of passing tests handsomely in the fifteenth week, recruits were found to have forgotten much when they reached the twenty-ninth week, and the fortnight just served to recover their old skill. After a further lapse of time these men having joined a company, a second revision under company arrangements would assuredly have required even less than two weeks to achieve the same standard, provided, of course, that their N.C.Os. worked on sound lines.

Trades Training

The British Service were faced with a very different problem. Their trades training mostly aims to improve the rating of men who have enlisted with a certain trade knowledge already acquired. In South India most Sappers come straight off the paddy fields, and they have to be brought to a trade *ab initio*. The Technical Recruiting Officer did at one time supply a few tradesmen for enrolment, but his and Sapper trades standards were two such differing kettles of fish that his assistance had to be rejected if only for the sake of peace in the ranks.

Several tradesmen did, however, arrive among the normal non-technical recruit parties. During the second week of handyman training each party had five half-days in the shops. Tradesmen in the party were discovered and tested. If they passed, they obtained their Engineer Pay immediately; if they were judged passworthy after a short training (Ordnance pattern tools and the native Indian equivalents are not always alike) they were kept for a maximum of three weeks to give them the chance of obtaining it, and then began military training with the next recruit party to arrive.

All the non-tradesmen were passed from shop to shop in order of skill, i.e., from "A" Group to "C" Group, where the record was made of their potential abilities, which determined to what trade they would eventually be posted.

In the protracted recruit's course of pre-war days very few passed out of the T.B. shops with less than fourth rate, which is somewhat inferior to improver, and candidates for the next (artificer) rate had to prove their worth during several years of practice in a field unit before being considered. In war such methods go by the board. The T.B. shops laboured to bring every recruit to fifth rate, little more than the bare apprenticeship with the tools of their trade. The bulk of them passed to the depot or field units in this condition, but it provided the basis on which units could further train their men if opportunity offered, and it removed from every man what is, amongst Sappers, the stigma of lacking a trade. A certain number had to proceed to higher rates, otherwise newly raised units would have had no artificers, the actual numbers to proceed depending on the prevailing circumstances. These men, chosen for their skill, remained after their leave in the Headquarter Company of the Training Battalion until fourth rate was achieved, whence they were drafted to the Depot Battalion for artificer training. There was an undoubted danger that these young artificers would have lost their skill just as quickly as they were crammed unless their field units could continue to let them practise it, but it was Hobson's choice.

This universal trades training was ponderous, but it did produce a homogeneity of standard which was an asset to all unit commanders.

Field Craft

It was found impossible, due to the inadequacy of the recruit's imagination, and to the juniority and inexperience of the N.C.O. instructors, to inculcate in the time available any intelligent tactical use of ground. I would have defied infantry experts to do better. The preliminary battle drill movements practised on the square helped greatly when it came to field craft, but even so the field craft syllabus had to be limited to applying the drill movements to set schemes repeated *ad lib*, like theatrical rehearsals, in open country till perfection was reached. Replicas of Japanese headgear were made from khaki drill and the subsection which was destined in any set scheme to be defeated in the engagement was required to wear them. Keeping the eye on the ball of individual training, subsections were restricted to operating alone, and not in co-ordination with others. The outcome was a recruit, who, if in a field unit he was intelligently directed upon a tactical manœuvre, would himself have co-operated intelligently. He knew the meaning of fire and movement, and he had had it dinned into him that ammunition must not be wantonly expended.

The field craft camp was situated in the open country, and in its midst was a sand model of the training area on which every exercise was explained before execution, and around the tree trunks in the camp area mud plinths were made and set with white stones to trace in all the relevant scripts the principal field craft precepts. This slogan technique might well have been extended to cover other courses.

Every recruit was taught how to set and light a camp fire, and on it to cook his rice and dhal in his own mess-tin, and how to bake a chappatti in the glowing embers. Certain lessons, in particular the individual stalk, and scout craft, were treated as competitions for small monetary awards, and the keenness was intense.

N.C.Os. and Umedwars

N.C.Os. for the forming service units were found from the static units of Corps Headquarters, which included the Training Battalions. There was consequently a steady eflux from them all. N.C.Os. used to be posted out individually by Corps Headquarters until at last it was established that the best training talent until stale must be kept for training. This might be considered inimicable to the field units, but training and leadership in the field call for different qualities which do not necessarily exist together. Besides, field units soon benefited, as was quickly patent, by receiving a better

quality rank and file. However, whether good or bad trainers left the T.B., there still arose training vacancies to be filled, and the "milking" scheme, under which reliefs were interchanged between Corps Headquarters and units on active service, did not help appreciably towards the filling of them.

The system which devolved, and which achieved an immediate success, to the amazement of the sceptical, was not original, and we were beholden for it to an interchange of co-operative visits with an Infantry Training Centre. Recruit lance-naiks used to be appointed from parties of recruits even in peace-time, but their employment was restricted, and they faded back into the anonymity of the ranks on drafting out, with but a note on their Recruits' Progress Cards to record their one-time achievement. It is not suggested that appointment to lance-naik before serving, and proving themselves, two or three years in a field unit is normally desirable, but it is apparent from the war-time procedure which developed that many more men could have been produced with the attributes for command, and the minds of the recruit lance-naiks might have been stimulated more than ever they were, had they been put to greater use and responsibilities.

The system involved the appointment of "umedwars" (which literally stands for "hopeful people"). In the fourth week of training one man per subsection was appointed "umedwar" for the week. Next week another was appointed in his place, and so on. The "umedwar" wore red shoulder straps, and he was considered to hold full authority over his mates. For short periods during the week he was summoned out of the ranks, made to command, and shown how to do it. He marched his men about the lines between periods of instruction, was answerable for the cleanliness of his subsection's portion of the barrack room, and in general he was encouraged to shoulder responsibilities. Most responded wholeheartedly. At the end of his week his potential "brain-power" and "power of control" were recorded in a book. For each pass-off it was the best of the "umedwars" who put his subsection through their paces, and the fact that many of the recruits had been "umedwars" was manifest in the intelligence displayed and the keen rivalry to carry out the tasks ordered. Every man-jack had benefited. The party N.C.Os. were either dismissed from pass-off parades, or they followed the C.O. round in a formed body to hear his comments on their training achievements. From only the markedly dumb was the opportunity to be an "umedwar" withheld, the number averaging between a quarter and a third of the whole. All the remainder had by the twenty-fourth week enjoyed several weeks of responsibility, and it was then that the best two "umedwars" in each subsection were stabilized as recruit lance naiks.

Officers, especially the field craft and field engineering officers, watched the recruit lance-naiks' prowess and reported on them individually to the Company Commander, who selected the best at approximately 10 per cent of the party strength for subsequent cadre classes. The cadre class began after the leave period, when the bulk of the party had gone to the Depot Battalion. It lasted twelve weeks, the candidates acquiring not so much command, for this was already inculcated, but how to teach what they had been previously taught. Each cadre was passed off in all subjects, the candidates having to instruct suitably untrained squads. Any weak candidates were usually put back a few weeks ; it was seldom necessary to fail one completely. The successful were drafted into the training companies, where they remained, and whence they were later drafted out for service, and so the cycle continued.

Demonstration Parties

Teaching is quicker through the eye than through the ear. Three demonstration squads, each twelve strong were formed to demonstrate everything demonstrable to all the parties before they themselves began to execute them. Two performed in teams for (e.g.) squad drill, battle drill, highwire fence, watermanship, action under gas spray, etc.; the third demonstrated the more individual activities in field engineering such as mauling a picket, reaving a tackle, erecting a 500-gallon tank, etc. To maintain the interest of the men there was a gradual filtration in from the parties and out to cadre classes. No man stayed longer than twelve weeks. This promise of eventual cadre meant that the standard of the demonstration squad remained high, consisting as it did of men who had just failed to make cadre class in the first instance.

Welfare and Miscellaneous

Recreational training remained much as of old, except that there was less time for it, and less inter-unit competition outside the immediate collection of units. Within the lines there was a canteen with recreation rooms alongside provided by the M.E.S., the whole but little bigger than a couple of barrack rooms, temporary tatti structures which scarcely lent themselves to decoration.

Each company dining-hall jutted from its cookhouse, roofed but without walls. Each unit walled in the last three bays and fitted it with chairs and tables, petromax lamps, darts, carrom boards, draughts, bagatelle, etc., newspapers, and periodicals, of which came several official ones beautifully illustrated in photogravure and with captions in all the four vernaculars. On the walls were pinned information and propaganda posters, and pictures of less bellicose intent. The result was disappointing. Only the Headquarter Company made good use of theirs. It appeared that the recruit was too

fatigued of an evening to want them. Later carrom, etc., were introduced into each barrack room, and there the varnish did get rubbed off the boards.

For other entertainments a radio with extension speakers was supplied (of doubtful value), and there was a weekly visit to the local camp cinema (of value without a doubt), and the battalion talent was turned to its own dramatic productions.

Durbars were introduced. A durbar comprised a company or less, each recruit attending four during his course. It was customary for the C.O. and Adjutant, with the Subedar-Major, to attend to the recruits, and for the Second-in-Command with an I.C.O. the separately formed durbar of permanent staff. Most of the talk concerned land, and family, and money troubles, failure to get letters, etc. Letters to the appropriate District Soldier's Boards settled most of the troubles. Indeed, these organizations were by oriental standards, quite expeditious. In addition, minor complaints were aired about conditions in the unit which led to amendment or improvement or, at worst, to explanations in default. It was noticeable that senior parties were too intent on forthcoming leave to concern themselves with worries and grievances. Altogether a useful innovation.

The Sapper was badly hit when beer became scarce and was restricted to British troops. Toddy vendors established flourishing stalls in the casuarina topes around the lines and it was next to impossible to prevent the Sappers from attending them, or effectively to eject the vendors. (They were on Mysore territory.) Diarrhoea became rife. After prolonged arguments with the local licensing authorities we eventually managed to obtain an arrack licence for the canteen, and matters mended forthwith. Arrack is in no way more injurious than rum, which was the Sapper's pet, but rather more expensive, peace-time brew.

In a period of enforced inactivity, running one of these Training Battalions was a most satisfying occupation. It was good to watch the growth of a smart recruit party out of the shabby unpromising material that arrived, and to see it pass out and finally attest, tails up, and each "thambi" vying with his mates to excel them. Idealistic? No, it happened, and not only once. And these young Sappers, given their chance in the field, worthily upheld the high traditions of all Sappers, be they British or Indian. This last is for me, I regret, hearsay, but I believe it.

THE ROYAL ENGINEERS AND THE TECHNICAL STAFF*

By MAJOR A. A. T. HISCOCK, R.E.

INTRODUCTION

Recent entries of Royal Engineer officers into the Military College of Science for the Technical Staff Course have been very small and the proportion of properly qualified R.E. officers occupying Technical Staff appointments is correspondingly low. This is a serious matter for the largest technical Corps in the Army and can only mean that in the years to come officers other than of R.E. will tend to usurp the position of Engineer Advisor to the Commander.

There has never been any lack of R.E. candidates for the Staff Colleges at Camberley and elsewhere and there is no lack to-day. The wisdom of encouraging as many officers of the Corps as possible to try for Camberley is not in doubt. The benefit to the Army and to the Corps is plain, and the number of ex-R.E. officers in high places to-day is very considerable.

The writer is of the opinion, however, that it would be unwise for the Corps to neglect the Technical Staff, whose influence must be increasingly felt in the future. The purpose of this paper is to examine the reason why there is a lack of R.E. candidates for the Technical Staff, to point out the advantages which the R.E. could obtain by making better use of the resources of the Military College of Science and to suggest improvements in the structure of the College which would enable it to exercise an even wider and more useful influence than at present.

RÔLE OF THE MILITARY COLLEGE OF SCIENCE

The broad rôle of the Technical Staff Officer and his training have been described by Major-General Eldridge, who was Commandant of the Military College of Science, in the August, 1950, issue of the *Journal of the Royal United Service Institution*, and also by Major Stewart in the December, 1950, issue of the *R.E. Journal*, and the writer will not enlarge on these general themes.

It is relevant, however, to repeat here the following extracts from the Charter of the Military College of Science which, as the main centre of technological training in the Army, has the task of training the Technical Staff Officer :—

> " The Military College of Science will be a centre of study and will have the rôle of educating officers in Science and Technology so that they may be capable of appreciating the Scientists' and Engineers' problems with relation to the technological aspect of

* *It is specially stressed that the views expressed in this article, as in all others in the* R.E. JOURNAL, *are those of the Author and do not necessarily expound official opinion.*

war. It will also train officers to apply their military knowledge to those problems in order that they may later advise those responsible for the design and development of material, regarding the practical military limitations and requirements."

The Charter goes on to outline the task of training young officers up to the degree standard of London University and then proceeds as follows :—

"It will train officers for appointments to the Technical Staff in the Army and the Ministry of Supply. It will allow these officers to specialize in particular aspects of Applied Science and Technology to meet the requirements of the Army and Ministry of Supply. It will also give the officer practical instruction in the practice of Production Engineering and Works Organization.

"During the course the military application of the Science and Technology being taught will be studied so that officers may appreciate the interrelation between tactics and scientific development."

Those parts of the Charter quoted above would, therefore, seem at first sight to offer a very great deal of value to the Corps, both as a whole and to individual officers. Apart from young officers studying for their degrees it would seem that a very high proportion of those trained as T.S.Os. should be Royal Engineers. The Corps has always been deeply concerned in new scientific developments in war. This is not altogether the case to-day.

The Present Field of Action of the Trained T.S.O.

Each year trained T.S.Os. are being passed out of the Military College of Science to appointments on H.Q. Staffs in the War Office and its establishments, and in the Ministry of Supply and its establishments. The fields in which these officers work are reflected in the designations of the three Military Directors of Study at the College. These are "Fighting Vehicles," "Weapons" and "Fire Direction." An officer studying under the first would have specialized in his second year of study in the application of related aspects of science and engineering to design of fighting vehicles and would naturally have studied heat engines, theory of machines, metallurgy and strength of materials, among other subjects. A "weapons" specialist would need ballistics, applied chemistry, metallurgy and so on. A "fire direction" specialist must study radar, survey, engineering physics, etc.

The conclusion must surely be that the emphasis is overwhelmingly given to the problems of the Royal Artillery, followed by those of the Royal Armoured Corps and Royal Signals. The valuable and unique resources of the College are not brought to bear, except in the primary training of young officers, on the problems of the Royal Engineers. This is a great loss to the Army.

The Lack of R.E. T.S.Os.

This concentration on R.A., R.A.C. and to a lesser extent R. Sigs. aspects has unduly narrowed the field in which Sapper officers feel that they can find congenial study at the Military College and subsequent employment as T.S.Os. There is no doubt that many are deterred because of this, and also because they feel that the Corps as a whole loses interest in them once they do become T.S.Os. It is felt that an officer who passes through the Camberley Staff College is assisting his career and that his *p.s.c.* qualification will be a great asset to him. On the other hand, many officers feel that a *p.t.s.c.* qualification may be a disqualification in that they will be considered " too technical " and that they will thenceforth have to make their way in the Army entirely on their merits as Technical Staff Officers without assistance from whatever merits they may have as R.E. officers.

There is no doubt a widespread feeling throughout the Corps that an officer may be prejudiced in his career if he shows much interest in applied science and technology. This may have arisen because of the scarcity of specialists (such as E. & M.) and because a few technological specialists did become rather remote from the realities of soldiering. The answer lies in more specialists and a more widespread knowledge of technology. Only by this means will officers become available to free others from excessive periods of service spent in comparatively minor technical appointments. The writer feels that distinguished nineteenth-century Sappers and Fellows of the Royal Society, like Sir Charles Pasley, would have had strong views on the subject of R.E. officers shying away from the applications of modern science to war.

The Training of the T.S.O. for R.E. Requirements

As has already been outlined, the Technical Staff Course has little emphasis on the Sapper side of the application of science and technology to war. What are the particular fields in which the R.E. officer can contribute and in which he needs help and guidance?

In the first place, a great deal of R.E. work is bound up with explosives and their use, for demolitions and for mines. There is here a tremendous field for the properly trained T.S.O. " of R.E. origin." There is the whole field of bridging, and of many other military aspects of civil engineering. Electrical developments are in much need of study from the R.E. angle. Radar, telecommunications, computing machines and servo mechanisms are not neglected by the appropriate arms. Mechanical developments, for instance gas turbines, are a closed book to all but a very few Sappers.

It is the writer's view that if the organization of the Military College of Science were widened to include more study of the Sapper

applications of technology, and if establishments such as M.E.X.E. and appropriate appointments on the D.F.W. Staff and elsewhere were filled in due course, as in other analogous establishments, by Shrivenham trained T.S.Os. with a *p.t.s.c.* qualification, then the Army and the Corps would benefit widely and there would be a very much increased interest by R.E. officers in the Technical Staff.

Reorganization of the Military College of Science

The major change needed at the Military College of Science is the establishment of a Director of Studies (Military Engineering) who should be a Sapper Colonel qualified to co-ordinate the applications of science to the appropriate subjects. He would need a nucleus of R.E. officers to assist him.

The academic organization of the College is based at present on four faculties of Science, organized as follows :—

Mathematics and Physics
- Mathematics
- Physics
- Ballistics

Chemistry
- Chemistry
- Applied Chemistry (including explosives)
- Metallurgy

Mechanical Engineering
- Heat Engines and Motors
- Machine Design and Production Engineering
- Applied Mechanics and Fluid Mechanics
- Materials and Structures

Instrument Technology
- Electrical Engineering
- Radar and Telecommunications
- Engineering Physics

Thus it is clear that all the essential academic foundations exist for the necessary introduction of Sapper problems into the syllabus for T.S.Os. There would be need for only small reorganization on the academic side.

The Director of Studies (Military Engineering), once established, would be able to ensure the setting up of appropriate study groups analogous to those which already exist and which include " field artillery," " A.A. artillery," " coast artillery," " tanks " and " wheeled vehicles." Groups which would be of value are " mine-field clearance," " mines," " military bridging," " demolitions," " industrial gas turbines," " water sterilization and filtration," and there are many others of great importance.

The Position of the S.M.E. and M.E.X.E.

It should not be imagined that the proposed reorganization of the Military College of Science would in any way detract from the responsibilities of the School of Military Engineering and the Military Engineering Experimental Establishment. Rather it would help these organizations by ensuring appropriately guided academic study of many of the problems "focused" by them and by training T.S.Os. to fill appointments in M.E.X.E. and elsewhere, particularly those with an R.E. "flavour." At the moment such training is not being carried out at all and there will come a time when there are no R.E. officers qualified to fill these appointments.

Conclusion

The Technical Staff is being neglected by R.E. officers, despite the fact that the R.E. is the largest technical Corps in the Army. This is due in part to the deficiencies of the Technical Staff Course and in part to the widespread belief that little interest is taken by the Corps in technological specialists in general and in T.S.Os. in particular.

This must be remedied if the R.E. is to play its true part in the modern army. The first essential is reorganization of the Military College of Science and the strengthening of the R.E. representation there.

"ASTRIDE THE LOAD"

By Captain W. W. Hazeldine, R.E.

The notes which follow are largely based on a similarly entitled article which appeared in the 30th April, 1949, issue of the trade journal *Motor Transport* and from additional information supplied to D.E.S. representatives during a subsequent visit to the timber yard concerned.

This visit was arranged with the object of assessing the possible application of Straddletrucks to handling problems in Military Engineer Stores Depots.

General

CUT timber stacked in varying lengths may at least be termed an awkward load and presents its own problems when required to be handled in docks or timber yards. The means of carrying out this work are therefore varied, but recent years have seen the introduction to this country of an American vehicle, designed especially for the purpose and which, owing to its ease of operation and manœuvrability in confined spaces, is rapidly gaining popularity.

The Straddletruck is a petrol-operated load carrier designed to pick up, move, and place a load, such as a pile of timber, by straddling it. It is built in a variety of sizes ranging in capacity to a maximum of 30,000 lb., and some idea of the latter size may be gained from the fact that it can "straddle" a 12 h.p. car. The hoist mechanism of the truck is either of the "rigid shoe" type in which it moves only in a straight verticle manner, or of the "swinging shoe" type in which it moves inward and outward as well as vertically.

The yard visited is that of one of the largest timber importers in the country, and uses four Ross, series "70," and one Ross, series "90", straddletrucks in co-operation with five Ross fork-lift trucks. The latter, four of which have a capacity of 5 tons lifted to 22 ft. and the remaining one a capacity of 8 tons to 24 ft., are employed mainly for stacking the timber and for loading the road transport delivery vehicles. The necessity for the combination is not hard to find. The fork lift truck is primarily a stacking machine, and the fact that it carries the load "breadthwise" rules it out as a transporting machine when the loads are in the region of 20–40 ft. long and have to be transported over normal roads ; on the other hand, the straddletruck, whilst ideal for transporting such loads, is incapable of *stacking* them to any height.

Straddling Technique

To pick up a load, the straddletruck is driven over a stack of timber which has previously been built up by hand on suitable stools (or bolsters—see sketch) and a lever in the driver's cab operated to raise the L-shaped lifting shoes which run along the two inner sides

"STOOLS" FOR USE WITH STRADDLETRUCKS

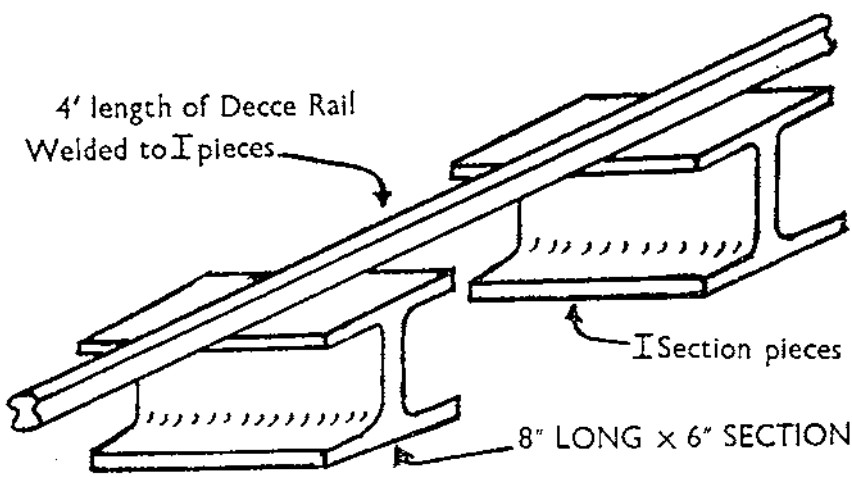


Photo 1.—Ross, Series "70" Straddletruck.
Picking up the load.—Note "Stool" is under the load and the height of the load permits locking against underside of carriage for rigid transport.

Astride the load 1

Photo 2.—Ross (5-Ton, 22 Ft. Lift) Fork Truck.
Side view of load at maximum elevation.

Astride the load 2

of the truck. These shoes, hydraulically operated, come up underneath the stools, which project on each side of the load, to lift the load clear of the ground. Unloading is equally simple ; the load is lowered to the ground and the vehicle driven over the load and away. The lifting shoes in their lowest position are approximately two inches from the ground and have a lift of about twelve inches.

This, with suitable standard load heights, enables the load to be raised sufficiently clear of the ground and also to bind it lightly on the underside of the truck frame to keep it steady in transit.

Handling Methods

Handling methods, in the timber yard were briefly as follows :—

(i) *Raw logs*, are handled by rail-mounted/mobile cranes.

(ii) *Processed timber*, most of which arrives by barge, is off-loaded and stacked, by hand, in convenient straddletruck loads on stools. In the sawmills the timber is handled by E.O.T. crane and finally stacked on stools, adjacent to the machine.

(iii) From the sawmills and barge off-loading areas, the processed timber is transported to the storage areas by straddle-struck. At the storage area the load, with its stools, is dropped adjacent to the stacking location where it is picked up and stacked by the fork-lift truck.
Short and long dunnage are used, as required, to facilitate handling operations and to stabilize the stacks.

(iv) *Loading on road transport* is by fork-lift truck.

Conclusion

The speed of movement resulting from the use of Fork-truck/Straddletruck combination is remarkable—it has to be seen to be believed, and the writer, equipped with a modern miniature camera and no desire to interfere with normal operations, had considerable difficulty in obtaining a number of illustrations of which two only are reproduced here. The visit achieved its object in so far that there is now no doubt that this is the method to adopt when the material to be handled is lengthy, e.g., bridging, transportation stores, and timber yards of military engineer depots, and is readily made up in standard loads for stacking, transporting, and issuing. Neither facts nor figures were available to support any claim for savings in time and labour, but it must be considerable, and a 50 per cent reduction on both is not considered extravagant.

Note.—A British prototype straddletruck, manufactured by Messrs. Pest Control of Cambridge, is now undergoing test by the Ministry of Supply.

POWER FROM NATURAL SOURCES

By BRIGADIER J. A. C. PENNYCUICK, D.S.O.

" When the Children of Israel made bricks without straw,
They were learnin' the regular work of our Corps.
The work of the Engineer . . ."

BRICKS without straw, electricity without fuel! Kipling's poem came to mind, when, as an officer of the Allied Commission, I found new power stations, near Naples, designed to generate electricity without using fuel.

They were not the conventional hydro-electric installations, but something unusual. Evolved by Italian engineers to take advantage of natural phenomena, a chemical, ethyl chloride, was used in one case and natural steam in another.

As some of the ingenious methods employed could be adapted for use in other conditions, the story may not be without general interest.

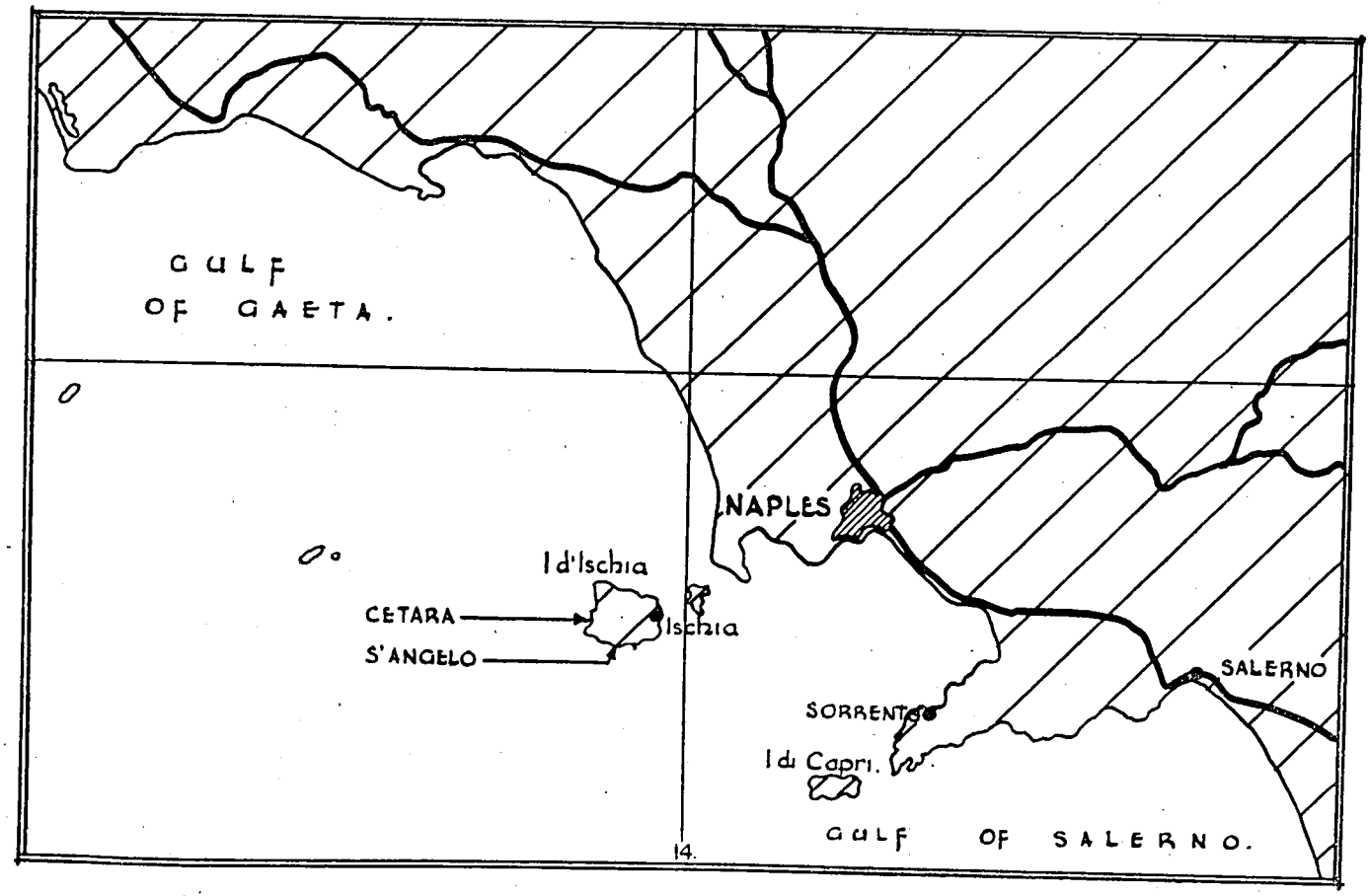
The island of Ischia is about twenty miles from Naples and forms, with that port and Capri, a triangle of roughly equal sides. It has an area of about fifteen square miles and so, is larger than its more glamorous sister island. The interior, which is mountainous and somewhat austere, includes an extinct volcano. Seaward slopes are vine covered, while the coastline is dotted with delightfully picturesque hamlets.

The population of nearly 10,000 persons, make a living chiefly by fishing and cultivating the grape.

Electricity supply for the community used to be conventional. A collection of diesel sets, arranged in a somewhat haphazard lay-out, ran the generators. Efficiency was not high, interruptions were endless and, although the machines were constantly out of action, they managed to burn a surprising amount of oil, about 160 tons in a year.

Like so much of the country dominated by Vesuvius, volcanic activity gives rise to natural phenomena in Ischia. One's first arrival at the island is, indeed, an introduction to its volcanic nature, as the principal port has been created out of an old crater, into which, a channel has been cut from the sea. This forms a delightful little land-locked harbour, nearly circular in shape, of unique character.

Close by, on the shore, there are thermal baths of natural hot water, renowned for their curative properties, while other hot springs and jets of natural steam, occur in different parts of the island. It is these natural features, that have now been harnessed by the Italian Engineers.


GULF
OF GAETA.
NAPLES
I d'Ischia
CETARA
S'ANGELO
Ischia
SALERNO
SORRENTO
I di Capri.
GULF OF SALERNO.
14.

In the first of the new power stations, situated near the little village of Cetara, about three miles south of Forio on the west coast, ethyl chloride ($C_2 H_5 Cl$) is used, in a closed circuit, to operate a turbine, which drives the generator.

At this place springs of natural hot water come out close beneath the surface of the ground, at a temperature just below boiling point, about 95° C.

These springs are within a hundred yards of the sea, so a power station has been built between the source of hot water and the beach.

The hot water is taken by a lagged pipe, to the power station, where it is pumped through a container. Inside this hot container, there is a so-called "boiler," containing distilled water. Ethyl chloride, a volatile substance, is injected into the "boiler" where it rapidly evaporates, as a result of the heat.

The ethyl chloride vapour, together with a small quantity of water vapour, passes through another lagged pipe to drive a turbine. The turbine, which is coupled to a generator, consists of a simple vaned wheel, of large diameter, driven at a low radial speed. After passing through the turbine, the ethyl chloride vapour is condensed in a surface condenser, using cold water pumped in from the near-by sea.

Condensed ethyl chloride is then again injected into the "boiler" to re-start the cycle.

Because of the volatile nature of the chemical, great heat is not required and the working temperatures of "boiler" and cooling sea water, were given as 55° C. and 25° C., respectively.

The sources of hot and cold water both being close to the power station, little energy is required to work the pumps. Once started, the plant is designed to run indefinitely, on the heat derived from the natural source.

About one and a half tons of ethyl chloride are required to operate the plant, but working losses of the chemical, in the closed circuit, were expected to be negligible.

The useful output, from this pioneer set, after allowing for the electricity required to drive the pumps, was 300 kw.h.

The plant is compact and is housed in a power station (see photograph 1) built to allow for future extension and also to provide living quarters for an attendant and his family. Maintenance is light and the site not without amenities. The soil of the small valley, above the hot springs, shown behind the power station in the photograph, is so heated up that very early crops of vegetables can be grown in the open. They are renowned for their excellence and find a ready market in Naples.

Although the Italian engineers, who worked out the project, were inspired by the presence of sources of natural hot and cold

Photo 1.—Cetara Power Station.
(by Courtesy of THE ELECTRICIAN*)*

Photo 2.—Steam jet from capped bore at San Angelo.

Power From Natural Sources 1,2

water in close proximity, it is not difficult to see that similar favourable conditions may be found in other places.

A set of this type, using ethyl chloride in a compact, closed circuit should, for example, be readily adaptable in ships, to run auxiliary services. Heat, going to waste from the main engines and unlimited cooling water from the sea, would again be available in close proximity.

Nor is ethyl chloride the only suitable volatile chemical. A small model trial set, constructed in Naples, ran successfully on Dieline ($C_2 H_4 Cl_2$). There are probably other alternatives.

When nature decides to be kind, she can be lavish with her gifts. Ischia has a second new power station, run without fuel, the source of energy being natural steam.

Coasting south by boat from Cetara (there is no road ashore, only a rough mule track), the south-west corner of the island is soon reached. Here the shore is joined by a narrow sandy isthmus, to a rock pyramid, standing out in the sea, like a tiny edition of Mont san Michele in Brittany.

The isthmus provides two short beaches, one facing west and the other east, within a few yards of each other, so that fortunate bathers can nearly always find an aspect sheltered from the wind.

Overlooking these beaches, the village of San Angelo clings to dark rocks, which throw into relief the sunny houses, gaily colour-washed in various shades of pink and green. The buildings drop steeply down to a miniature harbour and this secluded, artist's dream village, includes two small inns, celebrated for fish dinners.

Seven or eight courses of different varieties of fish, from young specimens of the octopus, fried in oil, to delicious red mullet, all washed down with a good local white wine, form a feast not easily forgotten.

About half a mile to the east of San Angelo, a white plume of steam, at the edge of the sea, marks the position of Ischia's second new power station.

The bore (see photographs 2 to 4) is about 2,000 feet deep and delivers some 5,000 kilograms of steam, per hour, at a pressure of about 140 atmospheres. The steam has been harnessed, as a first stage, to a steam turbine, driving a dynamo to give 100 kw.h. of power. There is allowance for expansion up to 600 kw.h.

This little power station will, no doubt, call to mind the giant installation, run by natural steam, at Lardarello in Tuscany. Though it was in the area of the American Fifth Army, Sappers who served in Italy, may remember the huge awe-inspiring jets of steam, blowing high into the air, with a deafening hiss, when the caps had been blown from the Lardarello bores, by the retreating German forces.

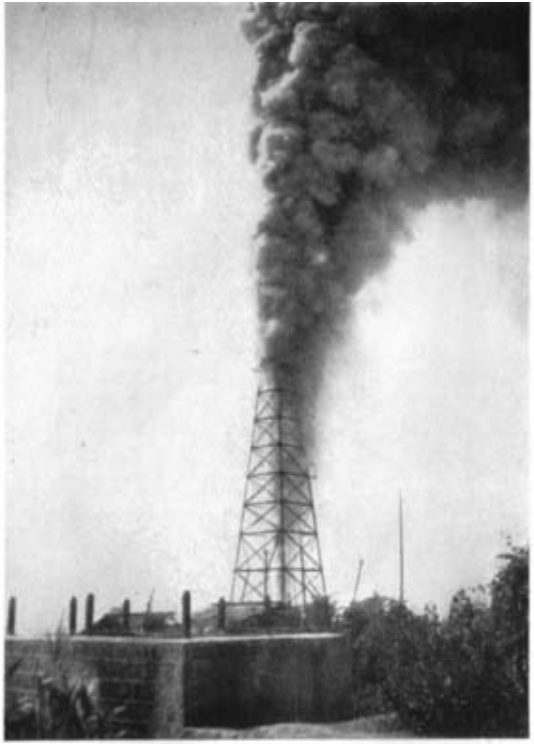


Photo 3.—Steam from the Drill.

Photo 4.—The main bore capped.

(*by Courtesy of* The Electrician)

Power From Natural Sources 3,4

Even the small jet at San Angelo, with its insistent, uncanny roar, was sufficient to produce a slightly uneasy doubt. Could it be that there, right down below, it was a volcano that had been tapped! Another Vesuvius?

And what of the inhabitants of this fortunate island, what do they think of the wonders done for them by their engineers?

Well. Diesel oil was understood. Was it not the good fuel so useful in the engines of the fishing boats? But, power stations that required the importation of no fuel! *Per Bacco.* The Good God might not approve of such goings on.

Sadly the engineers admitted, that there was a strange lack of appreciation, by the fisherfolk, of their brilliant projects. Faintly there came another echo from Kipling :—

> " *We build 'em nice barracks—they swear they are bad,*
> *That our Colonels are Methodist, married or mad.*
> *Insultin' the Engineer . . .*"

THE EMPLOYMENT OF TROOPS IN THE SEARCH FOR A MURDERER

By MAJOR R. E. EVERTON, R.E.

INTRODUCTION

CONSIDERABLE prominence was given in the national Press early in June, 1951, to the search for and the subsequent " besieging " in his home of Alan Poole, a young absentee from the Royal Corps of Signals, who shot and fatally wounded a Chatham policeman, P.C. Baxter.

Since the men of 10 Trades Training Regiment formed the bulk of the troops taking part in this operation, and as such affairs are becoming increasingly commonplace these days, this article is offered for the information of any who may be interested and in the hope that the experience gained by the writer may be of some use to any other officer " caught " for a similar job in the future.

The narrative and conclusions are written only from the point of view of O.C. Troops, and are based on the writer's report submitted at the end of the operation, the conclusions being, therefore, purely personal views, which more than likely do not represent any official viewpoint.

Narrative

Shortly after 0900 hrs. on 5th June a message was received that B. Sqn. of 10 Trades Trg. Regt., R.E., were urgently required to provide a force of fifty men, some armed, to take part in the search of a wooded area, south of Chatham, for a man who had wounded a police constable with a Sten gun the night before.

After issuing warning orders for assembling this force, the squadron commander went with the C.O. to a conference at Chatham Police Station at which senior police officers presided. At this conference it was agreed that the military force, with a small naval detachment under command, should be split into three parties, each under an officer. Two men armed with rifles were to be with each party, and the remainder were to carry pick-helves. The strengths of the parties were to be :—

Nos. 1 and 3	One sergeant and fifteen sappers each.
No. 2	One sergeant and twenty sappers, with ten R.N. police under command.

A police inspector and sergeant with local knowledge of the area were to accompany each party to direct its efforts through the O.C. party. A police dog was available to assist searchers in wooded areas. The R.V. for the start was to be the "Wheatsheaf Inn," Upper Luton (A).

The area concerned is shown on the folding plate at the end of the article, on which points mentioned are marked (A), (B), (C), etc.

No. 1 Party, under 2nd Lieutenant G. P. Godenir, and No. 3 Party, under Captain R. F. Scott, were to work south from the R.V. and No. 2 Party, under Major R. E. Everton, was to work north from the southern boundary road to search the areas marked on the map. A police cordon had been thrown round the district the night before, after the shooting.

A small H.Q., consisting of a W.O. II, a corporal clerk (to chronicle events as they took place) and a wireless set was to be set up at the R.V., with a Land Rover as transport.

After this conference the sappers were organized into the three parties, arms issued and orders given concerning the employment of firearms. The wireless sets (one per party and one for H.Q.) were collected, and the men conveyed to the R.V. in the only transport available, a troop-carrying vehicle and a 3-ton lorry. The R.N. police had their own utility truck.

The orders given to the armed men were that they were to load the magazine only, no round in the breach, safety-catch on. They were to fire only on receipt of such an order directly and personally from their particular officer, or, in an extreme case, to save their own or another life. They were to aim to wound in the legs. When not

actively searching, ammunition was to be withdrawn and held by Os.C. parties. In addition all ranks were given a brief outline of Common Law as applicable to the use of force in the apprehension of a person reasonably suspected of being a felon.

On arrival at the R.V., the allotted police were married up with each party, the dog being with No. 2. The R.N. detachment came under command at this moment. Wireless sets were netted and whistles (provided by the police) issued all round for inter-communication. Nos. 1 and 3 Parties set out to their start points, and No. 2 Party was led south by police cars.

No. 1 Party beat south, arriving at Gibraltar Farm (B), at about 1500 hrs., and meeting No. 2 Party there. From 1500 hrs. onwards No. 1 Party beat due west to Walderslade Bottom, arriving there at about 1730 hrs. This party then returned to the Upper Luton R.V., having collected a few stragglers from the other parties on the way. These were not at all numerous, having regard to the difficulty of maintaining contact in such close country.

When No. 2 Party arrived at road junction (C), the police stopped the vehicles and said that beating was to begin in a S.E. direction, and not as originally planned. So this party beat S.E. from its revised start line, arriving on the road between road junction (D) and Lidsing (E), at about 1300 hrs., where, fortunately, it being a hot day, there was an inn. This party later moved to road junction (F) and beat W.N.W. to Walderslade (G), meeting No. 1 Party at Gibraltar Farm and No. 3 Party on the road at (H) at about 1615 hrs. It then concentrated with No. 3 Party at 1645 hrs. at the "Hook and Hatchet Inn," Walderslade (I).

No. 3 Party beat south, arriving at Walderslade at 1615 hrs., and concentrating with No. 2 Party there.

Nos. 2 and 3 Parties, with the transport, were held as a mobile force from 1645 to 1830 hrs. ready to search another area, about which the police had received some information they were investigating. It was at this time that we learned from a police wireless car that the wounded P.C. had died, and that the search had thus become one for a murderer. At 1830 hrs. Nos. 2 and 3 Parties were withdrawn to Upper Luton on police orders, where they joined up with No. 1 Party. The whole force was reformed and suitably refreshed.

As soon as this had been accomplished, the entire force was deployed in close order along the road between points (J) and (K). The R.N. detachment were on the right flank, then No. 1 Party, with No. 2 in the centre and No. 3 Party on the left flank. This line beat due east to the next road, where it reorganized to cover the frontage between points (L) and (M). It then beat due east to the road from Maunders House (N), to Lower Shawstead Farm (O).

Suspicious movements were reported at this time in the farm, and a detachment was sent to investigate. It was nothing.

On arrival on this line, a police conference was begun at the track junction (P), the rubbish tip where the murder was committed, with a view to surrounding the wood at (Q), which was known to contain a hide-out once used by the wanted man. On receipt of a police wireless message this idea was abandoned. The men were concentrated at Upper Luton and withdrawn to Barracks at about 2145 hrs., fed and retired to bed very weary. This wireless message was to say that the murderer had been located with some certainty in his own home at Symons Avenue, about 1,500 yds. W.N.W. of point (A), where it was known that there existed a concealed chamber below a ground floor room. A further hide-out was subsequently found beneath the back garden.

Meanwhile the squadron commander accompanied senior police officers to a conference at the police station, also attended by the C.O., the A.P.M. and two R.N. gas training officers. This conference discussed means of getting the wanted man out of the house where he was hiding without causing any loss of life to the attacking party or avoidable damage. After much deliberation, it was decided that tear-gas grenades would have to be lobbed into the house to force him out into the open.

The murderer having announced his intention of not being taken alive, and of killing as many of the beseigers as he could, it was evident that there must be some shooting. It was debated for a long time who should do the firing. On the R.E. side it was maintained that this operation was not "duty in aid of the civil power" as meant in the pamphlet, but that it was rather the lawful use of reasonable force in the apprehension of a felon. This view was upheld by the police, but opposed by the A.P.M., who held that a written order from a magistrate was necessary to authorize troops to fire. The D.P.M. at Command was telephoned, after District H.Q. had been unable to give any decision, and he authorized R.M.P. to use arms in the siege. Rifles, Stens and revolvers only were to be carried. The Chief Constable eventually decided that his police should be armed and do all the firing unless it became more than they could manage alone. The R.M.P. were to be an armed military reserve. All police and military were to be provided with respirators.

The plan was to fill the house with tear-gas by lobbing grenades through the windows. If this failed it was thought that it might be necessary for the attackers to work their way into the house, which was in the middle of a row, by starting at the two ends of the row and breaking through the partition walls. Accordingly, a small R.E. party was to be present to give technical advice and assistance

in getting the tear-gas, supplied by the R.N. party, into any part of the house, breaking down partition walls or any similar R.E. task as required. The R.E. party was to be unarmed, but provided with sledge-hammers, crowbars, axes, picks, etc.

The Squadron Commander took a party of one sergeant and four sappers with a 15-cwt. truck to the police station at 0800 hrs., 6th June, where he attended a briefing conference, presided over by the Chief Constable of Kent. A large number of armed police, the R.N. and R.M.P. parties and some of the Fire Brigade also assembled there at that time. After this conference, the whole force led by the Chief Constable moved to the locality of the house.

The R.E. sergeant then made a recce of similar houses to determine all features of their construction which it would be desirable to know in the event of a R.E. task occurring.

After a lively exchange of shots, tear-gas grenades were flung by the police into the ground floor windows. Later further grenades were flung through the upper ones.

When this had apparently had no effect, the Chief Constable asked the R.E. party to break through the air-bricks below floor level and push tear-gas generators through these holes to gas the man's hide-out beneath the floor. As the R.E. party was about to do this, the Chief Constable cancelled his request and ordered police to do the task. The tools prepared by the Sappers were handed over to policemen, who successfully did the job.

As soon as these tear-gas generators had burned out, armed police, protected by others from behind cover, made a frontal assault on the house, breaking down the door to effect an entry. They very soon found the murderer's body in an upstairs room. He was dead, and had apparently been shot through a window by a police officer during the earlier exchange of shots. It had been a remarkably fine shot, at what could only have been a fleeting target as the dead man passed a doorway where he would have been silhouetted in the light from the back of the house.

The R.E. party was then employed at police request on crowd-control until the public were again admitted to the road. The Sappers were finally withdrawn at about 1130 hrs.

The Chief Constable of Kent expressed his appreciation at the end of the operation of the hard work and enthusiasm displayed by all ranks. This was passed on to those concerned.

Conclusions

(*a*) One-inch maps are useless for such an operation. Six-inch maps were asked for, but were not available. It is virtually impossible to keep direction or to locate oneself exactly (two things which it is essential to be able to do) in woods as thick as Lords Wood, with only a 1-in. map.

(*b*) Os.C. parties should have had an opportunity to recce their ground before starting to beat. The police did not allow any time for this, due partly to too great a faith in their own local knowledge, and partly to their great urgency to start beating. As a result, officers had no conception of the problems of the ground to be tackled, particularly, and most importantly, the undergrowth and built-up areas. These proved almost insuperable for No. 2 Party. The police evidently did not know that " time spent in reconnaissance is seldom wasted! "

(*c*) When thickly wooded country of this kind has to be searched at all thoroughly, a large number of men is required. In order to be sure of finding a lone man, determined to evade capture, the area swept by No. 2 Party would have required several regiments, and the fugitive might well have avoided detection even then.

(*d*) No. 31 wireless sets are not powerful enough for such hilly and thickly-wooded country when no trained operators are available. Wireless communication between parties and the R.V. was bad. However, during the final beat to the east they worked perfectly in the more open country with fewer intervening hills, and were invaluable, especially during the redeployment of the force during this beat, and on the many occasions when some of the men had to traverse a difficult place whilst others at the same time had easier ground to cover. It must be borne in mind that a central control station is undesirable, as it will probably give warning to the fugitive of the area of search by its position. Control was at the R.V. in this operation.

(*e*) Since the wanted man was not found during the search of 5th June, it cannot be said if the proportion of armed men was correct. The scheme of having the few armed men under the immediate and sole control of the officer in the centre of the line of beaters is felt to be correct, even though the hunted man was known to be desperate and armed. In this country a greater proportion of armed men, automatically entailing some of them being out of their officer's immediate control, is too liable to lead to repercussions. Abroad this may well be different, and the consequent risk acceptable.

(*f*) The troops tackled their tasks with great gusto on a very hot day and eventually worked themselves to a virtual standstill, and enjoyed doing so. On the whole they managed to keep a remarkably straight and unbroken line through some very difficult country. It is felt that it would be a good thing if more attention were paid during elementary training to that part of fieldcraft which covers advancing in a regular line through close and broken country. This is a requirement for war and does not apply solely for searches such as this one. Nos. 1 and 3 Parties particularly found that the line tended to sway dangerously at times in these conditions.

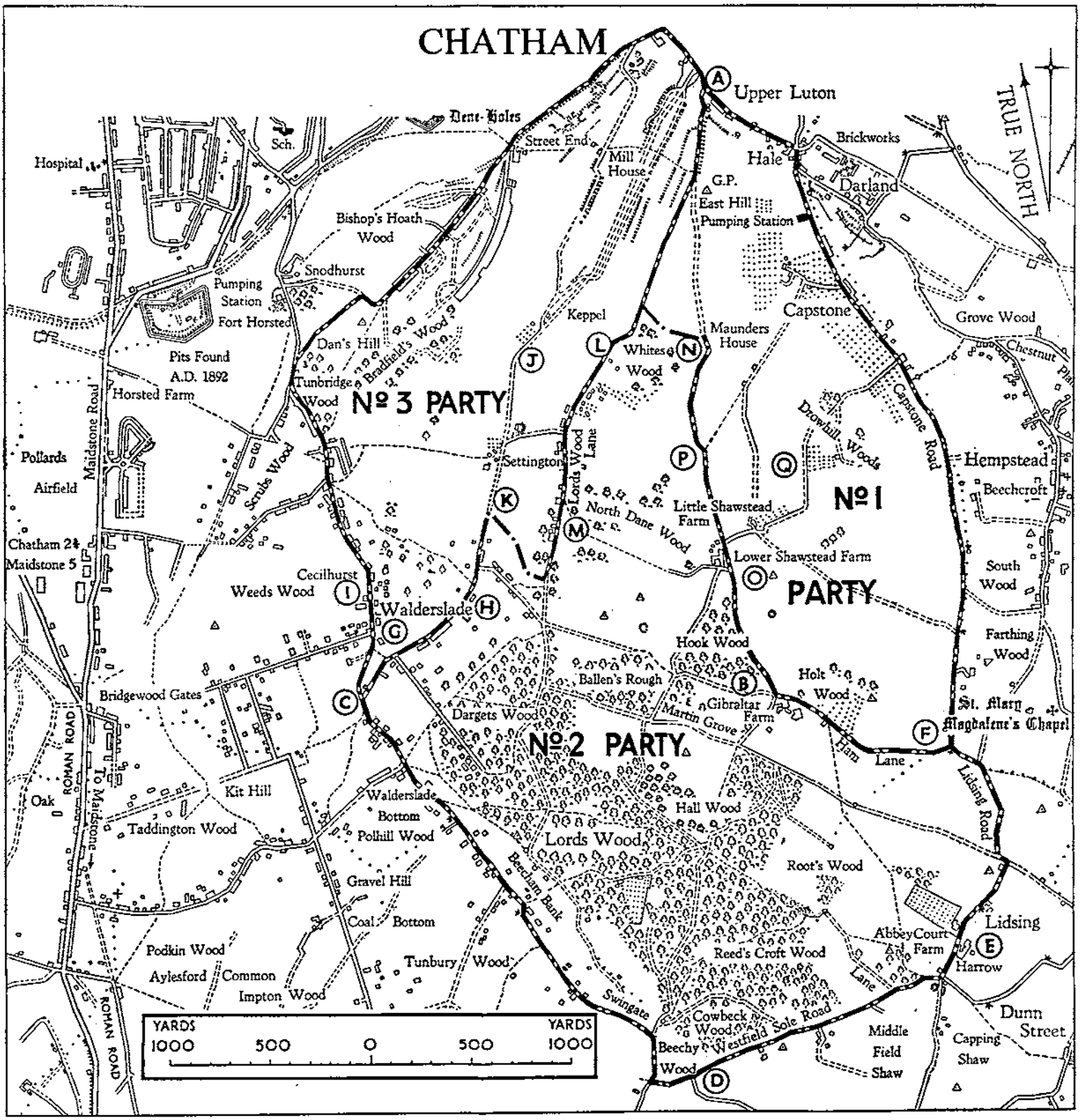
(*g*) A higher proportion of N.C.Os. would have been advisable. Owing to the urgent assembly of the force it was not possible to ensure the desirable proportion of N.C.Os. Experience has shown that it would have been advisable to spend more time over the detailed composition of the force, but the police were very pressing in their demands for us to begin. The N.C.O. shortage was particularly felt by Nos. 1 and 3 Parties, who often wanted to send a small group under a N.C.O. to search a small feature. No. 2 Party in the thick woods did not feel this shortage. For the more open country a proportion of one N.C.O. per five men is recommended. In thick woods more N.C.Os. would serve no useful purpose.

(*h*) The system of police in control of each party, giving their outline instructions to the officer for him to issue his detailed orders, is a good one and worked well. This was essentially a police and not a military operation.

(*i*) The 100 per cent employment of police for all the active jobs during the "siege" seems to have been a wise decision. The police, many of whom were former soldiers, did a very fine job, particularly one sergeant who did the lobbing of the tear-gas grenades from a position of considerable danger, where, fortunately, the murderer made no attempt to shoot him. The R.M.P. were not employed at all, but stayed in reserve. The R.E. party was unarmed during the actual assault. The apprehension of the man in the house was essentially a police job, and in the event they needed no military help.

The employment of troops instead of police in these circumstances might well have caused undeserved sympathy for the murderer. Had there been a more stubborn fight, it might have become unavoidable to call in the military reserve. The operation would, in that case, have become more of a battle, and thus have lost the purely police nature which in fact it had.

(*j*) One vehicle for each searching party is highly desirable. The problem of feeding the three parties during the day, with the wireless sets not working consistently and only two vehicles available, was a big one, and took a lot of solving by the W.O. II at H.Q. However, all ranks were in fact fed adequately.


CHATHAM
TRUE NORTH
A Upper Luton
Dene Holes
Street End
Mill House
Hale
Brickworks
Darland
G.P.
East Hill Pumping Station
Hospital
Sch.
Bishop's Hoath Wood
Snodhurst
Pumping Station
Fort Horsted
Keppel
Capstone
Grove Wood
Maunders House
Whites Wood
Dan's Hill
Bradfield's Wood
Tunbridge Wood
Pits Found A.D. 1892
Horsted Farm
Nº 3 PARTY
Maidstone Road
Pollards Airfield
Scrubs Wood
Settington
Lords Wood Lane
Drowhill Woods
Capstone Road
Hempstead
Beechcroft
Nº 1
Little Shawstead Farm
North Dane Wood
Lower Shawstead Farm
Chatham 2½
Maidstone 5
Cecilhurst
Weeds Wood
Walderslade
South Wood
PARTY
Farthing Wood
Hook Wood
Holt Wood
Ballen's Rough
Bridgewood Gates
Dargets Wood
Gibraltar Farm
Martin Grove
St. Mary Magdalene's Chapel
Nº 2 PARTY
Dam Lane
Lidsing Road
Oak
ROMAN ROAD
To Maidstone
Kit Hill
Walderslade Bottom
Hall Wood
Taddington Wood
Polhill Wood
Lords Wood
Root's Wood
Gravel Hill
Beechan Bank
Coal Bottom
Lidsing
Abbey Court Farm
Podkin Wood
Tunbury Wood
Reed's Croft Wood
Aylesford Common
Impton Wood
Swingate
Cowbeck Wood
Westfield Sole Road
Middle Field Shaw
Capping Shaw
Dunn Street
Beechy Wood
YARDS 1000 500 0 500 1000 YARDS

ON THE APPROACH OF A HURRICANE

By BRIGADIER-GENERAL SIR JAMES E. EDMONDS, C.B., C.M.G.

AT the end of January, 1898, in punishment for having taken "a two-years holiday" at the Staff College, Camberley, thus "evading the duties of the Corps" for which he had not sufficient officers, as he said, the D.A.G., R.E. who, under the Inspector-General of Fortifications in those days before the advent of the Army Council, ruled over the destinies of the personnel of the Corps, ordered me to Jamaica, where an epidemic of yellow fever was raging, to command the local Jamaica Submarine Mining Company (black and white) stationed at Port Royal. I received a kindly telegram from the C.R.E. Jamaica (a bachelor): "Port Royal evacuated. Don't bring your wife."

On arrival I was at once sent to Port Royal, three miles from Kingston by boat across the harbour, and for the next few weeks lived on the hospitality of the Naval Inspector of Hospitals, Dr. W. Coppinger, who was in charge of the large Naval hospital in the small Naval dockyard and had been a fellow-passenger on the mail-boat. I was formally appointed O.C. Troops, Port Royal. The troops, who now returned from their exile, consisted of a local battery R.G.A., the Submarine Mining Company, R.E., some A.S.C. and R.A.M.C., and a varying number of companies of the West India Regiment.

The first matter I had to deal with was a case of suicide of a Sapper who preferred self-inflicted death to living again at Port Royal (I later had a similar case on my hands, and another of an Artillery sergeant). Here Dr. Coppinger came to my aid, instructed me what to do, and lent me a coffin and the Naval corpse-boat to convey the body to the cemetery on the Palissadoes, as the narrow spit of pebbles, a natural breakwater, which connects Port Royal with the mainland, was called.

The garrison possessed no band to play cheerful tunes on leaving the cemetery, as laid down in Queen's Regulations, so on return to Port Royal, in order to divert the thoughts of the men from the dismal ceremony of interring a comrade in a grave with a couple of feet of water in it—the coffin being kept from floating by a few large stones placed upon it—I ordered a fire alarm. It brought the desired hilarity: it was only after a long search that the manual engine and the hose were found, and then the engine would not pump and much of the hose had served as meals for white ants; more than twenty-four hours elapsed before water reached the red flag which marked the site of the fire.

The rest of Port Royal was in the same state of decay as the fire-fighting apparatus. The machinery of the coast defence guns on hydro-pneumatic carriages was rusted up so that the guns could not be hauled down ; the cranes on the submarine mining pier and in the loaded mine store were similarly seized. When I investigated the accounts of the combined officers' mess, the mess secretary, £250 out, bolted and has never been heard of since—he was probably killed in Cuba. Hearing of my activities the native canteen sergeant took to the hills. I discovered other iniquities and was much tempted to write a novel about the garrison, as a German friend of mine had gained an immense success with one called *Aus einer kleinen Garnison*, in which he had described life in a small frontier garrison town—Forbach, he told me. But I refrained and set about putting the place in order.

No senior officer ever visited Port Royal if he could help it ; the place was regarded as a sort of lethal chamber, and the G.O.C. and the C.R.E. made only one short appearance, together, in the fifteen months that I was there. Trouble was brewing between the U.S.A. and Spain over Cuba—on 15th February, U.S.S. *Maine* was blown up by a mine in Havana harbour and on 25th April, Congress adopted a formal declaration that war had existed since the 21st. I therefore thought it advisable to be ready for any emergency. Full of zeal as a few-weeks-fledged *p.s.c.* I prepared standing orders for war, and for neutrality, and then went on to native troubles, evacuation on account of yellow fever or other epidemic, earthquakes, hurricanes, tidal waves, fires and funerals. Of these in view of the recent catastrophe in Jamaica the hurricane orders may be of interest. I had had some experience of typhoons in Hong Kong, and knew that it was of the first importance to get humans below ground and material well secured. As a preliminary I had chains and wire ropes prepared to throw over light buildings whose roofs might be blown off, fastened by shackles to holdfasts set in concrete. Here are :—

STANDING ORDERS

HURRICANE

In the event of the approach of a hurricane being notified the following programme will be carried out :—

(*a*) The married quarters on the beach will be evacuated, the R.E. families proceeding to the electric light oil-engine room, the other families to the basements of other brick buildings in Fort Charles [which built 250 years earlier had thick earthen parapets]. The units to which they belong will provide a few fatigue men to assist the move.

The Garrison Quartermaster will see that the evacuated quarters are secured as far as possible.

(*b*) The upper storeys of all buildings, and all verandahs, will be evacuated and the articles in or on them placed for safety in the basements. Fatigue parties, as per Appendix, will be provided to deal with Garrison buildings.

(*c*) All windows and doors will be secured by placing articles of furniture against them when possible, and the roofs secured by chains where these have been provided.

(*d*) All public money will be deposited in the Guard Room safe, and ledgers and account books carried off.

(*e*) Special orders for the R.E. and A.S.C. boats will be drawn up by the O.C., R.E., and O.C., A.S.C.

(*f*) The various units will be accommodated as follows :—

European R.A. in Victoria Battery and company office ;

Jamaica Coy., R.A. in company office and two eastern officers' servants quarters ;

European R.E. in test room and loaded mine store ;

Native R.E. in basement of native barrack rooms and submarine mining buildings.

(*g*) Each unit will send a party to the canteen, and the canteen steward will divide any comestible stores between them, taking a receipt for the quantity.

(*h*) The O.C., A.S.C. will arrange for a water-cart being supplied to each unit ; he will procure, if there is time, an extra ration of bread, and issue preserved provisions, each unit sending a fatigue party to the A.S.C. office to draw them.

(*i*) A first-aid post will be established by the Medical Officer in the basement of the O.C's. quarters in Fort Charles.

(*j*) The guards at Apostles Battery and Fort Augusta [outlying works] will be warned by telephone and left on duty without relief until the hurricane is over.

(*k*) The Officer Commanding and the Garrison Adjutant will be in Fort Charles.

During the hurricane season, July to October—the *aide-memoire* ran : "June too soon ; July stand-by ; August you must ; September remember ; October all over"—all vessels and boats were double moored. Standing orders were drawn up for the submarine mining flotilla, and for the A.S.C. transport vessels.

No occasion to act on any of these standing orders occurred whilst I was at Port Royal, except those concerned with neutrality—during the American-Spanish War ; but the various programmes were rehearsed from time to time.

SOIL STABILIZATION IN BRICK PRODUCTION

By CAPTAIN J. H. FOSTER, R.E.

WHERE earth is the only building material available, and fuel for burning bricks is scarce, *pisé de terre* and *adobe* construction is usually adopted. Neither of these methods is considered suitable for large-scale building projects.

The object of the W.D. trials, was to establish that soil/cement brick production with standard brick-making plant is technically sound and economic, and capable of producing bricks at normal production speeds.

Other developments in this field are summarized in *U.N. Bulletin No. 4*, October, 1950, entitled "Housing and Town and Country Planning." None of these developments are comparable with our trials, and do not provide a means for large-scale normal construction. The standard of stabilization obtained expressed in terms of crushing strengths is inferior in all cases to the results obtained in our trials.

Summarized, our results show that with a clay content up to 30 per cent, and cement content 5 per cent, crushing strengths up to 2,600 lb. per sq. in. are obtainable with normal sized bricks crushed on the flat. In determining the highest practicable clay content, material containing 60 per cent clay was "stabilized," with crushing strength of 1,800 lb. sq. in. after curing. With this high clay content the bricks are, however, unstable in moist conditions and 30 per cent clay content is considered to be the maximum for economic stabilization. These crushing strengths should be compared with those shown in the *Bulletin*, page 16, 11 per cent cement with 1,000 lb. sq. in. crushing strength ; and 8 per cent cement 525 lb. sq. in. crushing strength (76 kg. per sq. cm., 180 kg. cement per cubic metre earth, and 40 kg. per cm., 125 kg. cement per cubic metre earth, respectively).

LESSONS LEARNT IN TRIALS

The main lesson learned in the trials is the effect of lowering the air content of the material prior to final compaction. With moisture content under 10 per cent and cement content 5 per cent, prepressing well below the optimum compaction pressure removes most of the air content. At this stage the optimum compaction pressure is greater than that for the material in its first state. After applying final compaction pressure, the brick is ejected automatically from the mould and then stacked for natural curing.

In the rotary press used for the trials, prepressing and final compaction proceed continuously, prepressing being immediately followed by final compaction at a speed of 1,100 bricks per hour.

Crushing Strengths after Saturation

Bricks produced with these higher crushing strengths were after natural curing of three weeks immersed in water for twenty-four hours, and in all cases crushing strengths of over 1,000 lb. per sq. in. were obtained in this wet condition. (The moisture absorption averaged 12 per cent.)

Cement Economy

It is apparent that there is considerable scope for reduction in cement contents with adequate performance and reduced cost.

Costs

Soil/cement brick production has some similarity to sand/lime brick production, except for the material and natural curing instead of autoclaving.

Taking sand/lime brick production as directly comparable up to the completion of pressing, it is estimated that soil/cement bricks should be produced at a cost of £2 10s. per 1,000 providing that the plant used was operated to capacity as occurs in a normal sand/lime brick works. The cost includes depreciation over ten years.

Pilot Scheme

In considering the hazards involved in any pilot scheme, note should be taken that the plant used for making soil/cement bricks is capable of pressing sand/cement bricks, sand/lime bricks and if necessary clay bricks.

Dismantling and re-erection of the plant at another site after producing about 4–5 million bricks would seem to be practicable and economic.

Specifications of Suitable Soils

Material suitable for *pisé* and *adobe* is suitable for soil/cement brick production. It is further emphasized that providing the upper limit of 30 per cent fine clay is not exceeded, and organic matter is not present in the material, there is a considerable degree of tolerance in the process.

As a general guide a digest on the definition of suitable soils for stabilization in construction is likely to be available soon.

Performance

A question usually posed is " how do these bricks weather? "

The trial structure at Garston has been exposed to about ninety air frosts since early 1950. The exposed portions of the external walls show no sign of deterioration. The proposal is to wait until deterioration is apparent when economic protection in the form of cement paint or lime wash will be applied.

With this higher degree of stabilization it follows that resistance to failure by weathering is greater than with the degree of stabilization obtaining in *pisé de terre* and *adobe*.

Walls of normal thickness, up to two stories are practicable, with economic surface treatments such as lime wash, cement paint, and if desired rendering with the softer varieties of plaster.

Conclusion

With soils suitable for *pisé* and *adobe*, soil/cement brick production, can provide a practicable and economic alternative to normal brick production.

BATU ARANG COAL MINE

By Lieutenant-Colonel J. J. D. Groves, M.C., R.E.

Apologia

THIS is a thoroughly untechnical article. First it describes the early development of the Batu Arang coalfield of Malaya prior to 1942. It then gives a general picture of the unorthodox methods of the Japanese. Finally it recounts some of the many problems which beset the British whose task it was to restore the mine to normal.

It may also serve to show that, although coal-mining is not included in the regular syllabus of the School of Military Engineering, there is no limit to the demands with which the Sapper may be faced during the aftermath of war.

Pre-War Development

The great resources of Malaya in tin and rubber are common knowledge to every schoolboy. But the fact that this tropical country normally produces most of the coal required for its own internal needs is not known by many Britons who have served there. Indeed, the discovery in 1913 of valuable coal deposits at Batu Arang, in the thick jungle country 30 miles north-west of Kuala Lumpur, has since become a major factor of the industrial structure of Malaya.

The coalfield consists of two seams separated by nearly 200 ft. of shale, one of about 20 ft. thickness at the surface outcrop and the other of about 40 ft. The seams are inclined at a dip of 1 in 4 to the horizontal. In the early days only surface mining was carried on, and this was all done by the sweat of manual labour. First the

primeval jungle was cleared, then vegetation, subsoil and shale was stripped off to reveal the extent of the outcrop. Surface quarrying of the coal continued deeper and deeper, until in 1935 great mechanical excavators and face shovels were introduced, so that more overburden could be removed economically—still following the 1 in 4 dip. In some places these open-cast workings reached a depth of 120 ft. and, as may be imagined in a country whose rainfall may exceed 6 in. in a day, one extremely important factor was the maintenance of an adequate pumping system.

Meanwhile it had also been decided to develop underground workings. Inclined shafts following each seam at the 1 in 4 gradient, were driven into the mine, and lateral galleries ate into the working coal-face. Coal won at the face was loaded into tubs which were hauled up the tramways laid in the inclined shafts—and so to the surface. (See diagrammatic sketch and Photo 1.)

The company which was formed to develop Malaya's only coal-field realized early the necessity of assuring a settled and contented labour force. Coolie lines and bungalows of modern brick construction were progressively erected together with shops, clubs, schools, a hospital and playing fields. Water borne sewage and a supply of piped drinking water was provided for the township.

By 1940 coal production had risen to 780,000 tons per year. This was enough to meet the demands of power stations, Malayan Railways, and the many steam-operated tin mines and dredges. The colliery was well quipped ; the underground workings had been expanded ; and large reserves of stripped coal were ready for open. cast working. The concession area of 9,000 acres was served by 21 miles of metre gauge track linked with Malayan Railways. Subsidiary enterprises included a plywood factory for the production of packing cases, for rubber and tea ; a large brick and tile works ; a wood distillation plant, and a big saw mill.

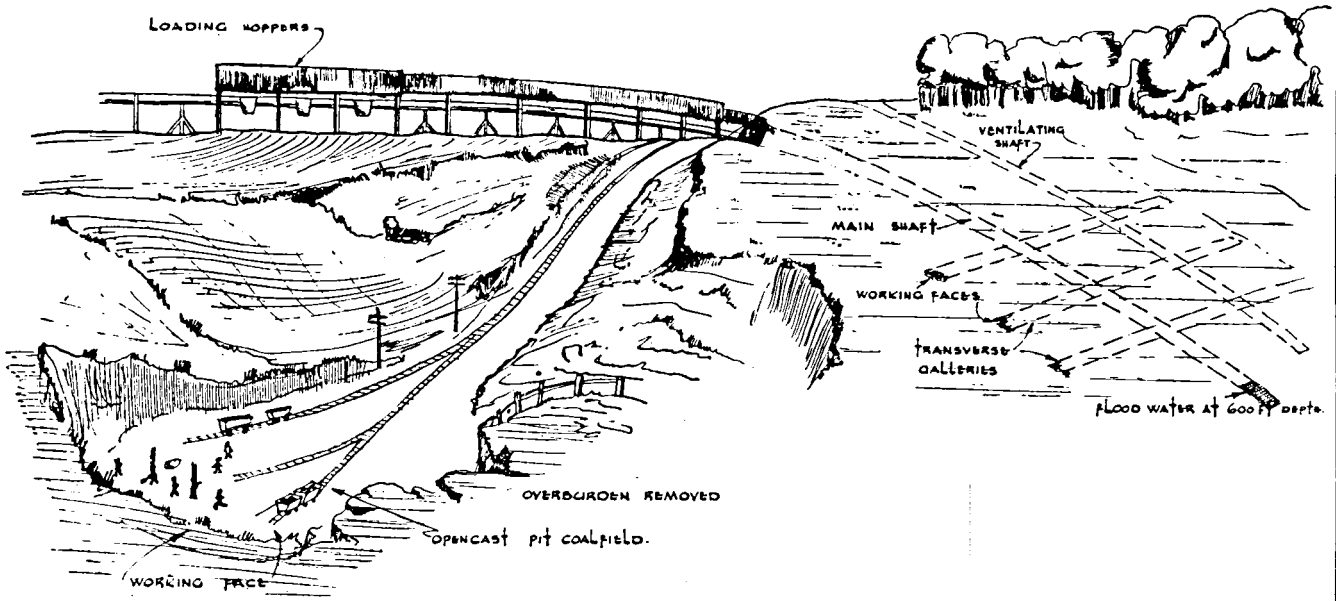
Such then was the situation at Batu Arang before the Japanese invasion.

Japanese Methods

In accordance with the defence policy of Malaya much of the colliery plant, including its power station, was destroyed by the army before the Japanese arrived. In consequence they found the pumps out of action and most of the mine workings under water.

But the Japs wasted no time and it is a testimony to their ingenuity that they produced 467 tons of coal in February, 1942. An overhead power transmission line from the Rawang power station, which the company had started to construct before the invasion, was completed with all speed. Mining engineers were brought from Japan and by the end of 1942 some 250,000 tons of coal were mined—that is, about one-third of the normal output.

DIAGRAMMATIC SKETCH OF A PORTION OF BATU ARANG COAL MINE.



From the outset it was clear that so far as Malaya was concerned Batu Arang was now to become a considerable factor in the Greater East Asia Prosperity League, that is to say, its full resources were to be rapidly harnessed to the Japanese war machine. Prodigious efforts were made to squeeze synthetic petrol out of the distillation plant ; the plywood factory churned out jetison petrol tanks ; a new factory emitted carbide for use by the Japanese Navy, and a host of similar activities were projected.

To accomplish this the Japs had to solve a difficult man-power problem. This they did by recruiting labour from rubber estates and tin mines throughout the peninsula, and initiating a drastic resettlement scheme. A large area of jungle around the mine was cleared for food cultivation and a certain amount of rickety accommodation was rushed up. The result was, however, that the population of Batu Arang jumped from 12,000 to about 18,000 in a surprisingly short space of time.

Although the grand conception for the development of the area revealed a breadth of vision and vigour which was admirable, the execution of the scheme was typical of the slipshod methods and utter lack of foresight in Japanese authorities at a lower level.

It seems that in their obsession to obtain coal as quickly as possible the local authorities would stop at nothing. When they found that the coal seam ran beneath a permanent workshop or block of offices, there were no two ways about it—the buildings were demolished, and not replaced. Mechanical equipment and engines were operated mercilessly with no proper maintenance, and the underground workings produced less and less coal due to continual failures of pumps and ventilating plant. Lack of spare parts and of adequate lubricating oils accentuated their troubles. But in their frantic zeal for removing overburden they excelled themselves by cutting through sewers and roads, and dumping spoil within the confines of the township or even on top of the coal seam which would later have to be worked.

The result was, that in spite of their tremendous activity, coal production diminished steadily until by 1945 it was not more than about 500 tons per day instead of 2,000.

Liberation

When planning the liberation of Malaya was first begun it was appreciated that a ready supply of coal would be a very important factor in the support of our field forces and the speedy rehabilitation of the country ; but the basic assumption was that the mine and its machinery would be largely destroyed by the retreating Japs. So it was that several people associated with the colliery staff (then in Britain) were asked by the War Office to prepare a scheme to ensure

that coal would be available as early as possible. The result was that certain essential equipment was ordered, and was to be of a design that could be handled and operated early in the anticipated campaign. A small team of technicians was also to be included in the liberating forces.

As it was, the unconditional surrender of the Japanese in August, 1945, occurred before much of this machinery was ready for dispatch. But, since our intelligence reports indicated that the mine was still in a state of partial productivity, it was to be hoped that extensive re-equipment might now prove unnecessary.

Although operation " Zipper " had been planned to wrest Malaya from the Japs in face of their normal do-or-die defence methods, the outline plan for the reoccupation of the country was not altered now that they had surrendered. So, as soon as the landings had been effected on the Morib beaches below Port Swettenham, representatives of the British Military Administration were dispatched to Batu Arang to take over control.

The chaotic conditions there have already been described, but by retaining the Japanese technicians a continued output of about 500 tons of coal per day was maintained. Even during the period of transition essential rail and power requirements could therefore still be met.

Post-War Problems

One might reasonably have supposed that, with the liberation of Malaya, a steady improvement of conditions throughout all industries should have been the case. In fact this is exactly what was expected by everyone in the country, including the British ' Tuan Besars.' The reasons which led to a continued deterioration were :—

(i) That the decay already caused by Japanese maladministration was bound to continue for some time anyway.

(ii) The scarcity of staple food, rice, throughout the peninsula—and consequent rise in all prices.

(iii) That the good intentions of our own B.M.A. officials were hamstrung by restrictions imposed by people in Westminster who had not the vaguest idea of conditions in Malaya.

(iv) That the liberating forces were themselves guilty in the first two months of more folly and tactlessness than was excusable.

Thus, when the British returned in 1945 the Batu Arang interpretation of liberation was more food, more pay and a general relaxation of regulations. There was a lot of disillusionment to say the least, and many of the squatters around the colliery who had found a living supporting Japanese war production were now without a job.

Photo. 1.—One of the main shafts inclined at a dip of 1 in 4. On the left are the delivery pipes of the pumping sets. On the right is the trolley line up which are hauled the tubs of coal

Batu Arang Coal Mine 1

Photo 2.—The bared coal seam. Here J.S.Ps. are loading "skips" by hand. In the right background a dozer is removing overburden. At the left is a giant derelict excavator ruined by the Japs.

Photo 3.—J.S.Ps. quarrying coal at an open-cast seam. The improvised lighting system made night work possible.

Batu Arang Coal Mine 2,3

Discontent spread quickly, and within two months all labour went out on strike.

Now, therefore, it became the direct responsibility of the Royal Engineers, first to save the machinery, which would soon be immersed by flood water, and second to maintain an output of coal for essential services. The Indian E. & M. Platoon which was immediately rushed to the site made prodigious efforts to keep the pumping operations ahead of the flooding. They were faced with constant failures in electrical supply, and it soon became evident that their exertions were best directed to the recovery of pumping machinery before it was lost in the rapidly rising water. The Mechanical Equipment Company, R.E. which undertook coal production from the open cast pits had a more practicable task.

The coal was quarried from the face of the exposed seam by Japanese Surrendered Personnel (J.S.Ps.) and loaded by diesel-driven excavators into "skips." The loaded skips were then hauled up the light trolley line to the "hoppers" into which they decanted their contents. From the hoppers the coal was run straight into the waiting trucks on the metre gauge railway line below. (See photographs 2 to 5.)

Indeed it sounds a simple enough operation; and really there was nothing very technical about it, but it was a novel enterprise for military engineers, both British and Indian, and it required quite a bit of interesting planning and administration.

Apart from the mechanical process of removing overburden and winning coal—the man-power problem was intricate to say the least. C.R.E. Works, Central Malaya, was the responsible authority. Four members of the colliery staff, who had been flown from England, were the technical advisers. The technicians provided by the E. & M. Platoon were Indians of the Bengal Sapper & Miner Group. The Mechanical Equipment Company was British. The J.S.Ps. had to be controlled through indifferent interpreters. This combine was also flavoured by a few Eurasian, Indian, and Chinese foremen who had not joined the strike. Such was the curious inter-racial set-up which, however, managed to produce about 400 tons of coal per day.

The strike was broken in its fifth week—on 20th November, 1945. Labour was re-engaged as soon as useful work could be found, and only the mechanical equipment, and operators of the Army, were retained on hire to the colliery. It may be interesting to note that the strike grew directly from the unsettled conditions caused by the war. It was not the result of Communist planning. But here were the ideal conditions in which the Communist seed could take root—and it certainly lost no time in doing so.

For more than a year Malayan Collieries & Co. Ltd., continued

slowly to re-open Batu Arang and repair its damaged machinery and workshops. But still they retained the army dozers, scrapers and excavators for the removal of overburden. By January, 1947, the output was up to 800 tons a day—but by now the Communist agitators were at work in earnest, and the army's strike precautions again required careful review.

On the 4th February, Batu Arang was paralysed when the employees walked out *en masse*, and once more did coal mining become the responsibility of the C.R.E. Works. This time we were fully prepared. Detachments of our Indian Workshop and Park Company were already rehearsed in the operation of key technical duties, so it was merely a matter of keeping the water level down, while J.S.Ps. were drafted into the open-cast pits.

Coal production continued fairly smoothly during the two months that the strike lasted, but not without its excitements. On one occasion 4 in. of rain fell in 1½ hours, with the result that the lowest stage pumping set in the west mine shaft was immersed in 10 ft. of water before it could be recovered.

In another instance the pump attendants were lucky to escape without serious injury, as 30 ft. of the main incline shaft collapsed, when the timber supports of the roof gave way.

On this occasion the strike was recognized as being the result of a carefully fomented scheme with a strong Communist flavour. The situation was critical and the manner in which relief was provided by the Sappers did not escape the appreciation of the Federal Government.

In conclusion, it can be affirmed that anyone wishing to obtain a first-rate sensation of Hades, should find a coal-mine within 3 deg. of the Equator, and in it spend a couple of hours, 600 ft. below ground, when the ventilation system is not working.

Bandit Warfare Postscript

Batu Arang was the first big target of the Bandit War. On 12th July, 1948, a large Communist force invaded the property, murdered five people and committed extensive sabotage to machinery. Many of the Chinese employees collaborated in this operation and have since disappeared.

In face of these setbacks it is quite astonishing what progress Malayan Collieries continue to make in the development of this vital equatorial coal-mine.

Since rooting out the Communist dissidents there have been no strikes or serious labour troubles of any kind. Further mechanization of mining methods continues, both in open-cast and underground workings, and a third shaft is now being developed.

So much, then, for British industrial enterprise and tenacity in our greatest dollar-earning overseas possession.

Photo 4.—A general view of an open-cast pit, showing "skips" being hauled up towards the "hoppers" at left background.

Photo 5.—The loading "hoppers"—with coal trucks of Malayan Railways standing below.

Batu Arang Coal Mine 4,5

Brigadier E M Jack CB CMG DSO DL

MEMOIR

BRIGADIER E. M. JACK, C.B., C.M.G., D.S.O., D.L.

EVAN MACLEAN JACK, who died on 10th August, 1951, was born in Edinburgh on the 31st July, 1873. Educated at Hastings Grammar School and the R.M.A., he was commissioned in the Royal Engineers on 25th July, 1893. After passing through the S.M.E., he was posted to Gibraltar, and transferred three years later to St. Helena, where he remained during the South African war. On his return to Great Britain in 1903 he was selected, greatly to his satisfaction, for duty with the Ordnance Survey, and served for two years in charge of the York office. After another two years at the H.Q. offices in Southampton he was appointed, in 1907, Assistant Commissioner, under Major Bright, of the Uganda-Congo Boundary Commission. He returned to the O.S. in 1909, but in 1911 was appointed Chief Commissioner to another Boundary Commission in Central Africa (Anglo-German-Belgian) which, in the course of its surveys, measured a section of the arc of the thirtieth meridian, the great work initiated by Sir David Gill in South Africa and carried by him, with the help of Cecil Rhodes, as far north as Rhodesia. For this work the Royal Geographical Society awarded him its Gill Memorial in 1916.

In 1913 Jack returned to England and was appointed G.S.O. in the Geographical Section of the War Office ; and in 1914 went to France with the B.E.F. as officer in charge of maps at G.H.Q. At that time it was universally expected that the war, the first to be fought between nations in arms, would be short and sharp. No one imagined that it could last for more than six months at most, and in this belief, all the maps thought to be needed for the campaign had been printed off beforehand and issued to the troops on embarkation. It was not expected that Major Jack (as he had now become) would have very much to do. His staff at G.H.Q. consisted of but a single clerk, with a small map section—really a map depot—of an officer and a clerk on the L. of C. The original plans for the B.E.F. had provided for three small survey sections being held in reserve by the Ordnance Survey, but when war broke out the War Office decided that these sections would not be required and they were, therefore, never formed. The personnel, which like all the R.E. personnel employed on the Ordnance Survey in those days, had been given annual courses in Fieldworks, were posted to other R.E.

units. When, later on, the need for trained surveyors arose, most of these men had become key men in their new units, and only a few of them could be recovered for employment in the new Field Survey units when these were eventually formed. It was with this tiny staff, and under these handicaps, that Jack had to cope with any eventualities that might arise. The eventualities were not long in arriving, and very pressing and perplexing eventualities they were. The retreat from Mons took the B.E.F. right out of the previously mapped area, and Jack had to arrange for, and distribute to the army, a completely fresh supply of maps. No sooner had this considerable hurdle been cleared (with the help of the Sérvice Géographique de l'Armée) than another even stiffer one appeared. As soon as the trench warfare began there was an urgent demand for maps on which the German trenches were shown. This was a problem indeed, to map a trench system in which the enemy was firmly established. How it was solved, for solved it was, is too long and too technical a story to be related here, but long before it had been disposed off, other problems almost as baffling had presented themselves.

Among the first of these was the problem of locating the enemy's artillery. Airmen flying over the German positions could see their batteries firing, but this was no help to our gunners until some means had been devised of fixing and defining the positions of any batteries seen. A detachment of R.E. surveyors, under Captain Winterbotham, was sent out to Jack from the Ordnance Survey to tackle this problem, which was ultimately solved by the invention of the map grid.

At this stage of the war airmen were not so numerous as they are to-day, and other means of locating enemy batteries had to be sought. Ere long Jack (promoted Bt. Lieut.-Colonel in 1915) was called upon to decide whether anything could be made of a French idea for locating the sound of a gun's discharge. After due investigation Jack recommended that the attempt should be made, and was authorized to go ahead with the formation of the "Sound-Ranging" organization which later made no small contribution to the British victory. This led on to the consideration of another scheme, now called Flash-Spotting, for locating enemy gun flashes which could be seen at night, by cross-observation. This plan had already received extensive trials by our own Gunners, only to be dropped as impracticable owing to the impossibility of distinguishing between one flash and another, and of getting two observers at widely separated points to look at the same flash. Jack and his surveyors, for by now he had collected a small staff, believed that this problem could be solved, and solved it also was. Last, but far from least, came the problem of aiming our own guns at the targets thus

located, without the necessity of ranging separately on each one. The solution of this problem, which made possible the accurate surprise bombardments by massed artillery, tried for the first time at Cambrai on 20th November, 1917, and used for all the great attacks made the following year, was perhaps the greatest single contribution made by Jack's surveyors to the winning of the first World War. By the end of the war Jack's survey organization had grown from its very modest beginning into a force of some 300 officers and 4,000 other ranks, organized in six battalions, with some independent units, like the " Overseas Branch of the Ordnance Survey " (" O.B.O.S.").

For his services in the war Jack received the C.M.G. and the D.S.O., as well as a number of foreign orders and decorations. He was also mentioned several times in Despatches and awarded the Founder's Medal by the Royal Geographical Society. When the war was over he returned for a short time to his old post in the Geographical Section, but was soon appointed head of it, with the rank of Colonel. He held this post for two years only (during which he secured authority for the establishment of an inter-service Committee, known as the " Air Survey Committee," to control the development of air survey) and in 1922 succeeded Sir Charles Close as Director-General of the Ordnance Survey.

When Jack became D.G., the notorious " Geddes Axe " had just descended upon the Ordnance Survey with crushing effect, and at a singularly inopportune moment, for not only had the revision of O.S. maps been suspended during the war, but the development of motor transport had been, and was still, bringing about changes in the countryside at a rate far exceeding anything experienced in the past. It is believed that the Geddes Committee made their recommendations without consulting the Director-General, but Jack, with characteristic loyalty, did his utmost to carry out his instructions and to maintain the work of the Department with a staff reduced to two-thirds of its pre-war size. This made it impossible for him to initiate any major changes, but he undertook the redesign of the 1-in. map of Great Britain, and substituted a grid for the 2-in. squares which had been the only reference system on the old map. He also authorized some experimental air surveys to find out whether this new technique could be used for O.S. revision. In 1924 Jack was promoted Brigadier* and in 1928 made a C.B. ; two years later, having reached the age limit for army service, he was placed on the retired list. He had then been head of the Department for eight and a half strenuous years, during which he had earned to an unusual degree the respect and confidence of the Ministry under which the Department worked, and the admiration, trust,

* At that time the rank was known as " Colonel Commandant."

and affection of the Department's own staff. Few officers could have looked back on a more varied, useful, or successful career than Brigadier Jack when he retired from the Service ; but his official retirement was only the beginning of another unofficial career, lasting for twenty years more, which was hardly less distinguished than the official one he had just completed. Jack's reputation in Southampton, when he retired, as a man of selfless disposition, high patriotism, and complete integrity stood so high that his help was eagerly sought for many charitable and other voluntary public services. Very willingly he gave himself to such work, and to every cause he took up gave unstinted care and attention. The only salaried post he accepted was one on the Board of the Southampton Gas Company, of which he eventually became Chairman. For many years he was Chairman of the Managing Committee of the Southampton Free Eye Hospital, and for some years Vice-Chairman of the Southampton and Isle of Wight Territorial Association. For several years also he ran the annual Poppy Day Collection for the British Legion. The Home Guard, The Army Cadet Force, The Southampton Scottish Association, and the Gordon Boys Trust were other causes which he served. Jack, who was unmarried, was made a Deputy Lieutenant in 1939 ; and, though he was a man with many commitments, yet managed to find time for several hobbies. He was a water-colour painter of great industry and considerable ability, a skilled carpenter, and a competent mechanic. Latterly he took up wood engraving with much success. One of the secrets of Jack's success was his unfailing kindliness and gaiety. He was a first class "mixer," who enjoyed meeting people, and who had many friends. Always tolerant and sympathetic, he had a notable flair for handling personal matters, and exceptional skill in pouring oil upon troubled waters. He leaves behind him a record which any man might envy, and a memory which all who knew him will long cherish.

M.N.M.

BOOK REVIEWS

OVER MY SHOULDER

The Autobiography of MAJOR-GENERAL SIR ERNEST SWINTON, K.B.E., C.B., D.S.O. (*Ole Luk-Oie*)

(Published by George Ronald, Oxford. Price 18s.)

When Mr. Churchill was presented in 1950 with the Chesney Gold Medal of the Royal United Services Institution, he acknowledged the honour in some memorable remarks about certain of the more distinguished earlier recipients of the award. Amongst those who received particular mention was Major-General Sir Ernest Swinton, the writer of this autobiography. Mr. Churchill described how in World War I the British public was clamouring for news from France and how he persuaded Lord Kitchener, who had a horror of the Press, to send out the then Colonel Swinton to be the first war correspondent at G.H.Q. Won over to the idea, but still rather suspicious, Lord Kitchener said "And who is this Swinton?" "The author of *Duffer's Drift*" replied Churchill. "Oh yes, he'll do," said Kitchener with relief and Swinton thus became "Eye Witness." *Duffer's Drift* was, of course, based on Swinton's experiences in the South African War, the vivid account of which occupies perhaps the best pages of the autobiography.

The variety of the General's schools, which included disjointed spells at Rugby, Cheltenham and University College, London, would have severely handicapped a less gifted boy than the author. He himself elected to do a spell at "Jimmy's," the then already famous crammer in Kensington, in order to acquire the final polish necessary for passing with certainty into the Engineers.

His reminiscences of India will remind all those who served there of their happy days in that wonderful training ground for soldiers. "An American Interlude" describes with a wealth of detail, how Sir Ernest joined in 1918 an American team of "spell-binders" who toured the States to create enthusiasm for the purchase of their equivalent of our War Bonds. There is an excellent account of the varying fortunes of M. Citröen, the famous French car manufacturer, who always wore a bowler hat. The Nuremberg rally of 1936 which Swinton attended as a guest of honour was an experience which aroused his most gloomy forebodings. The last twenty-seven pages of the book are devoted to the years from 1925 to the author's recent lamented death during which long period he was first a Fellow and finally a Distinguished Fellow of All Souls at Oxford.

It is a little sad that General Swinton did not live to see the publication of his autobiography, but he was essentially a modest man and its mosaic of anecdotes delightfully told will still remain to entertain a wide circle of readers all over the world, just as he would have wished. Particularly pleasing to old timers is the *Punch* drawing by Swinton himself, called "Sang-froid," about the examination for tactical fitness for promotion to Lieut.-Colonel. Sapper majors, fresh from bricks and mortar, constantly passed it with brilliance disconcerting to the examiners. Some will be disappointed that the General rather confined himself to the details of his life's journey without much comment on bigger issues. We should like to have learned more about the genesis of his famous stories and about the evolution of the tank, which is dismissed in a few pages. These were the high spots of his experience and merited a fuller description. But Swinton was like that.

B.T.W.

A SAILOR'S ODYSSEY

By ADMIRAL OF THE FLEET VISCOUNT CUNNINGHAM OF HYNDHOPE.

(Published by Hutchinsons. Price 21s.)

A Sailor's Odyssey starts on 7th January, 1883, when the infant Andrew Cunningham was born in Dublin. Then follows an account of a happy childhood, schooldays and a telegram from a somewhat absent-minded father asking, "Would you like to go into the Navy?" to which the boy replied, egged on by his aunts, "Yes, I should like to be an Admiral."

He did his early training in H.M.S. *Britannia* and was later sent to join a ship at the Cape. He joined the Naval Brigade to fight the Boers ashore; thereafter his career followed more normal lines, usually in destroyers and often in command. Between the wars he held various posts suitable to his steady rise in rank; and, as everyone knows, World War II found him C.-in-C. in the Mediterranean.

Many things in this book will strike the reader. The first is the whiff salt sea air that comes from the pages.

Next, one is impressed with the character of the man. Homer's Odyssey tells us "the story of *a man*" and there could be no better description of the Admiral's Odyssey either. He was a real man. He never specialized—unless it were in the command of ships and men. One feels throughout the 700-odd pages of the book that here is just the kind of man one can trust to win a battle if anyone can. He was not, however, neglectful of social duties. The soldier will be amazed at the terrific round of parties that a senior naval officer must attend—dances ashore, dances afloat, receptions, luncheons, and dinners galore. You need a good digestion to become an admiral.

Personally, I liked the early part best, I could not put the book down through the pages describing those difficult times in 1940–3. One sees the colossal task so pugnaciously carried out by the Mediterranean Fleet and its valiant commander; bombed every time it went to sea, nagged at by signals from Whitehall, pressed on all sides by conflicting commitments, yet always contriving to sink any Italian ship that dared to challenge its supremacy.

Gradually the tide turned. America entered the war. Eisenhower and Cunningham became comrades-in-arms, until the latter went to the Admiralty as First Sea Lord.

Here the author chronicles the deeds of others but we get the authentic ring when he describes the conferences of "The Big Three" at which he too was present.

Let every young man, on the threshold of life, read this book. Let him see in action those qualities of a leader that take a man to the pinnacle of fame.

M.C.A.H.

THE MAHDÍYA

By A. B. THEOBALD

(Published by Longmans, Green & Co. Price 21s.)

This is a very readable book and an admirable vignette culled from the vast canvas of African history. A cleverly condensed first chapter puts one in the picture by briefly sketching the story of the Sudan from B.C. up to the emergence of the Mahdi in 1881. It closes with the invasion of the Sudan, as far south as the great lakes, by an Egyptian Government

lured on with rumours of gold and slaves : the corrupt and oppressive rule of the officials finally drove the Sudanese to open rebellion, under the Mahdi as their guide and leader.

The book then describes with great clarity the spread of the Mahdi's rule over the greater part of the Sudan, up to his sudden death from illness in 1885. He was the man of words, who provided the ascetic example and religious inspiration. His faithful henchman and man of action was the Khalifa, a good organizer and administrator and his nominated successor: the latter half of the book deals with the Khalifa's governance of the Sudan.

Into this local history of eighteen years there is skilfully woven the parts played by the Egyptian and French Governments and, of course, by Great Britain—the vacillations of Gladstone's Ministry, the dispatch of small sporadic expeditions, dealings with Cromer and Gordon, etc.—all well and economically written in. Gordon himself is a live and dramatic figure in the story : his three tours of service in the Sudan are sympathetically and fairly dealt with.

Slatin Pasha was perhaps worthy of more generous mention by the author, not as leading actor in the spotlight but as influential prompter and counsellor. His quick grasp of affairs and sound judgment were sought and trusted through many of these years—whether as Governor of Darfur by Gordon, or by the Mahdi and Khalifa during his long years as their prisoner, or at Wingate's elbow in the Intelligence Branch during Kitchener's expedition. In later years in Khartoum the present writer knew him intimately and could fully appreciate his outstanding qualities, whether as mentor or friend.

The book closes with an excellent and graphic account of Kitchener's expedition of re-conquest of the Sudan, culminating in the battle of Omdurman in 1898 and the death of the Khalifa a year later.

The maps are ample and clear : illustrations and index are sufficient : the longish "selected bibliography" betrays the author's omnivorous research among the bare bones of his subject. And yet it is a comparatively short book—a model of compression and expression, compelling to those who have served in the country and inviting to all epicures in tit-bits of history.

E.E.B.M.

FOUR YEARS WITH JEB STUART

By Lieut.-Colonel W. W. Blackford, C.S.A.

(Published by Charles Scribner's Sons, New York. Price $4.)

These reminiscences of the war between the States, 1861–5, were set down by the author soon after its close at the request of his mother, but have never before been published. They provide not only an account of the operations but also a lively story of the daily life and intimate sketches of personalities. Engineer officers may not be attracted to the book by its title, which might have been "A Confederate Sapper Officer," but it is of special interest to them as Blackford, a railway engineer in peace, served on the staff of the great Confederate cavalry leader as his "Chief Engineer Officer," and in 1864 helped to raise, and then command the 1st Regiment Engineer Troops of Lee's Army of Virginia.

Until January, 1864, the Confederates had no engineer units ; on every staff there was an engineer officer, an engineer adviser as we called them

in 1914: but the engineer work was done by the troops themselves; often by negro labour. The duties required of the engineer officers were mainly reconnaissance and rough mapping—as Wellington often used his in the Peninsula—and looking for fords.

The operations beginning to trend towards position warfare, at the beginning of 1864—wire entanglements first appeared in the Wilderness in May, 1864—Lee decided to raise Engineer units. Regiments of ten companies of a hundred men each were formed; the officers were all appointed and no elections were permitted. Nearly all were Civil Engineers by profession; the N.C.Os. either well-educated men or men with some qualification in a mechanical trade. The men, aged 25 to 35, were skilled in the use of tools in some way, farmers as well as mechanics. Two companies of each regiment were trained as pontoneers and had a train of boats carried on wagons. The men of the other companies were instructed in the art of making gabions, sap-rollers, *chevaux-de-frise* and other siege material, and finally trained in sapping and mining.

The trench-warfare operations of the Petersburg lines for the greater part of a year gave the engineers plenty of work. The author provides a long description of the mining and countermining, a Petersburg mine holding the record of the largest military mine until Messines, 1917. No hand-grenades were thrown but the engineers rolled mortar shells (spherical) over the parapets. Everyone interested in the war of 1861–5 should read this book.

J.E.E.

THE NEW MILITARY AND NAVAL DICTIONARY

Edited by FRANK GAYNOR

(Published by the Philosophical Library, New York. Price $6.00)

The U.S.A. provide the world with many novelties. This military dictionary is not only new but also bold. The editor is to be congratulated for his courage and his industry. The book covers a vast field. General terms, highly technical ones and even military slang are all included. Some most useful tables at the end show how the U.S.A. organize their armed forces under the President. The technical terms seem to be right up to date and will no doubt be kept so in new editions. To the British reader a more comprehensive title would have been "The New Military Dictionary of Air, Sea and Land Warfare." Dictionary makers should uphold the general meaning of the adjective "military." Frequent U.S. Army usage suggests that the terms "combat command" and "combat team" require fuller treatment than they are accorded. The first is to us an armoured brigade group. The second is an infantry brigade group. Both are very important modern formations. "Angle of site" should surely be "angle of sight," beloved also by British gunners. No one can be surprised that in such a welter of different classes of words the definitions are occasionally rather rough and ready. That for strategy, for instance, would hardly satisfy a great commander, whilst that for logistics, the art of moving and quartering armies, is too diffuse. But on the whole the dictionary seems likely to be a successful book of reference for American students of war and to a lesser extent for all British officers working with U.S. armed forces. American military phraseology is notoriously full of dangerous pitfalls for the unwary.

B.T.W.

THE RIVER MATHEMATICS

By A. HOOPER, M.A.

(Published by Oliver & Boyd, Ltd. Price 18s. 6d.)

In this book the author, who has several works already to his credit on the subject of " Mathematics for the man in the street," sets out to cover the whole field of mathematics up to the standard of matriculation. His approach is historical and practical ; his explanations are very full and clear ; and he makes use of some novel and good illustrations, particularly in his chapter on " Building up Formulae."

Generally speaking his treatment is conventional, but the presentation is unusually good for a book of this type, and it deserves careful study in return for the pains which the author has obviously devoted to it.

W.G.H.B.

TECHNICAL NOTES

THE MILITARY ENGINEER

(Published by the Society of American Military Engineers, July–August 1951)

Atomic Bomb Protection Now, by Lieut.-Colonel T. J. Hayes, Corps of Engineers

The author, whose lectures at the S.M.E. Chatham during his service as Engineer Liaison Officer and as Assistant Military Attaché in London will be well remembered by many of his friends in the Corps, now finds one of his responsibilities is Washington's Civil Defence. Rather than wait for completion of the organization of the Federal Civil Defence Administration and official plans for locating and building costly atomic bomb shelters, he attempts an immediate analysis of what protective measures can be taken at once in the utilization of facilities which are already available.

He maintains that thousands of lives may be saved by the effective use of existing structures, many of which will provide reasonable protection if their safest areas are selected and adapted as a realistic beginning towards civil defence.

In developing criteria for the selection of shelters, the author reviews at some length the effects of the " nominal atomic bomb " (equivalent to 20,000tons of T.N.T. at 2,000 feet) to be guarded against under the three main leadings " Blast," " Radiation " and " Fire." These figures are by now too well known to require repeating, but it is interesting to note that the author records that gamma radiation is not instantaneous, 50 per cent of the total radiation occurs in the first second and about 80 per cent in the first ten seconds. Taking cover quickly can reduce radiation greatly and be the difference between life and death. The same applies to thermal radiation which continues for about three seconds. The selected shelter area should shield its occupants both overhead and

laterally to reduce gamma dosage to 100 R or less. Any shelter which reasonably protects from blast and gamma radiation will also protect from thermal radiation. The greatest danger of fire is not due to the incendiary effects of the bomb on inflammable material—the blast normally blows this out—but to the effect of blast upsetting stoves, breaking gas pipes, and causing electricity short circuits. The selected shelter area should be safe from fire and have duplicate or assured exits.

As a result of this analysis the author considers that protection from the bomb's effects at a distance of half a mile from ground zero is a reasonable basis for shelter planning. Assuming that alarms give five minutes warning to move to these selected shelter areas, they must be planned in sufficient number to be within that range, i.e., about 300 yards of the prospective occupants.

The author then analyses in detail the relative protection offered by various types of construction and relative safety to be obtained in various rooms, corridors and basements of such structures, and outlines certain simple and relatively inexpensive precautions to be taken to increase the protection provided. This part of the article is well illustrated by photographs of typical buildings, rooms, corridors and staircases and presents a valuable and well thought out contribution to the problem. He concludes with a six-step shelter programme for implementing his proposals.

(1) Select the safest area in each building. This should be the responsibility of the individual owner or occupant ; who, with the author's very complete analysis should be able to do this without professional assistance.

(2) Prepare each selected area to permit its proper use as a shelter. This will include clearing impedimenta in the area or in the routes thereto ; ensuring availability at all times ; determining capacity ; determining means of access and egress ; training occupants to serve as guides ; designating a responsible person to be in charge of the shelter ; and providing appropriate signs to show the location, route, and capacity.

(3) Improve each shelter, without great expense, by removing inflammable materials, replacing hanging fixtures and providing essential supplies. The first essential should be tunnelling tools for forcing a way out if egress is blocked.

(4) Evaluate each shelter, and classify it according to the degree of protection provided.

(5) Develop a shelter plan on an area basis. This will consist of dividing the city into refuge zones, based on logical boundaries and the distance people can be expected to move in five minutes. For each zone it will be necessary to determine the expected "shelter load" including day and night peaks and averages ; the shelters available, with the capacity and degree of protection of each ; a plan for fully utilizing the best, eliminating the inadequate, and developing additional shelter where required.

(6) An orientation programme including periodic exercises, to ensure that people are trained to move to shelters promptly on an air raid warning.

These simple proposals if carried out would, it is estimated, reduce casualties from a daylight bomb by 50 per cent.

A reprint of this informative and well-written article should be in the hands of all who are actively interested in Civil Defence.

A ROAD IN PRESTRESSED CONCRETE

(*Civil Engineering*, dated April, 1951.)

An article on the construction of a road in prestressed concrete which appeared in the April edition of the *Civil Engineering and Public Works Review* will be of interest to most Sappers. This road is part of the development of the new town at Crawley, in Sussex.

General Description

Lessons learnt from the prestressed road construction at Luzancy and Esbly and runway construction at Orly were used in the design for the road. The length of slab was fixed at 400 ft. using a maximum coefficient of friction of 0.50 (estimated by the Road Research Laboratory) and the depth of slab was fixed at 6 in. in order to give minimum allowable coverage to the cables. Prestress of 200 p.s.i. was produced in Freyssinet type cables consisting of twelve 0.2 in. diameter high tensile steel wires grouped around a 16-gauge mild steel wire core helix. The cables were aligned at an angle of 3 to 1 to the line of the road in a diamond pattern at approximately 7 ft. 6 in. centres. The concrete mix used was 3.9 : 1 by weight, with a water/cement ratio of 0.4 .

Special Features

In order to reduce construction costs it was decided to use a sub-base of 4 in. clinker. To minimize the high frictional resistance of such a material, however, a thin layer of sand was spread and rolled on the clinker before laying waterproof paper.

The cable anchorage cones were placed in high grade concrete haunches constructed independently of the main slab and running the full length of the road on each side of the carriageway. These haunches were 12 in. wide and 6 in. deep and were tied to the main slab by $\frac{3}{4}$ in. diameter tie bars. At the end of the road the cables were curved to anchorages in the side haunches. This avoided the need for any anchorages in the carriageway. All cables ran inside tubing and were grouted up with a neat cement grout immediately after prestressing, which took place three weeks after concreting the main slab.

In view of the difficulty of calculating the actual expansion of the 400 ft. long prestressed bay with unknown subgrade restraint, a short expansion bay 5 ft. long was constructed at each end. These expansion bays consisted of hardcore surfaced with tarmac and incorporated 2 in. thickness of expansion jointing material. After careful investigation being carried out by the Road Research Laboratory by means of fixed strain gauges and datum points it is hoped that final expansion joints may be designed and placed.

Conclusion

Consideration of the possible use of prestressed concrete in road construction shows that it can have advantages, provided that the cost can be made comparable with normal construction costs. The advantages are :—

(*a*) Elimination of cracks.
(*b*) Reduction of number of expansion joints.
(*c*) Following from (*a*) and (*b*) improvement in riding quality and reduction of maintenance costs.

There are, of course, disadvantages :—

(*a*) The difficulty of reinstatement.

(*b*) The possibly complicated nature of expansion joints if the bays are too long.

It is thought that for the military engineer (*a*) definitely restricts the use of this type of construction, to rear areas only.

ENGINEERS IN CIVIL DEFENCE

(*The Engineering Journal of Canada*, dated March, 1951.)

The Engineer has an important part to play in civil defence ; he will find food for thought and valuable information on the subject in an article entitled " Engineers in Civil Defence " in the March issue of the *Engineering Journal*. It is highly desirable these days to consider civil defence when planning new garrison towns and large military installations ; dispersion is the best counter measure against atomic attack, an atom bomb is an expensive device in man hours and needs a substantial target to justify its expenditure. The inclusion in a building, furthermore, of shock-resisting features, fire prevention requirements and basements suitable for use as shelters would greatly increase our civil defences at a relatively small additional cost and would reduce the fire risk in peace-time. The effects of atomic weapons is still a matter for considerable research work, but much has been done in this direction. It would appear, for example, that a distance of about half a mile from a point directly under the bomb burst is a reasonable compromise for the planning of general protective measures ; no one can foresee just where an atom bomb will go off and it is not, therefore, economically feasible to try and provide protective measures against a direct hit. A three-dimensioned graph has been evolved, a pressure–time–distance for shock waves ; this graph provides valuable data for the constructional engineer ; it shows that a total pressure of 86.4 tons for a duration of half a second can be expected on the side wall of, say, the family garage if its dimensions are of the order of 8 ft. in height and 15 ft. in length. A further graph shows the thicknesses of concrete required to reduce initial gamma radiation to the desired amount ; the thickness being given as a function of the distance from the explosion ; the thickness at 3,000 ft. is 22 in. and at 5,000 ft. is 2 in. It has been found that load-bearing brick or concrete block walls have poor resistance to atomic blast and not only do they collapse but the bricks become highly dangerous missiles ; our architects will furthermore have to reverse the present trend towards the extensive use of glass in building construction if we are to live in this age of possible atomic warfare. We all hope that our civil defences will never have to be brought into use in our lifetimes but to neglect them is to neglect our life insurance premiums in this troubled world.

THE SAINT LAWRENCE WATERWAY

(*The Engineering Journal of Canada*, dated June, 1951.)

The development of the St. Lawrence Waterway is a fascinating project, which has fired the imagination of engineers for decades. This is yet another paper on the subject by J. G. G. Kerry, M.E.I.C., of Port Hope, Ontario.

The author has devoted years of study to the conditions on the St. Lawrence Waterway. He has long forecasted that an all-season seaway

can be constructed using the latent heat contained in the deep waters of Lake Ontario to keep the channel free of ice. This briefly can be achieved by constructing deep channels for sea-going ships, and regimenting the flow of water from Lake Ontario to the St. Lawrence estuary, so that a speed of 3 m.p.h. can be maintained. He calculated that the water leaving the lake at 34° F. will then only take six days to travel the 420 miles to the estuary, and on arrival will still be above the temperature at which sheet ice or frazil will form.

In order to avoid negotiations with the U.S.A. and thus protracted delays, if the whole length of the St. Lawrence were used, through which the international boundary passes, he advances a second proposal. This is to divert Canada's share of the St. Lawrence waters from Galops Island across the St. Lawrence Lowland by canal, emptying it into the Ottawa River near Point Fortune. Here power would be developed on Canadian soil, new Canadian industries opened up in a hitherto undeveloped region, and the seaway kept a purely national undertaking. He admits, however, that this vast proposal needs further study and discussion.

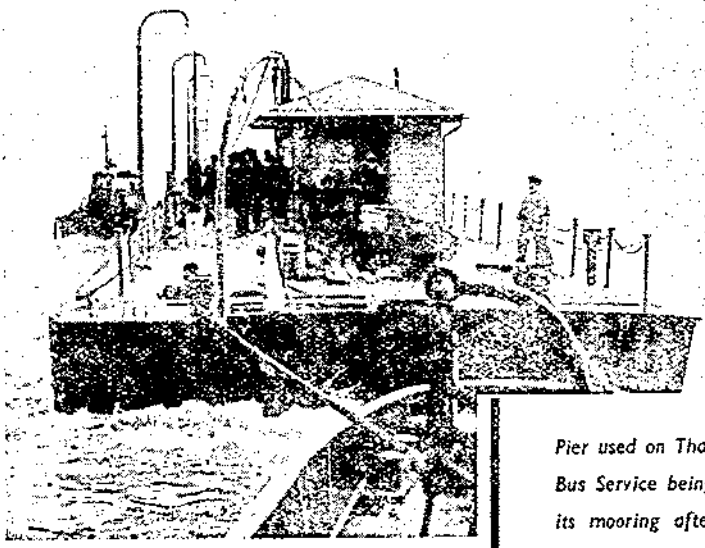
DEFENCE RESEARCH IN CANADA

(*The Engineering Journal of Canada*, dated August, 1951.)

A book *Scientists at War* was reviewed in the August *R.U.S.I. Journal*. It was mainly concerned with the war-time achievements of Canadian Scientists. This article carries the story onwards, and reveals that $35 million are being spent on research and development in Canada this year. In addition considerable sums are also expended on research by the National Research Council, and the Bureau of Mines.

Many of the items under research are on the secret list, but a few unclassified examples will serve to show that Canada is pulling her full weight. A new guided missile project is just beginning. A new infantry anti-tank weapon, modelled on the American Bazooka, but expected to be more accurate is under development. Improved shot for 17 pounder and 76 mm. guns, greatly improved and simplified flame throwers for infantry, and electronic computers for a wide range of military equipment are also on the programme. Naval and aeronautical research is also being extended.

In the field of mechanical engineering, the Board is supporting very interesting work being done by engineers and physicists on the production of a heat pump for use in the Arctic. This pump is intended for use when unfrozen water can be obtained beneath the ice in lakes. The pump freezes this water, and makes use of the latent heat of freezing as a source of additional energy to increase the efficiency of the pump. There remains only the minor problem of getting rid of the ice, not a commercial proposition in the Arctic at present!



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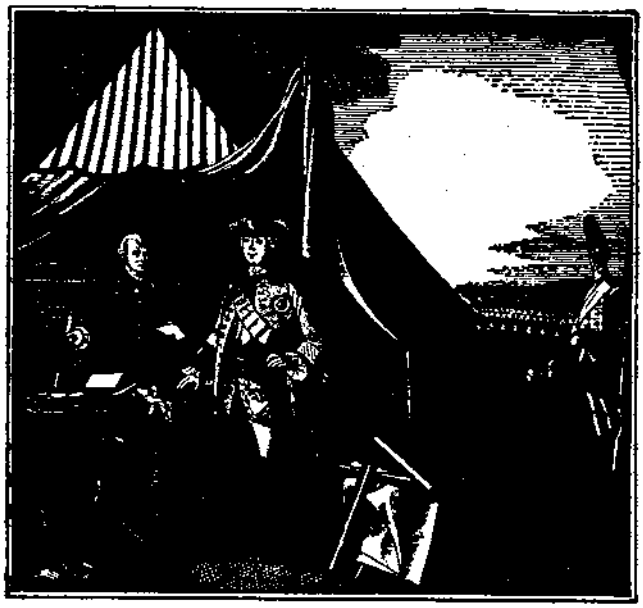

The appointment of Mr. Richard Cox in 1758 as Army Agent by Lord Ligonier

AT No. 6 Pall Mall can be seen the original charter granted by Field-Marshal Lord Ligonier to his private secretary, Richard Cox, as Banker of the First Regiment of Foot Guards. By 1815, Cox's had become Bankers, Official Paymasters and Agents to the entire British Household Brigade, the bulk of the Cavalry and Infantry Regiments, the Royal Artillery and the Royal Wagon Train—now the Royal Army Service Corps. Cox's have also been Agents to the Royal Air Force since its inception. Lloyds Bank absorbed this historical connection in 1923. A modern banking service is now provided dealing in every type of business but the individual attention to customers' banking requirements still remains a distinctive feature.

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