The Royal Engineers Journal

VOL. LIX SEPTEMBER, 1945

CONTENTS

Published Quarterly by
THE INSTITUTION OF ROYAL ENGINEERS
CHATHAM, KENT
Telephone: Chatham 2669

AGENTS and PRINTERS: W. & J. MACKAY & CO., LTD., CHATHAM.
LONDON AGENTS:—HUGH REES, LTD., 47, PALL MALL, S.W.1.

THE ROYAL ENGINEERS JOURNAL—SEPTEMBER, 1945. Pages 149—222.

THE ROYAL ENGINEERS JOURNAL

Authors alone are responsible for the statements made and the opinions expressed in their papers.

VOL. LIX CONTENTS SEPTEMBER, 1945

THE COUNCIL OF THE INSTITUTION OF ROYAL ENGINEERS

(Incorporated by Royal Charter, 27th February, 1923)

Patron—HIS MAJESTY THE KING

President

Lieut.-Gen. Sir Lionel V. Bond, K.B.E., C.B., Col.-Comdt., R.E. 1945

Vice-Presidents

Maj.-Gen. H. B. W. Hughes, C.B., D.S.O., O.B.E. 1945

Lieut.-Gen. Sir Francis P. Nosworthy, K.C.B., D.S.O., M.C., Col. Comdt., R.E. 1945

Elected

Brig. G. E. H. Sim, D.S.O., M.C. 1943

Brig. J. R. T. Aldous, M.C. 1943

Col. J. L. Lishman, D.S.O., O.B.E., T.D. 1944

Brig. B. K. Young, C.B.E., M.C. 1944

Lieut.-Col. P. F. Hayes 1944

Lieut.-Col. K. A. Lindsay... 1944

Lieut.-Col. C. M. Maclachlan, O.B.E. 1944

Col. W. Garforth, D.S.O., M.C. 1945

Lieut.-Gen. Sir Giffard Le Q. Martel, K.C.B., K.B.E., D.S.O., M.C., M.I.Mech.E., Col.-Comdt., R.E. 1945

Maj.-Gen. P. A. Ullman, O.B.E. 1945

Col. R. L. Withington, M.C. 1945

Brig. H. L. Woodhouse, C.B.E., M.C., M.Inst.C.E. 1945

Ex-Officio

Lieut.-Col. A. C. Mitchell, O.B.E.

Brig. H. T. S. King, O.B.E.

Maj.-Gen. D. J. McMullen, C.B., C.B.E., D.S.O., M.I.Mech.E

Brig. G. J. Eaton-Matthews, C.B.E.

Brig. E. J. B. Buchanan, D.S.O.

Maj. A. J. Le G. Jacob, M.B.E.

Lieut.-Col. G. T. H. Capron

Corresponding Members

Maj.-Gen. T. R. Williams, C.M.G., D.S.O., *Australian Staff Corps* ... 28th January, 1930

Lieut.-Col. W. H. Blake, M.C., *Royal Canadian Engineers* ... ... 15th June, 1943

Col. G. H. Cotton, O.B.E., M.I.Mech.E., S.A. *Staff Corps* ... ... 7th June, 1939

Col. G. H. Clifton, D.S.O., M.C., *N. Zealand Staff Corps* ... ... 27th July, 1937

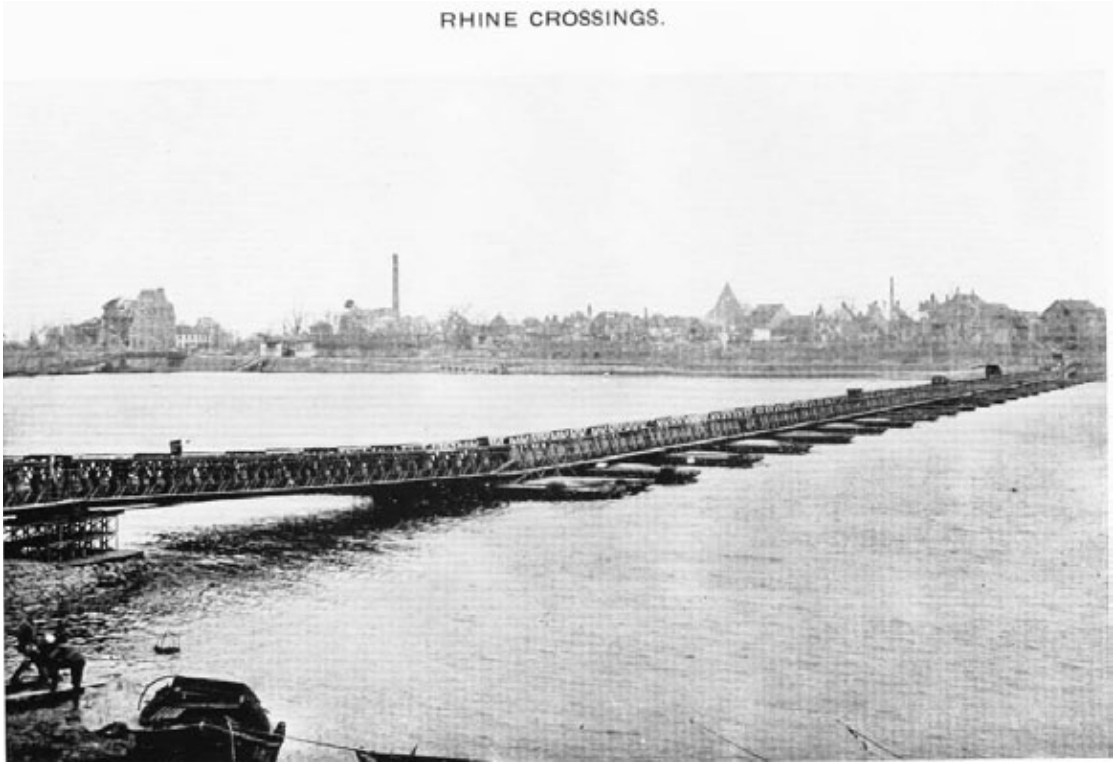
Secretary and Editor R.E. Journal :

Brig. C. C. Phipps, C.B.E., M.C. ... ... 13th January, 1945

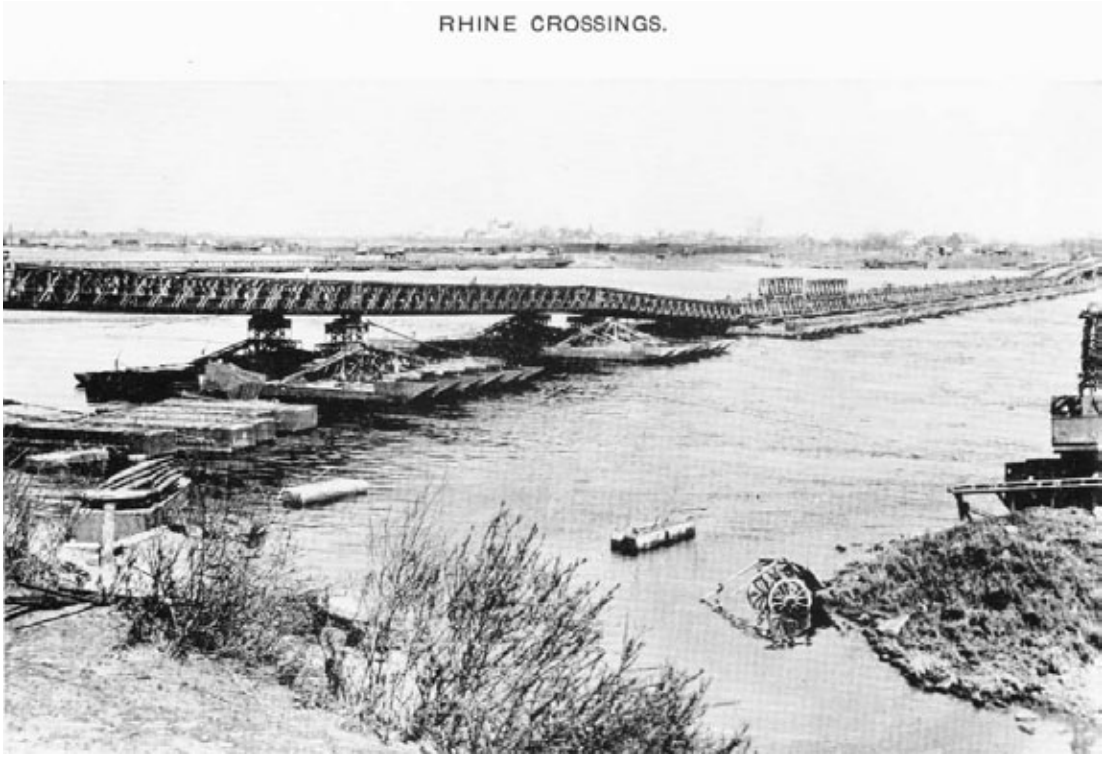
Bankers

Lloyds Bank, Ltd., Cox's and King's Branch, 6, Pall Mall, S.W.1.

2,350 1.9.45.



Class 40 Bailey pontoon bridge at Rees.



Class 40 Bailey pontoon bridge at Xanten

EDITORIAL NOTES

1. Frontispiece

We publish in this issue photographs of two of the many Bailey bridges built across the Rhine by 21st Army Group.

The Bridge at REES, named LONDON BRIDGE, was 1,148 feet long and was built in 30 hours by 8 G.H.Q. Troops Engineers.

The bridge at XANTEN, named SPARROW BRIDGE, was 2,080 feet long and was built in 144 hours by 15 (KENT) G.H.Q. Troops Engineers.

In both these cases, and at most other sites, a duplicate bridge was built near by to allow for two-way traffic.

This is not the first occasion on which the Rhine has been bridged as a Military Operation. On page 151 we publish a short account of a bridge built by Cæsar when he invaded Germany.

We hope shortly to be able to publish an account of the Bailey Pontoon Bridge built over the CHINDWIN RIVER in BURMA, which was 1,080 feet long and a wonderful achievement, considering the difficulties of transport in that theatre of operations.

2. Chief Royal Engineer

The tenure of appointment as Chief Royal Engineer and Colonel Commandant, Royal Engineers, of Lieut.-Gen. Sir Ronald Charles, K.C.B., C.M.G., D.S.O., has been extended to 26th June, 1946.

3. Members of the Institution of Royal Engineers

The granting of regular commissions to a number of officers during recent months has had a beneficial effect on the number of members of the Institution. Most of these new regular officers of the Corps have joined, and we are still awaiting replies from others overseas.

In the first six months of this year, 62 Full Members and 5 Associate Members have joined the Institution.

New members will be cordially welcomed.

Regular Army R.E. officers are eligible for Full Membership only.

Officers holding, or who have held commissions in the Royal Engineer Militia, Supplementary Reserve, Special Reserve, Territorial Army, or those belonging to the engineer arm of British Overseas Forces are eligible for either Full or Associate Membership.

The use of the Corps Library, at present situated at Chatham, is available free to all Full Members of the Institution. Outward postage on Books is prepaid and return postage is refunded.

Further particulars of facilities and rates of subscription are shown on page 222 of this *Journal*.

4. R.E. Kitchener Scholarships

These scholarships are available to help in connexion with the school expenses of the children of all regular R.E. Officers or other ranks killed or disabled on service and of temporary R.E. Officers or other ranks killed on service. Application should be made to the Secretary, R.E. Institution, Chatham. Members of the Institution should bring this to the notice of any families whom they consider might require such assistance.

5. ARTICLES FOR THE R.E. JOURNAL

Much has been published in the Press in recent weeks of great achievements which had been well kept secrets. Many of these outstanding works have been carried out entirely, or in very large measure, by the Corps of Royal Engineers. The building of the two large Military Ports in Scotland comes under the former heading and the "Mulberry Harbours" and "Pluto" under the latter.

Now that officers may have a little more spare time available, we hope that they will be able to write up some details of these undertakings, describing some of the many difficulties which arose and had to be overcome.

Members are reminded that, in addition to payments made for all articles published in *The R.E. Journal*, there are also two prizes available annually for officers, of the substantive rank of Major *or below*, as follows:—

Montgomerie Prize:—Consisting of a book, on certain subjects, to be selected by the recipient, and bound in leather, together with the balance of the year's income from the Montgomerie Trust in cash. The total value is normally about £14. The prize is available for any article on a Professional subject.

Arthur ffolliott Garrett Prize:—Value about £7, to be used by the recipient for the purchase of a piece of plate. The prize is available for an article on (i) Irrigation and Water Supply; (ii) Railways; or (iii) Survey. Failing any suitable contribution on these subjects, it can be given for any article eligible for the Montgomerie Prize.

At present we are strictly rationed for paper, but it is hoped that the ration may be increased before very long, when we shall be able to increase the size of the *Journal*. In the meantime, will authors please endeavour to be as concise as possible while maintaining a clear account of the subject.

All drawings should be in *black* ink. Black tracings on blue linen are quite suitable. Other types of drawings or prints should only be submitted if local conditions prevent the use of black ink. Photographs can be reproduced in limited numbers, but, in addition to expense, one page of art paper weighs ¼ cwt. for each edition of the *Journal* and is equivalent to more than 3 pages (6 sides) of text paper.

6. R.E. MUSEUM

The Museum is still closed, but some interesting exhibits have recently been received. These include models of various types of bridges used during the war, such as the Bailey Bridge, etc.; the last link in Germany of the oil pipe-line "Pluto"; models of British and enemy anti-tank and anti-personnel mines; and models of anti-tank obstacles.

Any proposals to re-open the Museum, must await decisions on a number of other factors which are at present under consideration.

CÆSAR CROSSES THE RHINE

(An extract from Chap. VI of the Third Book of Palladio's Architecture printed in London in the year 1733)

SUBMITTED BY MAJOR J. YOUNG, M.B.E., M.I.E.E., R.E.

JULIUS CÆSAR having determined to pafs the Rhine (as he himself informs us in the fourth Book of his Commentaries), that the Germans might be apprehenfive of the Roman Power; and concluding that it would neither be fafe in itfelf, nor a Thing becoming him, or the People of Rome, to pafs in Boats, he forthwith ordered a Bridge, which was a moft curious and difficult Piece of Workmanfhip, on Account of the Largenefs, Depth, and rapid Stream of the River. But after what Manner this Bridge was contrived, altho' he exprefly mentions it, is yet very difficult to determine, becaufe we have not an adequate Idea of the Force of fome Terms in his Defcription; and various Draughts have, for that Reafon, been made of it according to Mens various Conceptions. I having made mention of it likewife a little higher, I would not lofe this Opportunity of fetting down the Defign which I formed of it in my Youth, when I firft read thofe Commentaries; becaufe it agrees very much, as I take it with the Words of Cæfar: And alfo becaufe it fucceeded to Admiration, as Experience has fhewn, in a Bridge which I built immediately over the Bachiglione without Vicenza. I do not, however, intend hereby to confute the Opinion of others, who were all of them very valuable Perfons, and highly praife-worthy, for leaving the Defigns of this Bridge in their Books, according to their Idea of it; thus by their Labour and Ingenuity making it very eafy to our Underftandings. But before I give my Defign, I fhall quote the Words of Cæfar, which are as follows. "Rationem igitur Pontis hanc inflituit. Tigna bina fequipedalia, paululum ab imo præacuta, dimenfa ad altitudinem fluminis, intervallo pedum duorum inter fe jungebat. Haec cum machinationibus immiffa in flumen defixerat, feftucifque adegerat; non fublicae modo directa ad perpendiculum, fed prona ac faftigiata, ut fecundum naturum fluminis procumberent. His item contraria duo, ad eundem modum juncta intervallo pedum quadragenum, ab inferiore parte contra vim atque impetum fluminis converfa, flatuebat. Haec utraque, infuper bipedalibus immiffis, quantum eorum tignorum junctura trabibus, diftabat, binis utrinque fibulis ab extrema parte diftinebantur: Quibus difclufis, atque in contrariam partem revinctis, tanta erat operis firmitudo, atque ea rerum natura, ut quo major vis aquae fefe incitaviffet, hoc arctius illigata tenerentur. Haec directa injecta materia contexebantur, ac longuriis cratibufque conftrnebantur; ac nihilfecius, fublicae, ad inferiorem partem fluminis oblique, adjungebantur, quae pro ariete fubjectae cum onmi opere conjunctae, vim fluminis exciperent; aliae item fupra pontem mediocri fpacoi, ut fi arborum trunci five naves, dejiciendi operis caufa, effent a barbaris miffae, his defenforibus earum rerum vis minueretur, neu ponti necerent." The true Senfe and Meaning whereof is, that he ordered a Bridge to be made after this Manner. He joined two Pieces of Timber together, each a Foot and a half thick, at two Foot Diftance, pretty fharp towards the lower End, and as long as the Depth of the River required. Having ftuck thefe Pieces in the Bottom of the River, by Engines, he directed them to be rammed down not perpendicularly, but inclining according to the Courfe of the River. Overagainst thefe, in the lower Part of the River, and at forty Foot Diftance, he fixed two others, joined together

after the fame Manner, leaning thefe againft the Stream, and Force of the River. They laid long Summers two Foot thick (according to their Diftance from each other) between thefe two double Piles, which were held faft by two Braces at each End, and preffing contrary to each other; fuch was the Strength and Nature of the Work, that as the Force of the Water was the greater, the fafter was all linked together. Thefe Summers were joined with others acrofs them, and covered with long Piles and Hurdles. Over and above this, there were feveral River-Poles, or Pofts, in the lower Part of the River, which floping againft the Bridge, ferved for Buttreffes againft the Force of the River. Others were added in the upper Part of the River, at fome fmall Diftance from the Bridge, that in Cafe the Trunks of great Trees or Ships fhould be let down by the Barbarians to demolifh the Works, the Violence of fuch things fhould be leffened by thefe Defences, fo that the Bridge might not be damaged. Thus Cæfar defcribes the Bridge which he laid over the Rhine; and the following Draught feems to me very comformable to that Defcription. The principal Parts of it are marked by Letters on the drawing.

A. The two Pieces of Timber joined together, each one Foot and a half thick, pretty fharp towards the lower End, not fixed perpendicularly in the River, but inclining according to the Stream, and at two Foot Diftance from each other.

B. The other two Pieces of Timber fixed in the lower Part of the River, over-againft the Pieces juft mentioned, and forty Foot diftant from them, but inclining againft the Stream.

C. The Figure of one of thofe Pieces by itfelf.

D. The Pieces of Timber, every Way two Foot Thick, making the Breadth of the Bridge, which was forty Foot.

E. One of thofe Pieces by itfelf.

F. The Braces, which being open, or divided one from the other, and bound contrariwife (that is, one in the inner, and the other in the outer Part; one above, and another under the Pieces two Foot thick, which made the Breadth of the Bridge) did fo corroborate the whole work, that the greater the Violence of the Water, or the more pondrous any Load was upon the Bridge, the more it united, and became the firmer.

G. Is one of the Braces, or Ties, by itfelf.

H. The Pieces of Timber which were laid the Length of the Bridge, and were covered with Poles and Hurdles.

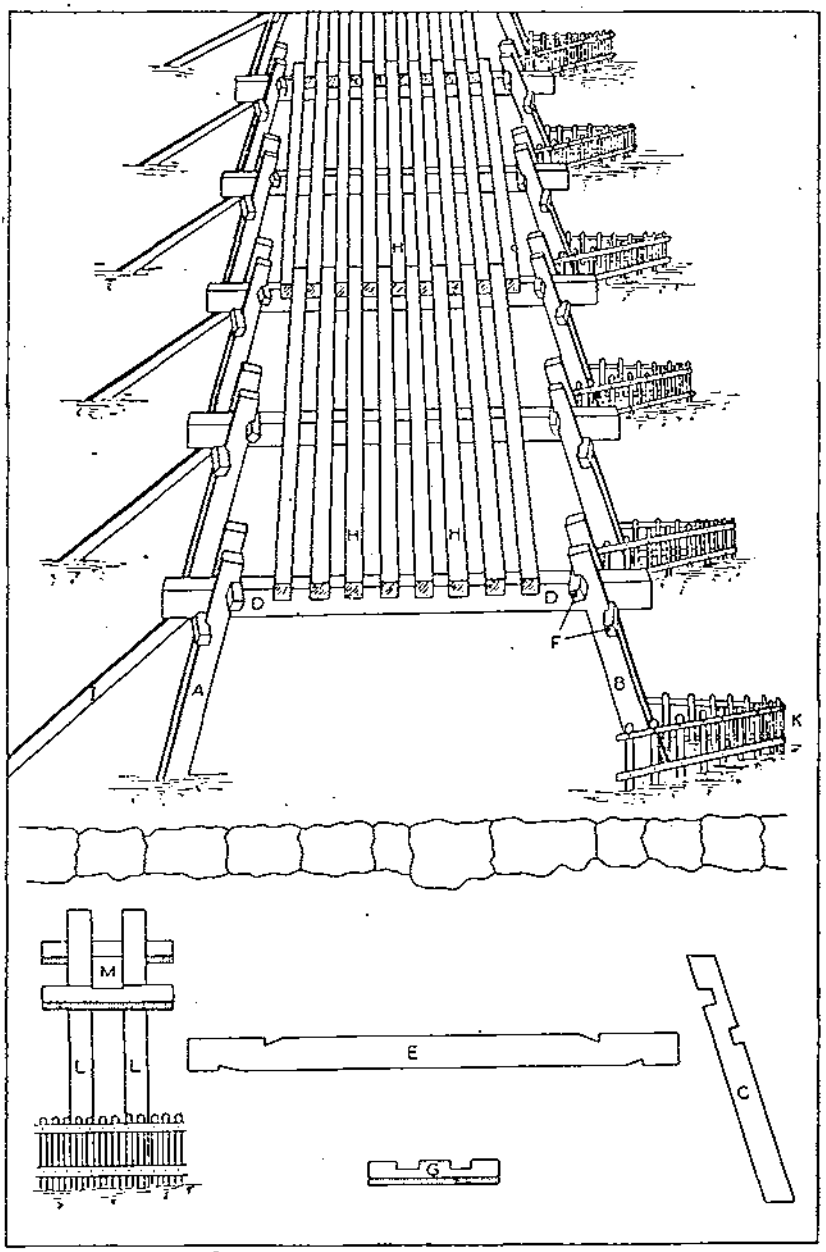
I. The Pofts below the Bridge, which inclining againft, and joined to the whole Work, refifted the Force of the Stream.

K. The Pofts above the Bridge for its Defence, in Cafe the Enemy fhould let down the River Trees or Veffels to deftroy it.

L. Two of thofe Pieces of Timber, which being joined together, ftood in the River, not perpendicularly, but inclining.

M. The Head of the Pieces which made the Breadth of the Bridge.

CÆSAR CROSSES THE RHINE.



Plan showing design of Bridge over the Rhine as described in Cæsar's 4th Book of Commentaries.

WAR OFFICE

By Brig. W. G. D. Knapton

1. Introduction

During the course of a year a large number of Officers are appointed to the Staff of the War Office, and quite a high proportion are Sappers. Most people, when they get such a posting order, say something to the effect that they wonder what it involves and anyhow what do they know about the War Office? (They sometimes say a good deal more!) Usually there is no one to answer their queries and this article, therefore, endeavours to give in outline such information as an Officer may find useful before he joins for duty.

One of the most difficult things to learn is "who does what," and "who must be consulted" before a decision is given. It will be as well, therefore, to start with a general description of the War Office set-up.

2. General Description

The first thing to realize about the War Office is that it is a Government Department, and not a Military Headquarters. This may sound strange; but a moment's thought makes it clear. The Army is controlled (in the broadest sense) by Parliament through the Secretary of State for War, and the War Office is the machine through which control is exercised. This being so, the administrative "Head" of the War Office is the Permanent Under Secretary of State, known as the P.U.S., who is a Civil Servant. A large proportion of the staff, both Officer and "other rank" grades, is also composed of Civil Servants, not only in purely civil branches, but in military branches too, though in the latter the proportion of civil to military varies with the branch. The newly-joined Staff Officer may find, therefore, that he has civilian colleagues, either male or female, and civilian clerks of all grades. This may take a little getting used to, but an Officer should not find any difficulty once he has realized that Civil Service conditions and discipline, admirable for their own object, are not those of the Army Act. Some Officers never realize this, to the detriment of their work and tempers.

Like any other large organization, the W.O. set-up is tiered, with the Army Council at the apex ("the highest level") and spreading downwards to sub-branches and sections at the base. The composition of the Army Council is given in the beginning of the Quarterly Army List, from which it will be seen that the W.O. is divided into Departments, each in charge of an Army Councillor. The military element consists of the three Military Departments, "G," "A" and "Q," and the Military Secretary to the S. of S.; but there are also certain military officers employed in Departments controlled by civilian Members of Council.

Military Members of Council may have one or more Deputies. Within each Department the main subjects with which it deals are divided among Directorates, each under the charge of a Major-General, or, in the case of some Class B Directorates, a Brigadier. Directors may have one or more Deputy Directors (Brigadiers or Colonels) and in a few of the largest Directorates, there are one or more Major-Generals subordinate to the Director.

Directorates are composed of a number of branches, each headed by a first grade Staff Officer. The branch is the "basic unit" of the War

Office, in much the same way as a battalion and its equivalent is the basic unit in all formations. Branches in their turn may have sub-branches or sections dealing with one particular aspect of the subject for which the branch as a whole is responsible. Generally speaking a branch is designated by one or more letters or an abbreviation to denote the Department or Directorate which it serves, and a number. Some branches which have expanded during the war from one parent branch may also have a small letter as a suffix, but generally such a suffix denotes a sub-branch or section. Thus AG1 is obviously a branch of the Adjutant-General's Department and is in fact part of the Directorate of Organization, while MP1, also of the AG's Department, is part of the Directorate of Manpower Planning. As an example of the suffix, AG1 pre-war was a single branch, which now has expanded into several branches, each being known as AG1a, AG1b, etc. On the other hand MP1a and MP1b are merely sections of the single branch MP1.

Of course, the War Office has expanded enormously since the war began; pre-war branches have split and multiplied, and new branches dealing with new subjects that were unknown before the war, have been formed. But this does not mean that expansion goes on unchecked. It has often been said, the writer has heard it on more than one occasion, that when an Officer at the War Office thinks he is due for promotion, he gathers under him a few more subordinates, and then announcing that the job has got too big for whatever rank he is holding, gets himself promoted. This, of course, is nonsense. A W.O. branch has a W.E., which has to be approved by the W.E. Committee, the same as any other Unit. In fact their W.Es. are even more strictly controlled than a Unit's, as every proposed increase has to be examined and approved by a civil branch of the Director of Establishments (a senior civil official) before it can even be considered by the W.E. Committee; and the same civil branch is constantly reviewing W.Es. in the light of the ebb and flow of work, and recommending a reduction where it considers such can be made. Furthermore, a proposal for a new first grade appointment in the W.O. has not only to be passed by the W.E. Committee, but has also to receive the sanction of the Treasury before it can be finally approved. So it is no easy matter to get an increase in the establishment of a W.O. branch.

3. How the Business of the W.O. is Conducted

As in an ordinary H.Q., business is conducted through the medium of files. These constitute a convenient means of conducting a recorded discussion, which is carried on in the form of "minutes"; they also hold all incoming correspondence, memos, etc., relating to the subject with which the file deals, as well as copies of replies and instructions issued.

Sometimes as a result of an incoming communication, or for some other reason, a question requires to be dealt with for which the file is "in action" by another branch. In such cases a "Branch Memorandum" or B.M. is opened in which the matter is dealt with, but on completion of the business the B.M. is enclosed in the main file as a permanent record of what has transpired. This enclosing is important, as B.Ms. are not registered (in the central registry) and consequently cannot be traced by anyone else who at a future date wishes to refer to the matter with which they dealt.

In addition to the ordinary files and B.Ms. there are certain special ones which require special treatment.

(*a*) "Top Secret" files have a large red diagonal cross printed over the front; these must be handled by Officers only, or in certain branches by specially selected confidential clerks.

(*b*) Files containing "Secret" matter are marked "Box" in black lettering

on a blue label. This refers to a former rule that such files must be conveyed between branches, etc., locked in a transit box. It now denotes that the file must pass under cover of an envelope.

(*c*) Green B.Ms. contain questions raised by Members of Parliament to be answered by a minister in the House, either orally or by written answer in the Official Report. They are issued by the Army Council Secretariat with an indication of the time and date on which the reply should reach the Secretariat. These B.Ms. are invariably passed by hand to avoid delay.

(*d*) Blue B.Ms. contain either matters raised in letters from Members of Parliament, generally on behalf of a constituent, or (if over-printed in red) a matter initiated by a Member of Council in person. In both cases they have to be given priority.

(*e*) "Personal" files contain the dossiers of all Officers, from the first paper referring to him that arrives in the W.O. The number is the same as an Officer's personal number and has a prefix of the letter P/. These files are stamped "Not to be seen by the Officer to whom this file relates" for obvious reasons! (N.B.—A confidential report on an Officer is not kept in his personal file, but in a special file in the custody of the Military Secretary.)

All files are kept in a central registry, which is responsible for opening new ones as required, and for recording the whereabouts of all files, so that anyone requiring a file either gets it direct from the Press, or is told with which Branch it is in action. To enable this to be done, files are passed from one branch to another through "Transit" staffed by officials of Central Registry who record the movements of all files. If in a case of great urgency a file must, to save time, be passed direct by hand from one branch to another, the move is reported to Registry on a special pink-coloured slip, and is recorded.

Business is also conducted by means of Standing Committees and *ad hoc* meetings. When a number of Directors or branches are involved in a question under discussion, it is often best to hold a meeting of those concerned, with the representative of the sponsor Director or branch in the Chair. Everybody's views can then be obtained simultaneously and points of divergence can be thrashed out. The results of meetings are embodied in the minutes, produced by the Secretary, and action taken accordingly. To act as Secretary at a meeting may be one of the first jobs given to a junior Officer. It is not difficult to produce minutes of a sort, but to produce good and concise minutes which accurately record the trend of the discussion, and clearly indicate the action to be taken (and by whom) requires a good knowledge of the subject discussed, and what Branches the various people present represent.

Standing Committees are usually constituted under the authority of the Army Council and have a permanent Chairman and Secretariat. An example is the War Establishment Committee, consisting of representatives of all three branches of the Staff and Finance, and which deals with proposals for new or amended W.Es. Members of Council and Directors may also constitute their own Standing Committees as may be necessary.

4. "Action Taken"

One of the chief difficulties that confronts a new-comer to the War Office is to know who should be consulted when dealing with any particular problem. Very few questions, whether put to the War Office from outside, or initiated inside, concern one Branch only or even one Director only. Another difficulty that can only be overcome by experience is to know on what level a particular question should be dealt with. Some apparently minor matter which on the face of it could well be decided on third grade level, may require

reference to a Director owing to the indirect effect it may have on another more important matter under discussion on a higher level. Or a seemingly innocent enquiry calling for a straightforward reply may compromise a change of policy that has been decided upon by the Army Council itself. On the other hand what may appear to be a matter of major importance can be dealt with throughout on Branch level, if the policy governing the action to be taken has previously been settled by Directors.

It is this multiplicity of interests, both vertical and lateral, which have to be considered and consulted that sometimes causes what to the originator of the enquiry appears to be unwarranted delay. This can best be illustrated by an example. Let us suppose that a certain C.R.E. considers that all Class I Electricians should wear a special badge, and puts this up "through the usual channels." If this should reach the War Office, a file would be opened with the C.R.Es. letter and remarks of Higher Formations in it; it might have attached to it other files that had dealt with similar suggestions in the past. Assuming that no specific policy had been laid down, such as "no more badges until after the war," the following Branches would be interested and would have to be consulted before authority could be given for the suggested badge :—

AG4	responsible generally for dress policy.
OS7	production and issue of the badge.
E3	Engineer-in-Chief's Branch dealing with matters affecting R.E. personnel.
AG7	R.E. personnel Branch.
FINANCE	for financial authority to expenditure
DRAC, DRA, DSigs., DST, DME	Arms of the Service controlled by these Directors all have Electricians Class I; they must, therefore, be asked whether the proposed badge should apply to their Corps.
AG1 (Records)	for Part II Order action and recording the award of the Badge on documents.
AG1c	for recording award in AB 64.
AG19	for possible application to ATS.
AG (Co-ord)	for possible discussion by the Morale Committee.
DTT	Director of Technical Training for opinion on incentive to improve.

Thus a possible fifteen separate interests must be consulted and their views co-ordinated. If discussion goes against the proposal, especially if Finance dissent, it can be turned down without further reference; unless, in in the process of going through "normal channels" it has received the personal backing of a General Officer, when it would be as well to refer it to the Director of the sponsoring Branch—in this case DPS—before finally turning it down. But if all are agreed (including Finance) that the proposed badge should be authorized, the result should be reported to the Director concerned for his approval. This he may give straight away, or he may decide to refer it back on his own level for further discussion, particularly if he himself does not concur in the decision reached on Branch level.

All this takes time, and meanwhile the author of the proposal cannot understand why the War Office is unable to give a reasonably quick answer to a simple straight-forward question!

When the decision has been made, it must be communicated to the originator, again through the "normal channels." There are several ways in which W.O. correspondence is given to the outer world, varying in

formality. The most formal is the " commanded " letter, used for decisions of the Army Council, or for a matter of important policy that has been discussed on Council level ; it is also used by the Military Secretary in certain forms of correspondence with individuals. It starts: "Sir, I am commanded by the Army Council to inform you . . . ", ends " I have the honour to be, Sir, your obedient Servant," and is signed by a civilian official, normally the Assistant Under Secretary. All such letters must be initialled by the Officer responsible (usually not below first grade) and sent over to the A.U.S's. room for signature.

The next in degree is the " Directed " letter, which is used for a matter of fair importance (even if it has never been on Director's level) and for letters to members of the public. It starts : " Sir, I am directed to inform you . . . " and is signed by a Staff Officer " for " the Director concerned ; it also ends with the formal " . . . honour to be . . . ," even if the officer who signs is a Brigadier and the addressee a Subaltern !

Then there are Urgent Memoranda, Secret Cipher Telegrams, teleprinter messages, and ordinary memos ; these last four form the bulk of war-time correspondence.

To discover from which Branch a communication has emanated, it is only necessary to look at the reference number, which always includes the number of the Branch. This is also true of A.C.I's, the number of the Branch responsible being included in the reference printed at the end of all A.C.I's.

5. Personal to the Staff Officer

Life and conditions generally of an Officer on the Staff of the War Office, differ in many respects from those at lower formations. As pay is always of prime interest, we will take this first. An Officer posted to the War Office draws additional pay at 2/- a day, over and above normal staff pay as allowed by the Royal Warrant ; Officers holding appointments in the rank of Colonel and above also draw it. R.E. officers holding recognized technical staff appointments may also draw additional pay under Art. 370 R.W.P. in lieu of engineer pay, or technical pay under A.O. 58 of 1943. There is no mess, and all Officers are placed on the lodging list for purposes of allowances, and in particular Officers are not permitted to have soldier servants, even if they forgo their servant allowance.

Finding one's way is not always easy. But both in the main building and in some of the subsidiary buildings the first number of a room indicates the floor. In the main building, too, there are plans hung up on the corridor walls. Telephone numbers do not correspond with room numbers—obviously, since one room may have several telephones—but a comprehensive directory on the loose-leaf principle (to facilitate amendments) is maintained.

In most Directorates there is night duty. This varies, of course, according to the Branch or Directorate. In some of the General Staff Branches, night duty may come round every three or four days. In administrative Branches, night duty may be organized on a Directorate basis, in which case the roster may take two months or more to work through. Bedding is provided, and of course, there are facilities for washing, etc. Breakfast is more difficult and most Officers have their particular haunts for this important meal—for the Whitehall buildings one of the best being the Queen Elizabeth Club for Officers (Y.M.C.A.), opposite the Whitehall Theatre. But all things considered it will probably be best for yourself and your colleagues, if you take your weekly day off following a night on duty.

THE EVOLUTION OF THE MOTORCYCLE

By Lieut.-Col. E. W. C. Sandes, D.S.O., M.C., R.E. (retd.)

THE invention of the 4-cycle internal combustion engine by Dr. Otto in 1876 heralded the era of mechanized road transport. It is true that, as far back as 1769, Cugnot's steam carriage had lumbered slowly along the roads of France, and that in 1801 Trevithick had run a steam carriage in the streets of London, but these vehicles were regarded as mere curiosities and nothing came of them. Steam could not compete with horseflesh on the highways, and another century was to elapse before the horse began to give way to the petrol-driven car or cycle. The steam road vehicle was killed by the advent of railways.

Few motorists are aware that the designer and builder of the first motorcycle in the world was an Englishman, Edward Butler, who patented a motor tricycle in 1884. Until 1896, when the first Motor Car Act was passed, the law prohibited a speed of more than 4 miles per hour and insisted that a man on foot, carrying a red flag, must precede any motor vehicle. This regulation put the two-wheeler out of court, so Butler's motorcycle had three wheels. He exhibited drawings of it at the Inventions Exhibition in London in 1885. Briefly, it was a standard pedal tricycle with a petrol engine added. In the early eighties, the young and adventurous rode the high bicycle or "penny farthing," but their elders perambulated the roads more sedately on tricycles of various designs, one of which had a small rear driving wheel and two large front steering wheels. Butler adopted this type. His machine had two horizontal water-cooled cylinders, one on either side of the rear-wheel, which they drove by long and curved connecting rods. These curious rods passed above the cylinders and were attached at one end to the forward projecting piston rods and at the other to cranks on an epicyclic 4-to-1 reduction gear on the back axle. The rear mudguard was a tank which contained water for cooling the cylinders. The engine worked on a two-stroke cycle. A mixture of benzoline vapour and air was exploded in the rear end of the cylinder, while the front end formed a pump which compressed the mixture into a reservoir below the cylinder, where it was heated before ignition. On the outward stroke, the mixture was admitted for about a quarter of the working stroke and then fired by a low-tension spark produced by a wiper breaking contact with the piston. Current was supplied by a low-tension magneto or a battery. Primitive valves, of a rotating plug type driven by chains, were fitted at each end of the cylinder, and the explosive mixture was supplied by a form of spray carburettor. Road speed was controlled by a throttle valve, and selfstarting was arranged by using the power of the compressed vapour in the mixture reservoir below the cylinder.

To start the machine, the rear wheel was first lifted from the ground by depressing a pedal which forced two small side-wheels downwards, and when the engine had been induced to fire, the wheel was lowered till it gripped the road surface and urged the tricycle forwards in jerky fashion through a drive of extreme harshness. The solid rubber tyres must have had a short life. Perched on a small wooden seat between the front wheels, the rider steered an uncertain course by pulling or pushing two vertical levers.

Butler's tricycle had features which were far ahead of its time—for instance, electric ignition, spray carburettor and self-starter. Its bad points were its

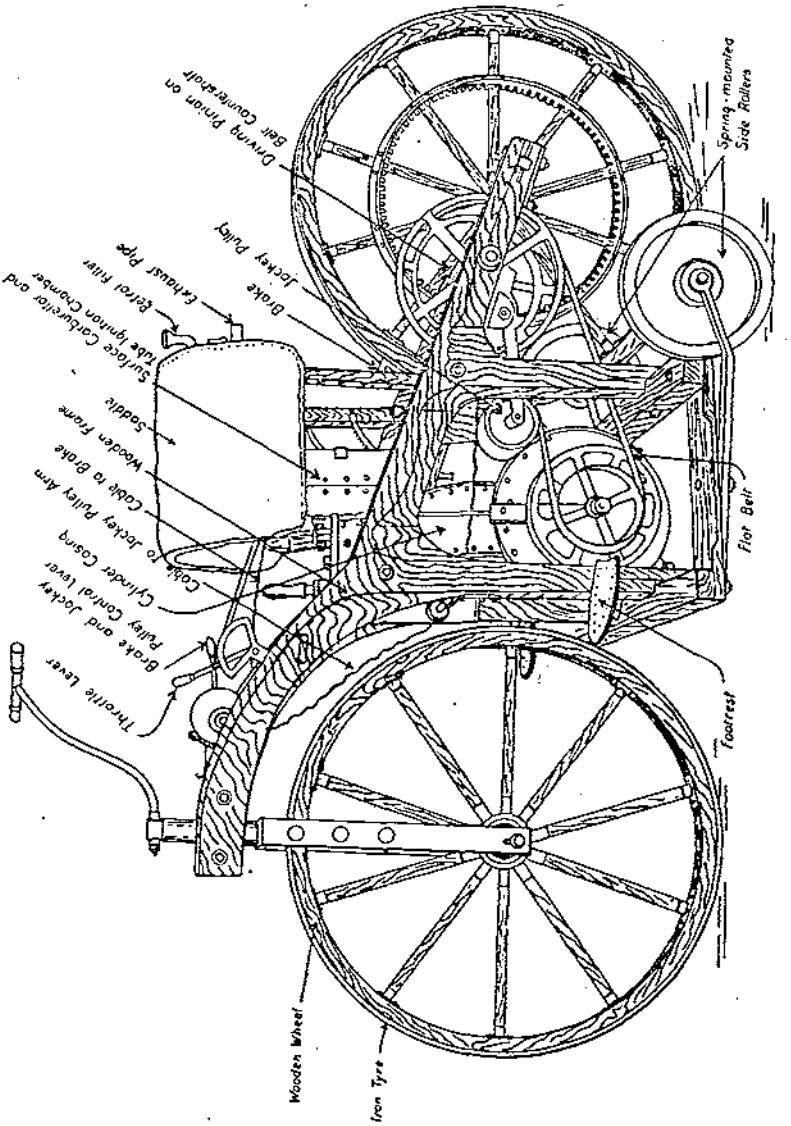
clumsy transmission by curved connecting rods, harshness of drive, tendency to overheat, and insufficient power at the low engine speed attainable. A specimen was built in 1886. Three years later, Butler produced an improved model with an engine in 4-cycle form provided with high tension battery-and-coil ignition. By permitting the engine to run up to 600 r.p.m., and altering the epicyclic gear reduction to 6-to-1, he obtained about 2 h.p.; but even this was quite inadequate for a vehicle weighing 400 lbs., and consequently his praiseworthy adventure into a new field of endeavour came to an end. Nevertheless, he was the pioneer of the British motor industry, though he made no attempt to produce either a car or a motor bicycle.

I wish it were possible to name an Englishman as the inventor of the motor bicycle. That honour, however, must be accorded to a German, Gottlieb Daimler, who patented a high-speed vertical light-oil engine in 1885 and fitted it in 1886 to a bicycle. (See Plate 1.) A specimen is preserved in the Deutsches Museum in Munich. The Daimler engine bore a superficial resemblance to one of the present day. It was air-cooled and had mushroom valves, and the crankshaft was built up of two flywheels in a crankcase. The cycle frame was pre-historic in design and appearance for it consisted of a heavy timber structure supported on wooden wheels shod with iron tyres. Daimler designed, and possibly built, two types of this "hobby-horse" motor bicycle, differing chiefly in steering control. The original design had a straight handlebar of "penny-farthing" type, set behind the steering head and turning the front forks by means of a flat belt. The handlebar could be twisted to tighten or slacken a cord wound round its centre. One end of this cord was attached to a lever applying a brake to the back tyre, and the other operated a jockey-pulley which tensioned the driving belt and secured a free engine for starting or stopping. In his improved design, Daimler substituted tiller steering for the twisting handlebar type and provided a hand-lever in front of the bulky saddle to operate the brake and jockey-pulley. The original model had a round belt drive direct to a grooved belt-rim on the back wheel, but the tiller type had a flat belt which drove a counter-shaft provided with a pinion engaging with an internally-toothed ring attached to the wheel. Spring-mounted side-rollers kept the machine upright when at rest. The vertical engine was enclosed in a metal casing, air-cooling being arranged by a flywheel fan. A surface carburettor provided the explosive mixture, and ignition was by hot tube—a retrograde step from Butler's electric type. The rider was kept unpleasantly warm by the exhaust which emerged direct into the open air from immediately below the saddle. Experiments with both models must have been brief, for neither ever appeared on the market. Motor bicycles subsequently departed considerably from the Daimler layout, though in process of time they reverted to it as regards main structural principles. Continental firms soon lost interest in Daimler's bicycle and turned their attention to cars, while British designers, handicapped by the absurd speed limit, made no attempt to enter the field.

The three-wheeled motor car produced by Carl Benz of Mannheim in 1885, and its successors between 1886 and 1900, did much to demonstrate the possibilities of motor transport on the roads. The motor bicycle was too unweildy, noisy and dangerous to appeal to the public. The early Benz car was a two-seater resembling a high dog-cart with a front wheel added. It had a single water-cooled horizontal cylinder over the rear axle, which was driven by a complicated system of belts and chains. Steering was by tiller, and ignition by battery and coil. An improved 1888 model was probably the first petrol car ever brought to England, where it was manufactured later as the Benz-Roger; but, as the engine could develop only 1½ h.p. at 300 r.p.m., its maximum speed was limited to 10 m.p.h. on the level on top

PLATE I.

DAIMLER, 1886



gear. A four-wheeled Panhard-Levassor car of 1894 make was brought to England in 1895 by the Hon. Evelyn Ellis. This vehicle had a 2-cylinder water-cooled engine in the fore part, driving a longitudinal shaft through a friction clutch, whence the drive was carried by another shaft, gear box, bevel gearing and chains to the rear wheels. It had a float-feed carburettor, and ignition was by hot tube. It preserved the " horseless-carriage " appearance of the Benz-Roger, and as it weighed 15 cwt. and the engine developed only 4 h.p. at 800 r.p.m. it jibbed at any moderate gradient.

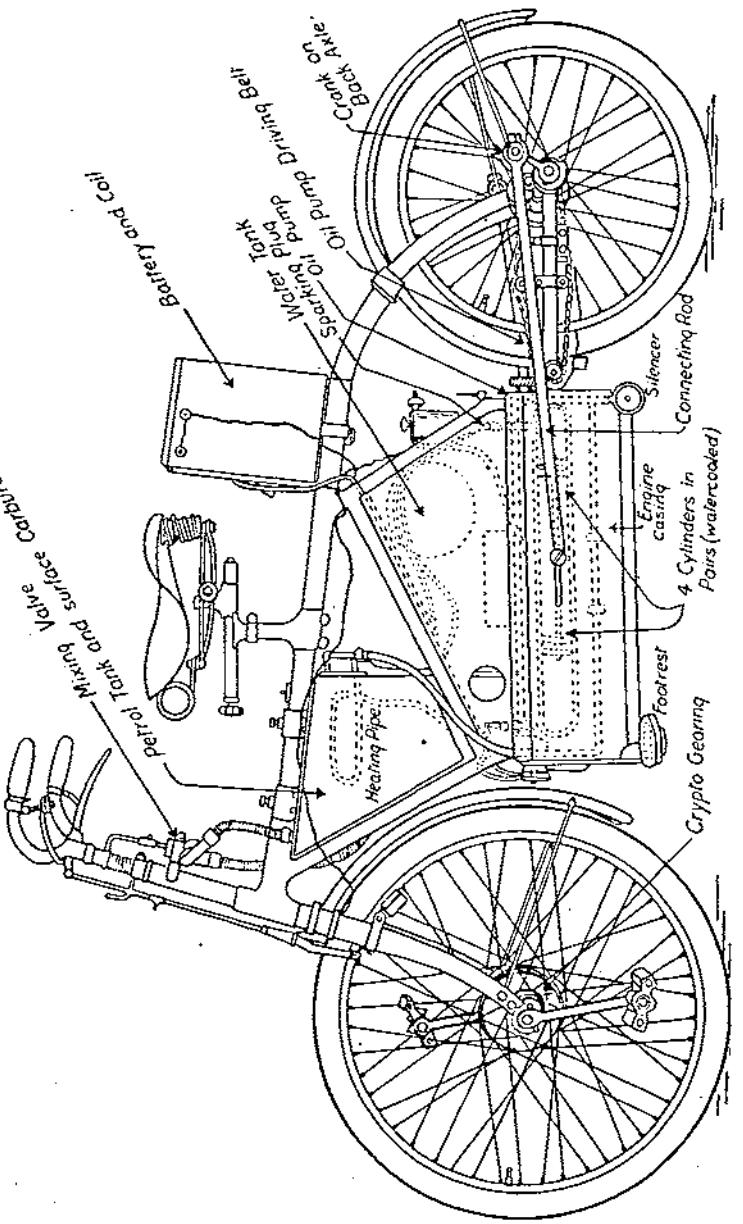
At length, in 1896, motor vehicles in England were permitted to run at 12 m.p.h. and F. W. Lanchester built his first car and put it on the market in 1897. It had a 2-cylinder air-cooled engine and was of phæton type with tiller steering, wire wheels, pneumatic tyres, shaft drive, cone clutch, and an epicyclic gear giving two forward speeds and reverse. The Lanchester had low-tension magneto ignition and was probably the first to incorporate it. In 1898 the 4-cylinder Daimler was being manufactured at Coventry and was the first British car to bear some resemblance to the modern vehicle, though the rear wheels were larger than the front and all were of wood with solid rubber tyres. The engine, developing 12 h.p. at 700 r.p.m., was placed vertically at the front and drove the rear wheels through a gearbox, transverse differential shaft and chains. The Daimler had four speeds and reverse, spray carburettor, automatic inlet valves and L.T. Simms-Bosch magneto ignition. These cars, and a few foreign quadricycles or tricycles such as the Bollée of 1896, were the only motor vehicles on British roads before the birth of the motorcycle industry in this country.

Meanwhile, untrammelled by a speed limit, Germany had forged ahead in design and had placed on the market the first practical motor bicycle, the Hildebrand and Wolfmuller (H. & W.), patented in 1984 and manufactured in Munich in 1896. The H. & W. had features copied from the Butler tricycle of 1884, and, in its turn, influenced the design of the first motor bicycle built later in England. The frame was composed of four horizontal tubes, united at their front ends to four inclined tubes which were connected at the top by crossbars carrying the steering head. On this platform was a 4-stroke engine with two horizontal water-cooled cylinders, the drive being carried by long connecting rods to parallel cranks attached to the axle of a very small (22" disc) back wheel. The mudguard above the wheel was hollow and contained water. Each cylinder-head had a spring-loaded automatic inlet valve and a mechanically operated exhaust valve. A surface carburettor, with a mixing valve adjusted from the handlebar by a small lever and chain, supplied the explosive mixture. Tube ignition was arranged by heating two nickel tubes over a spirit lamp housed in a box attached to the cylinder-head, and below the lamp-box was a combined silencer and air-intake. Lubricating oil was stored in the rear down tubes of the frame. The machine had a maximum speed of 24 m.p.h. and weighed only 115 lbs. Perhaps its most interesting feature was the diminutive back wheel, designed to reduce the extreme harshness of the direct drive.

At length, in spite of the speed limit and the consequent start gained by foreign competitors, an Englishman set himself to design and build a reliable motor bicycle. In 1895, Major H. C. L. Holden, R.A. (afterwards Brig.-General Sir Capel Holden, K.C.B., F.R.S.) happened to be in a good position for experimental work as Superintendent of the Gun Factory at Woolwich Arsenal, and produced, in 1896, a design based partly on the H. & W. machine. (See Plate 2.) The Motor Traction Company manufactured some models but could not exploit the machine properly although it had many novel features. Nevertheless, it remained on the market until 1902. The Holden followed the H. & W. design in that the engine had horizontally-

PLATE 2.

3 H.P. HOLDEN, 1897



opposed water-cooled cylinders and the drive was transmitted by long connecting rods to a small back wheel: but whereas the H. & W. had only two cylinders, the Holden had four, so the drive was smoother and there was less tendency to side-slip on greasy roads. Also, the engine was actually incorporated in the frame. The pistons of each pair of cylinders were in one piece, and the connecting rods to the parallel overhung cranks on the back axle were hollow. Although each pair of pistons moved together, the impulses were arranged alternately at each end, thus securing an impulse at each stroke. Automatic inlet valves and mechanical exhaust valves were housed in the cylinder-head castings. An exhaust valve lifter gave easy starting.

The surface carburettor of the Holden motor bicycle deserves some description, since carburettors of this type, though of somewhat different design, were popular until 1903. A petrol tank, located in the front triangular space in the frame, incorporated the carburation arrangement. The tank had a longitudinal diaphragm of copper wire gauze through which air was drawn on its way to an ingenious mixing valve on the head tube. The diaphragm, being wet with splashing petrol, provided a large surface from which the rushing air took up petrol vapour. In the mixing valve the rich mixture met a supply of pure air entering through a self-closing valve, the quantity of air being regulated by a piston adjusted by a handlebar control lever. The lever had a form of "stop" for slow running purposes—a very modern innovation. To warm the mixture and assist carburation, part of the exhaust gas was led through the tank in a curling pipe. It should be remarked that commercial petrol was then extremely volatile, being equivalent almost to modern aviation spirit, and that consequently, provided the engine power was low, surface carburation was moderately efficient. Holden's carburettor differed in detail from the type adopted later by several makers. This pattern consisted of a triangular tank having a vertical chimney, through one wall in which telescoped a tube forming the main air inlet. To the bottom of the tube, and above the petrol surface, was attached a flat plate which the rider could adjust by the telescopic arrangement so that it lay always about $\frac{1}{2}$" clear of the petrol, the necessary level being indicated by the stem of a float projecting from the top of the tube. The petrol in the tank was warmed by a branch of the exhaust. On the suction stroke, air flowed down the chimney and under the plate, picking up vapour from the surface, and the mixture then rose to the apex of the tank, where it entered a transverse barrel containing a rotating sleeve with orifices for admitting extra air and regulating the amount of mixture passing to the engine. Mixture control was difficult owing to vibration on rough roads which often caused excessive generation of gas, and an adjustment of the extra air lever on the tank had sometimes to be undertaken on most inconvenient occasions, for instance, when negotiating a sharp corner with only the left hand on the handlebar. The stem of the float also needed constant attention, for if the carburation chamber was too full, the mixture would not fire. I had many hair-raising experiences with a surface-carburettor machine. Sometimes, it would merely sulk; on other occasions, it would refuse absolutely to start. But at its worst it would beguile me by sweet running on an even road, and then, taking the bit between its teeth at a corner, career straight for the ditch!

Lubrication in the Holden machine was effected mechanically by a small pump driven by a belt and skew gear from the rear hub, and cooling was arranged by water-circulation from a tank in a compartment above the engine. Ignition was by electric spark, a secondary battery and coil being carried on the top tube behind the saddle. A contact breaker was fitted on the rear hub, and a commutator on a camshaft distributed the secondary current to the four sparking plugs. The engine developed a nominal 3 h.p. at 420

r.p.m., giving a speed of 25 m.p.h. on the level. The 1897 pattern Holden was beautifully made and was probably the first 4-cylinder road-vehicle of any kind to be designed in this country, but it had an odd appearance because of the advanced position of the saddle which necessitated front-wheel pedals and an epicyclic hub-gear. Footrests were provided so that the rider could remove his feet from the revolving pedals. A specimen of this remarkable machine, and of others mentioned in this article, may be seen in the Science Museum, South Kensington, to the Director of which I am indebted for much information and assistance. The Holden met with little favour in the Press, where it was affirmed that motor bicycles in general were pernicious because the benefits of healthy exercise were lost by the application of motor power to a pedal cycle. It is evident that the members of the Press had never attempted to ride an early motorcycle, for I can guarantee that such a machine, could, and often did, give its rider far more exercise than any "push-bike." The Press may have taken its cue from certain eminent engineers who held a low opinion of mechanical road transport. After witnessing some trials of "horseless carriages" in France, one of these gentry wrote in a standard work on Gas and Oil Engines "There will be no great future for this type of locomotion on account of the inflammability of the fuel." Comment is superfluous.

In a small publication entitled *Early Days of the British Motor Cycle Industry*, kindly lent by the Editor of *The Motor Cycle*, Mr. E. W. Walford writes:—"One cannot help being struck by the simplicity of the earliest motor bicycles. Change-speed gears were conspicuous by their absence, and the very simplest drive was adopted between the engine and the road-wheel. There were no spring-forks, stands or carriers, but pedal equipment was an essential feature. It must be borne in mind that the motorcycle involved the development of a completely new industry, overlapping a number of other trades. The engine was a mechanical job beyond the capabilities of the bicycle-maker. Of carburation, nobody really knew anything, and the requirements of electric ignition were not properly understood. Everlasting troubles were experienced with electric ignition, not because the principle was wrong, but on account of the defective components which were fitted, since the manufacturers did not realize the conditions under which these would operate." Without spring forks, the machine bounced horribly on rough roads. Electric connections worked loose. Accumulator cases cracked, and the acid ate its way through the walls of the battery compartment in the tank. The plates buckled and sulphated. Lubricating oil percolated from the crank case on to the belt-pulley, whence it was sprayed on to the rider's trousers. Belts slipped and broke, and after the pulley had lost its correct V-section groove, the belt slipped still more persistently. Piston-rings and gudgeon-pins fractured. Carbon formed rapidly on the piston heads. Cylinders overheated. Valve-springs failed, and the valves pitted rapidly or seized in their guides. Sparking-plugs oiled up, and every fitting which could drop off unobtrusively did so with the least possible delay. There was, indeed, no end to the tribulations of the pioneer motorcyclist.

Today, with a garage round every corner, it may be difficult to realize that, at the beginning of the century, the inexperienced motorist, even in England, could rarely get expert advice outside the larger towns, and overseas he had to rely entirely on his own ingenuity, often with disastrous results. The small book of instructions supplied with each machine gave little information. Because the silencer of a machine which I owned in India was most ineffective, I encased it in a canvas bag and thus secured a really silent exhaust; but after covering a few miles, the machine was nearly destroyed by fire, for the flames from the bag were then lapping the petrol tank which was immediately

above the silencer. Again, seeing a tempting oil-hole in my high-tension magneto, I injected a liberal dose and spent the next week in trying to extract it from every part of the apparatus. On the road, every motorist regarded his fellow enthusiast as a brother, and it was a point of honour never to pass a breakdown without an offer of help. Thereby hangs a tale. An unscrupulous driver once boasted that he had never yet mended a puncture. He explained that he always drove with his young and pretty wife and, should a puncture occur, left her and smoked a pipe behind the nearest hedge. Before the pipe was finished the puncture had always been mended by some chivalrous fellow motorists, and he then knocked out his pipe and resumed his journey with clean hands but not too pure a heart.

While Holden was designing his motorcycle, a man named E. J. Pennington arrived from America and startled the British public with extravagant claims for a machine of somewhat similar arrangement. The Pennington motor bicycle of 1896-97 was advertised profusely, one poster showing it in mid-air in a flying leap over a wide stream with high banks. It had two horizontal air-cooled cylinders located actually *behind* the back wheel, which they drove by short connecting rods and cranks. Petrol was supplied through one of the rear down-tubes, and the only method of speed control was by twisting the stem of a long needle-valve extending from below the saddle to a petrol valve and air intake behind the cylinders. There was no proper carburation. Ignition was secured by chloride primary cells, an induction coil, and low-tension plugs. Each plug carried a spring wiper, and each piston had a projecting stirrup contact. As the piston approached the end of the compression stroke, the stirrup engaged the wiper, and a spark occurred as the wiper sprang into the aperture of the stirrup. On the reverse stroke, there was a similar spark as the wiper left the stirrup. The ignition system failed rapidly because new spring-wipers are needed constantly. Two specimens of Pennington's machine were made at the Humber Works in Coventry. It could attain a speed of 30 m.p.h. on the level, but as it had neither exhaust valve lifter nor compression release tap it was most difficult to start, and it seldom covered more than 10 miles without a breakdown. Also, it was extremely prone to sideslip on bends as the centre of gravity was so far back. Attracted by flamboyant advertisements, the British public ordered a number of these machines, but they never got them. Pennington is said to have received no less than £100,000 for his invention and retired well satisfied. His operations were probably the indirect cause of the slump which followed the boom in the motor industry at the beginning of the 20th Century.

Pennington was connected with another financial adventurer, H. J. Lawson, who had formed a " British Motor Syndicate " after purchasing the patent rights of the foreign Daimler and De Dion engines. An exhibition of motor vehicles, held in London in 1896, helped Lawson to float his next venture, a " Great Horseless Carriage Company" with a nominal capital of £1,000,000. In the same year he launched the Beeston Cycle Company, which produced 1¼ h.p. motor tricycles and quadricycles and had some success in the first motor trial held in Great Britain, the " Emancipation Run " from London to Brighton in November. This was in honour of the passing of the Motor Car Act permitting a speed of 12 m.p.h. The Great Horseless Carriage Company was reconstructed in 1898 as the Motor Manufacturing Company but went into liquidation in 1904. The Beeston Company had closed down three years earlier because, as the Directors said, they had come to recognize the uselessness of the motorcycle for general purposes.

The truth is that the two-wheeler had become thoroughly discredited in the eyes of the public, not only through Pennington's operations but because of its tendency to sideslip owing to its harsh drive at low speeds, an accident

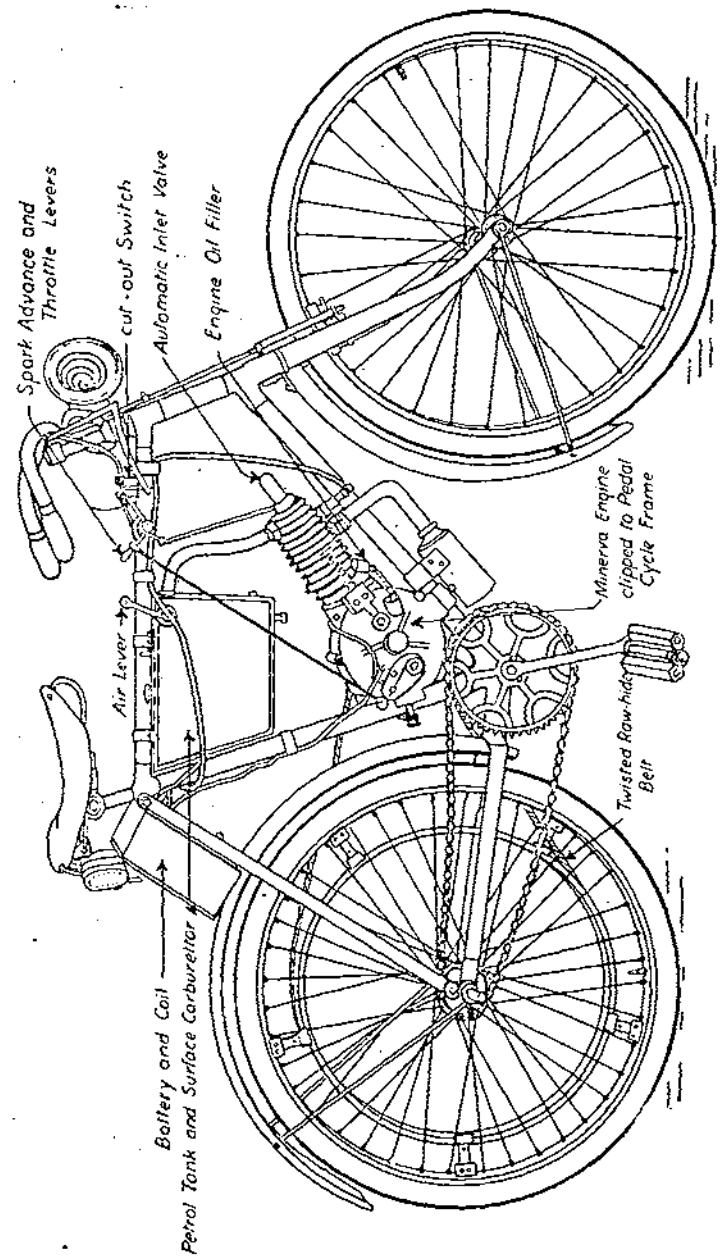
which often resulted in a conflagration when the hot-tube ignition set fire to some leaking petrol. Accordingly, in 1898, public attention became focused on the motor tricycle, and notably on the 1¾ h.p. M.M.C., a copy by the Motor Manufacturing Company of the famous French De Dion tricycle with vertical air-cooled engine behind the back axle and spur-gear drive. In 1899, the Ariel motor tricycle and quadricycle became very popular. These machines had the engine in front of the back axle, but no clutch or change-speed gear. Humbers, Ltd., placed on the market an "Olympia Tandem"—the first tricar to appear. The engine was mounted behind the back wheel, and the passenger sat in a sprung seat between the front steering wheels. Tricars, such as the Phœnix, were in great favour until the sidecar combination was invented in 1903 and gradually ousted them because of its two tracks and greater sociability. Meanwhile, the three-tracker held the field. It had more space for fittings than the bicycle, though it could not always avoid potholes in the macadam surface. In 1899, many leading firms, such as the Riley, Swift, Star and Components Companies, specialized in motor tricycles, and it is interesting to note that in 1900 the War Office ordered a number of 2¼ h.p. M.M.C. tricycles for the use of despatch riders during the South African War. The M.M.C., however, proved unsuitable for the rough tracks of the veldt. A 1,000 miles trial run held in the spring of 1900 showed that the motor tricycle was reliable on good roads, and with some fifty British firms turning out models, the tricycle industry reached its peak.

Then, belt drive revived the popularity of the motor bicycle. The belt started as a flat strap of raw hide; next, the strap was twisted to form a round belt; and in 1902, a leather belt of V-section, such as the Lincona, formed of riveted strips, was adopted by most firms. The side-slip bogey was finally laid by the invention of the elastic V-section rubber- and-canvas belt and by lowering the centre of gravity of the machine. Tricars and tricycles disappeared gradually from the market after many, such as the Rex Company's Rexette, had been brought to a high degree of efficiency. The early three-wheelers were too heavy for a belt drive and very hard on their back tyres.

Improvements in ignition played a part also in securing the final supremacy of the motor bicycle. With the hot-tube system, the engine was practically inflexible. The flame of the spirit burner was often extinguished by the wind, and the rider had either to stop and relight or hold a match against the hot casing and apply it quickly to the burner without stopping—a dangerous proceeding when petrol leaks were common. Electric ignition had been fitted to a stationary gas engine by Lenoir in 1860, and Carl Benz had adopted it for his petrol car in 1885. By 1900, its use on motorcars was almost universal, but the battery-and-coil system was always installed. For motorcycles, however, there was a growing tendency in favour of low-tension magneto ignition in which a magneto supplied current of low voltage to a make-and-break device inside the cylinder (as in the Pennington) and the armature was oscillated instead of being revolved as in the high-tension type. About 1903, the high-tension began to replace the low-tension magneto. It simplified the electric system, though starting from cold was often difficult. Whatever the type, electric ignition had outstanding advantages over the original hot-tube arrangement, notably that the time of ignition could be varied and a weaker mixture fired, thus allowing control by throttle. With the adoption of the H.T. magneto, the festoons of electric leads, which encumbered the earlier machines, began to disappear. My experience in 1903 with a 3 h.p. Quadrant fitted with accumulator and non-trembler coil ignition taught me the disadvantages of this system under rough conditions. The sorry tale is told in an article appearing in *The R.E. Journal* of December, 1926, under the title of "Pioneer Motorcycling in India." Yet when I bought my

PLATE 3.

1½ H.P. B.M.T., 1900



second machine, a 3 h.p. Triumph, in 1905, I was advised by the makers to have battery ignition in preference to the magneto on the ground that the battery was more reliable. However, I chose the magneto model and never regretted it.

By 1900, the continent had outstripped Great Britain in the design and production of motorcycle engines, and consequently British firms made a practice of buying foreign engines and fittings and attaching them to pedal-cycle frames, the drive being usually by belt to a rim fastened to the back wheel spokes. The era of "conversion sets" had begun. A typical example was the 1½ h.p. B.M.T. motor bicycle (See Plate 3) with inclined Minerva engine, surface carburettor, automatic inlet valve, battery-and-coil ignition, and roundleather belt drive to the back wheel. Pedalling gear was provided, though the machine weighed only 88 lbs. Werner Bros. produced a model of similar power in which the engine was attached vertically to the front of the steering head and drove the front wheel—a most dangerous position as the centre of gravity was very high, and most unpleasant for the rider, who was dosed with fumes and oil. The Raleigh and Royal Enfield Companies copied the Werner position, but the drive of the Royal Enfield was taken to the back wheel by a very long crossed belt. The Ixion Company placed their 1 h.p. engine in the Werner position, but fixed it in a small triangular frame which could be pivoted by a hand lever so that one or other of two rubber-sided sprockets could be made to press on the front wheel tyre and give a 2-speed friction drive. Mr. A. A. Scott, afterwards famous for his 2-stroke water-cooled machines, made a somewhat similar attachment. The Ormonde had an inclined engine behind and below the saddle; the Kitto an inclined engine behind the steering head; the Lawson, a vertical engine on an extension behind the back wheel. All three had belt drive to the back wheel. These examples show that every firm tried to produce a distinctive layout, often with extraordinary results. Petrol tank, battery, coil and controls were clipped on wherever space admitted. There was a general rush to enter the market, and little knowledge or experience was available.

(To be continued.)

CHICAGO CAMEO

By Col. J. C. T. Willis, O.B.E.

THE Delegates of Fifty-Seven Nations were all assembled in one of the largest hotels in America in which the glittering chromium-plating, the thousands of bedrooms, miles of corridors, lifts, bookstalls, florists and ladies' underwear shops made it indeed, as the advertisements state, "A Veritable Home from Home."

Representatives from every corner of the world, whose gorgeous uniforms made up in splendour what their countries of origin lacked in territorial

expanse, jostled one another at every turn. Through all the days and most of the nights, on all of the thirty-odd floors of the hotel, Parthians and Medes, Edomites and dwellers beyond Jordan chattered, whispered, and declaimed, argued, drank and gesticulated. And at meal times the seven restaurants of the hotel, the Palm Court, the Ocean Liner, the Schloss, the Early Pullman, the Chromium Wonder, the Twilight Sleep and the Chinese Grotto, were all packed with the nations taking their meals. In the least expensive of these it cost but a dollar to open your mouth, and the trifling addition of a further dollar made it permissible to close it again. A light luncheon here could be obtained in less than forty-five minutes and for a total of little more than a pound.

Into this maelstrom I was flown at four hours' notice from a Davis Estate house in Suburbia. My first meal in the main restaurant, eaten to the accompaniment of hasty accountancy and stock-taking on the back of an envelope was also my last. Visions of Mr. Cox, pursing his lips and shaking his head at Mr. King across the Board-room table in far Pall Mall drove me in search of less costly pasturage. The search ended in the Drug Store, a spacious glittering hall in which, in addition to everything else under the sun, the normal stock-in-trade of a druggist could also be purchased. There was a black glass and chromium bar equipped with a myriad bottles and flanked by high stools with custom-built seats. But, most important of all, there were small tables where inexpensive sandwiches could be obtained. I ate there regularly.

Late one evening, when the nightly sandwich was half consumed and the Store was crowded, two of the toughest-looking citizens in Chicago forced their way to the bar. Truck drivers they were perhaps, or hog killers, who knows, but of an unparalleled ferocity of appearance, unshaven, with dirty singlets through which the hair on the chest was growing in a manner reminiscent of cress on a flannel, half covered with an assortment of rough coats piled one on top of the other and huge hands and blue, prognathous jaws.

Chicago, of course, we know. The educational blessings of Hollywood teach us what to expect and it was obvious that they had not come to buy a nail brush. One glance at the lowering brows and pugnacious slouch made it clear that shortly there would be a row, a big row; possibly with shooting and, grim thought, no Orchids for a lone British officer. I watched fascinated, frightened and poised for instant flight. Here and now, surely, would I see the bar tender send two tall glasses spinning down the counter followed by the more slowly moving bottle of Hooch, blushing at the eloquent certificate of purity inscribed upon its label. I was wrong. The first citizen, pulling his cap more firmly over his eyes, clearly, as I judged, to make his subsequent identification impossible, jerked from the side of his mouth the words "Same again?" The lips of the second citizen did not move, his expression did not alter; but from some cavern within his mighty chest rumbled the reply "O.K. by me." I eased my knees from under the marble-topped table and took a firmer grip on my hat. The first citizen leant over the bar and gave his order to the white-jacketed bar tender . . . "Two chocolate sundaes please."

WAR BOOKS AND VICTORY

By J.E.E.

ALTHOUGH the defeat of Germany was accomplished some months ago it is yet too early for many writers to take as their theme the last victorious campaign of the Allies. The serial histories of the war have not advanced so far. That edited by Philip Graves, which still maintains its high standard, reaches March, 1944, in its "eighteenth quarter," and may be noted for the passages it contains concerning the political difficulties of the United Nations. *A Miniature History of the War* from the practised hand of R. C. K. Ensor does, indeed, take us forward to the liberation of Paris; but this model of compression, judicious selection and lucidity consists of no more than eighty pages. Major-General H. Rowan-Robinson whose *From Tunisia to Normandy* is a sequel to his "Auchinleck to Alexander" has striven to bring his story up to D Day; but he is chiefly interesting for his critical commentary of the Tunisian battles and the Italian landing operations. Vol. VII of the *Caxton Publishing Company's serial*, edited by Geoffrey Dennis has many notable contributors, including Admiral Thursfield and Air-Commodore Charlton, but does not keep the recital of events in the various theatres of war at the same chronological level. Major-General J. F. C. Fuller's *Watchwords* is a collection of articles on various phases and incidents of the war reprinted from periodicals, with some fresh matter added; naturally his criticisms are of interest.

Morning will Come by Gordon Waterfield and *Glory and Bondage* by Edgar Snow relate personal experiences in a number of war areas. The first is by a press correspondent and soldier who was in Somaliland, Burma, India and the Middle East, and at Cairo and Chung-king during the period 1940–43; the second describes Russia, India and China at war, and the author obviously knows and understands China best.

Some individual stories of the invasion of Normandy and even of subsequent events have, however, made their appearance. First comes *We Planned the Second Front* by Major John Dagleish who writes authoritatively of the administrative work; his book is full of information concerning the invasion plans he helped to formulate and the difficulties he helped to solve. *Stand by to Beach* is by Gordon Holman, a press correspondent with the Royal Navy, who, from a "headquarters ship" saw the landings on D Day. Later came the air-borne operation at Arnhem which was bound to capture the public interest: *Arnhem Lift: The Diary of a Glider Pilot* is to be commended; *With the Red Devils at Arnhem* in translation is by Marck Swiecicki, a Polish newspaper correspondent who went with the gliders and writes well of what he saw and experienced.

The campaign of 1940 is represented by *The Six Weeks War*, published in New York. The author, Theodore Draper, an American journalist who knows Europe well, supplies a remarkably clear and informed account of the German conquest of Holland, Belgium and France.

Two French books, probably hard to obtain, give excellent accounts of French troops in action: *Corps à Corps avec les Blindés* is by Henri Lespès who commanded a battery of 75's; André Soubiran, a doctor attached to an armoured regiment relates his personal experiences in *J'étais Médecin avec les Chars*. Joseph Kiessel, a French journalist writes in *Army of Shadows* of typical episodes of the resistance movement during the German occupation,

and as a pendant to this comes George Millar's *Maquis*, the author having been dropped in France by parachute, a week before the invasion, to organize special sabotage activities. In *The Three Years of Fighting France* Felix de Grand'Combe describes the Free French effort under General de Gaulle from June, 1940 to June 1943, and Maurice Edelman's *France : The Birth of the Fourth Republic*, in the Penguin series, traces political developments from the Allied landing in North Africa to the liberation of Paris. Before leaving France and the French, attention may be drawn to *Pétain : The Old Man of France* by Janet Flanner, published in New York : it is chiefly a study of the political outlook of the Marshal, " un grand timide."

Russia and the Peace by Sir Bernard Pares, in the Penguin series, gives us a balanced view of the U.S.S.R. which are not regarded by the author as a " Bolshevik menace " ; whilst *Stalin, 1879–1944*, the work of J. T. Murphy, is, in some ways, as good a study of the great Georgian as we have yet had. It does not accentuate Stalin's opposition to capitalism and " Imperialism." Russian military operations are represented by *Behind the Front Line* in which some of the partisan leaders tell their stories.

Polish Peace Aims by Adam Pragier betrays a great distrust of Russia, and in discussing the revision of frontiers has nothing good to say of the Curzon Line. Many Poles will regard the author's idea of a Central Eastern European Federation as chimerical, at least in the form which he desires.

Turning to the old and now smitten arch-enemy : efforts are still being made to persuade us that there is much good in him. *In Tyrannos* contains a by-no-means convincing symposium by many different hands which endeavours to prove that there is a real democratic tradition in Germany ; and K. K. Doberer's *The United States of Germany* seeks to show that the German people have a real, if latent, desire for federal independence. *Germany : From Defeat to Defeat*, by Karl Spiecker, an official of the Weimar Republic, is an apologia for the German people and demonstrates thereby the intransigeant outlook of a " moderate " German. In a far different category come *True to Type*, a selection of letters and diaries of German soldiers and civilians collected on the Soviet-German front ; *The Nazi Culture in Poland*, an impressive record of German misdeeds published by H.M. Stationery Office for the Polish M.O.I. ; and *German Radio Propaganda*, from the American Institute of International Affairs which, as a record of the activities of Goebbels up to the middle of 1943, is interesting for reference, but is a big and very expensive book. *Behind the Steel Wall* by Arvid Fredborg, published in New York, is the record of a Swedish journalist in Berlin from 1941 to 1943 ; it discusses Hitler's military judgment and his relations with the German General Staff. *Der Fuehrer : Hitler's Rise to Power*, in translation is a good study by Konrad Heiden of Hitler and all he stood for, but ends with 1934.

Here, perhaps, is the place to mention *What Buchenwald Really Means*, a pamphlet by Victor Gollancz who, as is to be expected, states his case well ; but to say that the moral responsibility for Buchenwald and similar horrors rests upon the British rather than upon the German people is a gross perversion of reasoning.

Before surveying our own records of naval achievement, *Thrice Against England* by Kurt Stechert, translated from the German, deserves attention. The author studies the effect of our sea power on the invasion aspirations of Napoleon, and of Germany in 1914 and again in 1939 ; he considers that in each case British naval supremacy was, inevitably, the deciding factor and takes a complimentary view of our foreign policy which, it is said, always brings us friends and, eventually, allies.

Northern Escort, by Lieut.-Commander J. E. Taylor, is a tale of a convoy to

Russia before escort carriers were available; as commander of a destroyer the author is well qualified to describe the long fight against U-boats and enemy aircraft. In *Escort Carrier* Lieut.-Commander John Moore writes of the work of these vessels. *Before the Tide Turned* by Lieut.-Commander Hugh Hodgkinson is more ambitious: it explains the naval problem in the Mediterranean before the North African victories, and the excellent narrative includes our withdrawal from Greece and Crete, the Battle of Matapan and the siege of Malta. Lieut.-Commander Trevor Blore, journalist turned naval officer, has for his theme in *Turning Point* the operations in the Mediterranean and the Atlantic during 1943, drawing on his own experience wherever possible.

It is good to see the Merchant Navy represented among the official booklets: *Merchantmen at War*, published for the Ministry of War Transport, is worthy of the subject. Other more individual tributes are *Ocean Odyssey by* Stanton Hope, with fine illustrations, and the smaller *Heroes of the Merchant Navy* by Leonard R. Gribble.

An account of the development of British aircraft up to 1939 has been very well done in *Per Ardua* by Hilary St. George Saunders who was responsible for the official booklets *Bomber Command* and *Coastal Command*. *Tail-Gunner Takes Over* by Flight-Lieutenant R. C. Rivaz is a record of the author's training which turned him from a tail-gunner into a pilot. Good fiction founded on fact, Squadron-Leader Frank Tilsley's stories in *The Boys of Coastal* possess the authentic ring. *Air Aces* is a collection of studio portraits of R.A.F. officers by Gordon Anthony, with biographical notes. Added to the admirable series of official booklets published by M.O.I. is one on the Atlantic ferry-service called *Atlantic Bridge*.

The official record of R.A.F. operations is enlarged by two booklets: *R.A.F. Middle East* which covers the period February, 1942 to January, 1943 and shows how effective was the co-operation of our air and land power; and *The Air Battle of Malta*, June, 1940–November, 1942, which does not omit the part played by naval aircraft and the ground defences. In *Malta Besieged*, R. Leslie Oliver provides a sequel to *Malta at Bay* the long and detailed account starting from 1942. *Middle East, 1940–1942: A Study in Air Power*, by the late Philip Guedalla, is a characteristic production and follows accepted judgments regarding our air strategy.

The Army: From April, 1942 to June, 1943, by Major E. W. Sheppard, is a volume in a series which forms an illustrated record of all three Services in the War; there are good narratives of the first campaign in Burma, the Madagascar operations, the fighting in the Pacific, on the French coast and in Africa; but the pictures form the great attraction. *Parachutist* is a most interesting little book in which "Pegasus" describes in matter of fact fashion his experiences in training and actual operations.

Although the African campaigns have been tolerably well covered, special interest attaches to Major W. B. Kennedy Shaw's *Long Range Desert Group;* for the author was Intelligence and Topographical Officer of the Group which operated behind the enemy's lines in Libya and Cyrenaica: a personal narrative as it was bound to be. *Tobruk, 1941: Capture—Siege—Relief* by Chester Wilmot, the B.B.C. commentator and correspondent with the Australian forces, has been very highly praised for its critical comments and its impressions of the Australian soldier in and out of action. Major Tony Mellor, who was wounded and captured in the Western Desert, describes his escape and his experience of desert warfare in *Machine-Gunner*. Alan Moorehead's three books on the campaigns in Africa are now issued in one volume called *African Triology*.

The New Zealand forces have not yet been written about to any great extent;

but the latest (fourth) booklet published by the Army Board, Wellington and entitled *Return to the Attack*, describes the New Zealand Division in action in Libya : the narrative is short, but there are many maps and pictures. *Troop Target* is the contribution of a New Zealand subaltern, J. H. Fullarton, who writes of his own people in Greece, Crete and North Africa and uses part fact and part fiction.

Italy has not yet received much attention and Richard Tregaskis, American correspondent who writes of the Sicilian and Italian landings, the capture of Naples and the Italian surrender, in *Invasion Diary* mostly supplies a personal narrative with good pictures. Lionel S. B. Shapiro describes his experiences in *They Left the Back Door Open.* Lieut.-Colonel A. W. Valentine has compiled *We Landed in Sicily and Italy : A Story of the Devons*, which has some good photographs and may be regarded as preliminary work in the writing of regimental history : it follows the fortunes of a Regular battalion of the Devonshire Regiment up to September, 1943.

Somerset de Chair's *The Golden Carpet* and *The Silver Crescent*, which describe phases of the fighting in Iraq and Syria, are now issued together in a cheaper—but not cheap—edition called *The Golden Carpet.* An interesting commentary by Glubb Pasha has been added.

The late Major F. Yeates-Brown wrote a welcome volume in *Martial India*, which explains how the Indian Army was expanded to two million men without recourse to compulsion : this is not only a valuable record of achievement but also a sidelight upon the whole Indian question.

The best of the books on the Burma theatre of war is undoubtedly *Beyond the Chindwin* by Colonel Bernard Fergusson who commanded No. 5 Column of Wingate's " Chindits " in the 1943 operations : this makes good and exciting reading, and it has a preface by Lord Wavell. A very graphic story is told in *With Wingate in Burma* by David Halley who covers the same phase in what almost appears to be, but isn't, a personal narrative. C. J. Rollo has compiled *Wingate's Raiders* principally from information supplied by those who took part ; he betrays a prejudice against staff officers who, after all have their virtues and their uses. Dr. Neville Bradley, a medical missionary, has converted his notes made over a considerable period into *The Old Burma Road* which describes the old trade route, very primitive in places, from China to Bhamo.

Lieut.-General H. Gordon-Bennett who commanded the Australians in Malaya has much that is of interest to say in *Why Singapore Fell.* Considering that the official records are not yet available one can hardly look for a more authoritative book ; and the General sees much to praise in the civil administration.

Alan Brodrick writes of China with knowledge in *Beyond the Burma Road* and attractively dispenses a tremendous amount of information concerning South-East Asia generally.

The Crime and Punishment of Japan comes from New York ; it is an analytical study of the Japanese and Japanese policy by Willis Lamott who is of opinion that the victors must insist upon a change in the constitution, remodelling it on Western ideas ; but allowance must be made for Russian influence which cannot be ignored. John Goette, in *Japan Fights for Asia*, gives a first-hand impression of the Japanese war machine as seen in action in China : it is not a flattering view of the aggressor's military efficiency.

The first of our M.O.I. booklets to deal with the War in the Pacific is *Ocean Front ;* it is more remarkable for its fine photographs—another debt to the U.S.A.—than for the amplitude of the text. The period covered extends to the U.S. landing in the Phillipines, and we may be sure that other publications in the series will follow in due course.

MacArthur and the War Against Japan is written by Frazier Hunt, a journalist with exceptional knowledge and experience of the Pacific; his admirable accounts of the operations based on Australia are well authenticated and mapped. Another American war correspondent, Ira Wolfert, has put on record in *Torpedo 8* the operations carried out by a squadron of torpedo aircraft. *South from Corregidor* is really a true tale of adventure, for Lieut.-Commander J. Morrill, U.S.N., and P. Martin describe how seventeen American sailors escaped from the fortress on the day it was forced to surrender and reached Australia after a passage of over 2,000 miles in an open launch.

Much remains to be written about the war effort at home, but authors continue to give their individual experiences and impressions. Richard Dimblebey, the B.B.C. commentator, in *The Waiting Year* has for his theme Great Britain during the twelve months which preceded the invasion of Normandy; he has much that is interesting to say concerning the preparations for invasion, but writes also of a bombing raid over Berlin. *The Unbeaten Track* by Collie Knox is an admirable record of the war activities of the Great Western Railway. John Brophy's *Britain's Home Guard* is, perhaps, the best book on the Home Guard which has yet appeared; the author was an original member of the L.D.V.; typical portraits by Eric Kennington are included.

With the San Francisco conference brought to a conclusion the news and theories of the publicists concerning post-War reconstruction tend to become merely academic. Lionel Curtis in *World War: its Cause and Cure* advocates the "limited sovereignty" of nations and international controls leading to the establishment of a "world state." Professor E. H. Carr's *Nationalism and After* adopts much the same view; for the professor sees "national sovereignty" as an anachronism. Sir William Beveridge in *The Price of Peace* advocates compulsory arbitration for international disputes and expects Great Britain, the U.S.A. and the U.S.S.R. to give the lead. It will be seen that the tendency is to encourage every nation to meddle in the affairs of others. *A Soldier Looks Ahead* by "Captain X" is a little book containing much good sense and some wrong-headedness; the author, formerly a Labour journalist was reported missing during the Normandy campaign. More in line with the Charter formulated at San Francisco are the views expressed by Air Vice-Marshal Donald Bennett who in *Freedom from War* advocates a Supreme World Congress and the formation of an International Law Force: almost a pool of the armed forces of the world.

The Control of Germany and Japan, published by the Brookings Institution Washington, is of particular interest, for here we have the considered opinion of two economists of repute, Harold G. Moulton and Louis Marlio, that economic control will not suffice: military control is essential.

In a category of its own comes *The Anatomy of Courage* by Lord Moran. To say that it is a study of man in modern battle and his reactions thereto is, perhaps, hardly an adequate description of the book which all soldiers can read with interest.

Students of war may be reminded that *Clausewitz*, translated and condensed, appears in a volume of the *Living Thoughts Library*; but whether his philosophy will be more readily assimilated and understood in this form is open to doubt. Lieut.-Colonel Joseph I. Greene "presents" the great theorist who was, it must not be forgotten, a practical soldier in his time serving both Prussia and Russia; there is a foreword by Major-General J. F. C. Fuller.

EASTERN ARMY BOAT BRIDGE

By Major G. G. Layton, R.E.

A. FOREWORD

1. This is an account of the bridging of a River with Eastern Army Boat Equipment, of failures which occurred, and of some of the lessons to be drawn from them. The bridge was constructed by Ind. A.W. Coy. of Fourteenth Army Engrs. This river is notorious in the district for its treachery and speed, but from all accounts it is a fairly close parallel to the River Chindwin in its behaviour. It is thought that it may be of general interest for this reason.

2. The account is given therefore from a technical point of view and does not pretend to picture the scene, nor to take note of what must have been very hard and dangerous work. Considerable nerve must have been required to work on the rafts on both occasions when the bridge broke. Credit must be given to the O.C. and all ranks of Ind. A. W. Coy. who assembled the boats, built the bridge and rescued the pieces. They have again reassembled the bridge and held it open to traffic even with the river two feet below high level.

3. Brief Description of Eastern Army Boat Bridge

The E.A. Boat Bridge was designed to provide a floating bridge for Class 12 loads to release lighter operational equipment for use further forward. It was necessary to design a bridge which would stand plenty of battering, have sufficient free board to withstand severe river conditions and yet be capable of carriage in standard M.T.

The Boat

The E.A. Boat is constructed in pre-fabricated pieces and sections. When assembled, which is always done on the site, it is a heavily constructed punt-shaped pontoon, 40′ long, 6′ beam and 3′ 9″ high and weighs between 3 and 4 tons. Once it has been assembled and caulked it is a permanent structure which cannot be dismantled without damage.

The Bridge

It is a class 12 gunwale loaded floating pier bridge.

One boat forms a pier and two piers connected by a set of superstructure form one raft. The road bearers, chesses and ribands are made of timber, the chesses being positioned by pegs in the outside roadbearers.

The ribands are fixed to the outside roadbearers by pieces of angle iron. (See drawings at Figs. 1 and 2.) The raft connectors consist of steel plates fitted round the end of the riband with a strap over the top. A bolt passes through this strap to the underside of the riband.

On one of the ribands the plates form jaws which fit over the end of the other riband. Articulation is allowed for by a bolt passing through the jaws and the riband. (See Fig. 3.)

FIG. 1.

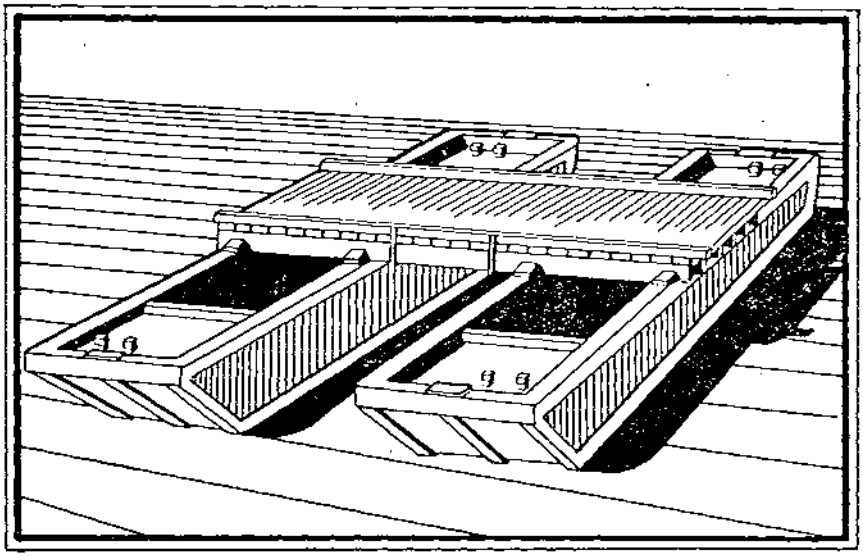
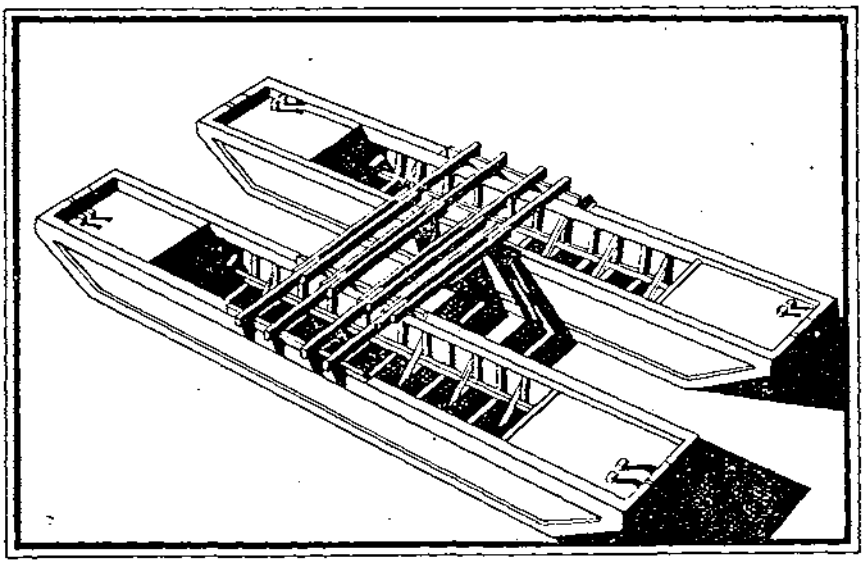


FIG. 2.



The Landing Bay

The landing or half-floating bay consists of one boat with specially long bearers, one end of these rest on the boat and the other on a shore transom.

The boat, even when high and dry, can take the load subject to having a level bearing and reasonable gradient.

For normal bridging purposes the landing bay is joined to the next raft with ordinary connectors.

By this means a considerable rise and fall in the water level can be dealt with satisfactorily.

The Raft

A Class 12 ferrying raft can be made from E.A. Equipment.

A landing bay is required on each bank. The rafts consist of two boats and a set of superstructure.

To allow for the difference in level between the rafts and the landing bays, two steel plate ramps are provided on the ends of the landing bay superstructure. The ordinary connectors are not used in this case. (See drawing Fig. 4.)

The Sliding Bay

Up to date no sliding bay has been put into production.

B. REPORT

1. OBJECT OF THE BRIDGE

(*a*) To provide a fair weather crossing.

(*b*) If possible to keep the bridge in operation during the monsoon period.

The bridge to be in lieu of the existing ferry which serves the Airfield.

2. DESCRIPTION OF RIVER

(*a*) *Fair Weather*

1. Width of river in October, 1943—580 ft.
2. Depth of river at deepest point in October, 1943—60 ft.
3. Speed of flow—2 knots.

(*b*) *Monsoon*

1. Width of river—730 ft.
2. Depth of river—95 ft.
3. Speed of flow—up to 12 knots maximum.

(*c*) *Nature of Bed*

Reported to be soft with a layer of mud silt 20 ft. deep on top.

It was considered that this silt would move when the current reached a speed of about 6 knots. This would complicate anchorage of the boats.

(*d*) *Debris*

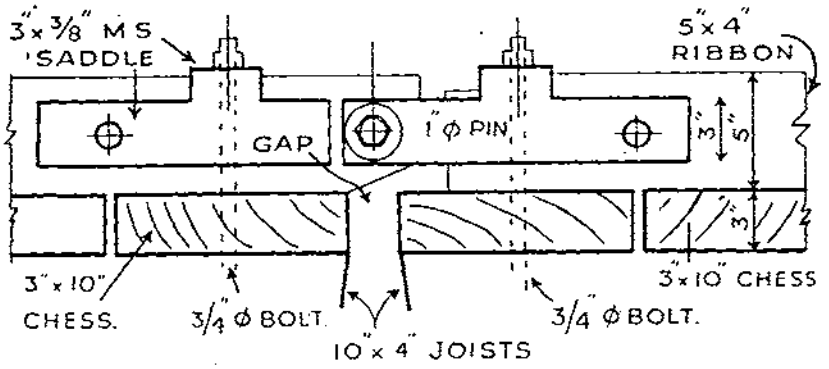
A considerable quantity of debris might come down, also timber and bamboo rafts, which are brought down the river, might get out of control and do considerable damage.

3. PASSAGE OF RIVERCRAFT

To enable river traffic to pass up and down it would be necessry to form "cut," the gap varying from 60 ft. to 200 ft., the latter gap being required only twice a year. This would put considerable extra strain on the bridge due to the two free ends.

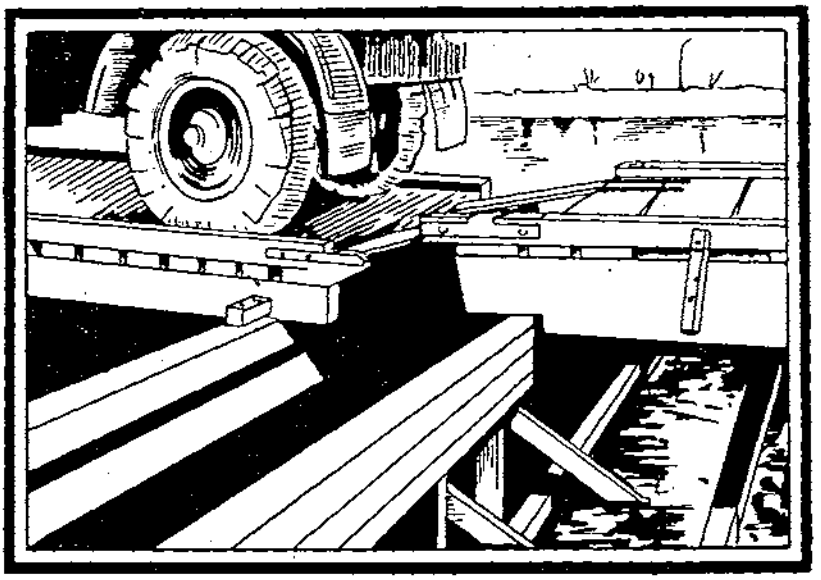
A launch would be needed to form "cut" and keep the bridge clear of large debris, timber, and bamboo rafts.

FIG. 3.



ELEVATION
SHOWING CONNECTION
SCALE = 1½" = 1'-0"

FIG. 4.



4. Requirements for Bridge Construction

(*a*) *Fair Weather*—Rafts, Nos. 35.
—E.A. Longlanding bays—2.

(*b*) *Monsoon* —Rafts, Nos. 44.
—E.A. Longlanding bays—3 (one spare).

5. Moorings

Monsoon moorings were to be concrete blocks sunk in river bed and 3" S.W.R. cables.

6. Performance of Bridge

The fair weather bridge was completed and opened to traffic on 5th May, 1944. The moorings were steel bridging anchors and 3" Manilla cables. Work was still proceeding on production of concrete blocks for monsoon moorings.

The bridge worked satisfactorily until the night of 26–27th May, carrying 300–350 vehicles per day. As the launch was not yet available, four 9.8 h.p. outboard motors were in use.

7. Failure of Bridge

During the night of 26-27th May the river rose some 15 ft. and the landing bays had to be removed, although the bank seats had been raised to allow for the rise in the river. The river had increased in width by some 150 ft. The bridge was ready to be put into new bankseats as soon as the river settled.

The river was back flowing owing to the volume of water from a tributary river which flows into the river downstream of the bridge. By the night of 27th May, the river had started to flow in its normal direction.

The river continued to rise and its speed increased to 5 knots. During this time the bridge had been hit by two big bamboo and log rafts which slewed it at an angle to the bank.

At 13.00 hrs. on 28th May, the 3" anchor cables started to give one after the other in quick succession like machine gun bullets, and the whole bridge moved downstream.

Two motor ferries, which operated alongside the bridge site, were called upon, but could only manage to get a 2" S.W. Rope ashore. This was made fast to a tree of 2'–2' 6" diam. which, on taking the strain, was uprooted and leaped 6' into the air.

Due to the speed and momentum of the bridge all efforts to get cables ashore or check its progress by anchors were useless.

It was decided to break the bridge into sections. This was done and eventually all sections were brought into the bank and moored. One section was only brought under control with great difficulty, and was eventually moored 25 miles downstream of the bridge site. During this time, outboard motors had been brought out, but were found to be of little use.

8. Reason for Failure

The 3" cordage moorings were not sufficiently strong to hold the bridge under the circumstances.

9. Condition of Bridge After Failure

The bridge suffered no ill effects despite its severe handling. No boats or superstructure were lost.

10. Re-assembly of the Bridge

Twenty rafts were towed back to the bridge site by steamers made available by the Joint Steamer Coy., and fifteen were brought back by outboard motors.

The bridge was re-assembled on the monsoon moorings using 3″ S.W. Rope; this operation took four days. The bridge was in full operation by 13th June; there had been no bridge for 17 days.

Gaps of 80 to 100 ft. were provided for the steamer feeder service. These took 60 minutes to open and 90 minutes to close.

11. Second Failure of Bridge

On 15th June the river rose 3′ necessitating the removal of the Western bankseat to allow for a further rise. The river rose another 2′ and continued to rise 6″ per hour. It was decided not to complete the bridge until the river had settled; the speed of the current was about 3–4 knots at this time.

During the night the river rose very quickly and the current increased in speed to 4½ knots.

Shortly afterwards, the bridge was hit by a raft of heavy 20′ logs and some of the cables straightened out, putting a great strain on the superstructure. This resulted in the ribands being pulled away from the roadway, the ribands remained in the line of bridge, while the part of the bridge which had been hit moved downstream about 5 ft.

At this time a great deal of debris and timber was coming down the river, and every possible effort was made to keep the bridge clear.

Within an hour of being hit, the bridge broke completely at the point where it had been hit by the logs and one boat on the edge of the break sank. The break was approximately 75 ft. from the bank and the boats on the bank side of the break including the sunken boat (No. 3) were all made fast to the bank.

The loose end of the bridge, being in the swiftest part of the current, began to straighten its cables and moved slightly downstream under the load of debris which was continually hitting the bridge.

One of the upstream connectors (seven rafts from the loose end) failed, allowing the bridge to bend even more.

It was decided to lift the superstructure, working from the loose end and bring the boats into the bank. Five boats were brought in by this means.

The river continued to rise and eventually reached flood level; it was now moving at 6–8 knots, spates continued to come down in 6″ rises and the speed of the current was increasing. One of the boats adjacent to the raft connector which had failed, had its cable hit by a heavy log and it dived straight into the water. This caused the superstructure to collapse and the bridge had to be cut at this point. This left five rafts and two boats loose at each end in the swift part of the river. The remainder of the bridge being in quieter water.

These five rafts were taking a very severe battering from logs and debris. S.W.R. cables were got ashore from these rafts and fixed to winches in an endeavour to pull the whole into slacker water. Work was continued till nightfall, when the rafts were manned and kept under observation.

The river was travelling at 6 knots and was full of backwashes, whirlpools, and debris. During the night one raft at either end was swamped by a sudden spate and sank. The position of the remaining rafts was so bad that they were abandoned.

By morning only one boat of these rafts remained afloat, everything else had gone. All other rafts were kept under control during the night. The next night the end bay of the main bridge was hit and one bay and one boat had to be disconnected.

12. Reasons for Failure

Before looking into the actual reasons for failure, the following points which directly affect it should be noted :—

i. All anchorages and anchor cables held.
ii. No boat was damaged or made to leak as a result of its being hit by debris.
iii. The speed of the flow did not affect the bridge, the damage was caused by debris and by sudden 6″ spate rises.

The initial failure at 03.00 hrs., Saturday the 17th June was caused in the following manner :—

When the bridge is normally moored by 3″ cable, the cable being heavy drops almost vertically from the boat to the bed of the river and then lies along the bed. As the speed of the river increases the pull on this cable becomes greater, and it tends to straighten out. This movement should take place more or less steadily along the whole length of the bridge. On this occasion however, great strain was put on one point (as indeed it generally will be in rivers of this type), the cables at this point straightened up and the strain was too great for the bridge to hold.

Subsequent incidents and sinkages of boats were caused in the following manner :—

As explained above, the anchor cable drops from the boat nearly vertically and is, for its whole length, loaded with weed and debris. Even when the river is flowing normally, the weight of the cable and its drag causes the upstream end of the boat to lie three or four inches lower in the water than the downstream end.

When a spate comes down, the river rises between 2″ and 6″ and brings with it all types of debris. When this weight of water and debris hits the bridge the cables are forced back and the forward part of the boat comes further down into the water.

In most cases this does not seriously affect the bridge but at a point where there is any weakness, such as a break, or the end boat of a loose end, the boat lacks support from one side and, if it is hit by heavy debris, its nose goes under and the boat is swamped.

13. Conclusions and Future Action

(1) No bridge can be held in this river during spate.
(2) Previous warning of impending floods must be given.
(3) Plant and tackle must be permanently in position to draw the bridge into the bank within two or three hours.
(4) The bridge must be cut before heavy floods—these occur about five times a year on the river.
(5) At least one powerful launch, preferably two, must be available, well upstream of the bridge, to compete with the quantity of heavy debris, and shepherd it in the right direction. A small searchlight or Aldis lamp also is required to enable this work to be carried on at night.

"BOLERO"

A Short Account by MAJ.-GEN. A. G. B. BUCHANAN, M.Inst.C.E.

1. INTRODUCTORY

THIS is the story of "Bolero," and in particular of the part which the Engineers, both British and American, played in it.

"Bolero" was a code word coined by the Combined Chiefs of Staff. It was to be used in planning the reception and the accommodation for the Troop and Supply "build-up" of American forces in the United Kingdom preparatory to the invasion of the Continent.

It was an unprecedented administrative and constructional achievement, and its successful completion was essential to pave the way for the build-up of the forces launched upon the Normandy Beaches on D-Day.

Accordingly, while our great victories in Europe are still fresh in our memories, it is considered that a short account of "Bolero" would be of great interest to Engineers, both British and American, more especially as Official histories in both countries will undoubtedly be slow in making their appearance, and interest will largely have evaporated by the time that they do so.

In order to form a just estimation of the magnitude of the task, it is necessary to recapture something of the "atmosphere" of the end of 1941 when the United States entered the war.

An American Special Observers Group (S.O.G:) had been in this country since the summer, had oriented themselves and conducted many reconnaissances in plain clothes. The British Works Service was in the throes of a complete reorganization, including the introduction of a system of machine accounting. The organization also included a very large increase in staff, notably the District organization—this was fortunate as it gave a framework for the expansion. Civil labour was short and building tradesmen were mainly inexperienced youths, or elderly men who would normally have given up active work. Many materials were in short supply, more especially timber and steel. The outlook for the launch of an enormous works programme could hardly be described as encouraging, more especially as a large part of the British military labour available was locked up in two very large projects, the colossal new Ordnance Depot at Bicester estimated to cost £5½ million and an Ammunition Depot at Kineton to cost £2 million.

2. RESPONSIBILITY FOR PROGRAMME

From the start it was recognized that while the implementation of "Bolero" was a British responsibility, shortages both of man power and materials made it essential for the U.S. Forces to make a large contribution of assistance in both directions.

Broadly speaking, it was for the Americans to state their precise requirements, for the British War Office and Air Ministry to consider them, and then to agree with the Americans as to the parcelling out of the work and supply involved.

The policy of the British furnishing all facilities eliminated the problem of two agencies competing for the same labour and supplies, and the U.S. did not have to set up a duplicate contracting agency.

3. Some Inner History

A bit of the inner history of the start of " Bolero " is of interest.

When the decision was taken to send an American Expeditionary Force to the U.K. the Q.M.G. was asked to prepare for receiving it and to estimate the cost of accommodating it in these Islands. As has been mentioned, the Works Service was in the throes of reorganization and the Q.M.G. felt that in order to carry out this colossal task it might be essential to modify the reorganization. However, the E.-in-C. advised against this and carried his point on the understanding that no delay would be caused.

The Estimate which was asked for in a hurry (as many important Estimates are unfortunately) was produced in half an hour and typed on a half sheet of paper. It amounted to £50 million. It was taken to the P.U.S. (F) by hand and immediately reported to the Treasury who approved this amount also in half an hour.

The final figure of cost was £49·9 million, so the original Estimate which could not be more than an informed guess was marvellously justified. One of the minor wonders of the war !

4. Key Plans

The *1st Key Plan* was issued by the War Office on 31st May, 1942. It provided for accommodating 1,049,000 U.S. troops, broken up as follows :

Air Component	240,000
H.Q.	2,900
Supporting Troops	294,050
Divisions	235,050
S.O.S...	277,000
Total	1,049,000

This was followed on 25th July, 1942, by a *2nd Key Plan*, bringing the total numbers up to 1,147,000, of which it was planned that 904,600 would have arrived by 9th April, 1943 with the balance at 120,000 per month.

These figures however were not destined to last for long, as it was decided to embark on the North African campaign (Operation Torch). This caused the issue of a *3rd Key Plan* on 11th November, 1942, which was as follows :—

1st Contingent—

Air Force	172,000
Ground Force	150,000
S.O.S...	105,000
Total	427,000

This contingent was assumed to arrive by May, 1943, but it was enjoined that no retardation was to be made in the rate of provision of installations required for offensive operations, and the necessary planning and construction were to go ahead at full speed.

The full " Bolero " programme was reinstated on 12th July, 1943, in the *4th Key Plan* :—

Air Force	448,000
Ground Force	567,000
S.O.S.	325,000
Total	1,340,000

This accommodation to be completed by 30th April, 1944.

The large increase of numbers is noticeable, and a still further increase a little later brought the figures up to 1,446,100.

As things turned out the date of the operation for the liberation of the Continent was two months later than had been envisaged when the plan was made. This resulted in 300,000 additional American troops being in the country, and consequently much bivouac accommodation had to be used. As the winter season was over this did not entail undue hardship on the troops.

In addition to providing accommodation for men, it was also necessary to provide depots for stores of all descriptions, and hospitals, the figures for which are given below :—

Depots	*Covered Storage*	
	Southern Base Section	8,734,803 sq. ft.
	Western Base Section	6,492,920 sq. ft.
	Eastern Base Section	1,784,584 sq. ft.
	Central Base Section	931,879 sq. ft.
	Total	17,944,186 sq. ft.
	Open Storage	
	Southern Base Section	15,501,000 sq. ft.
	Western Base Section	13,532,000 sq. ft.
	Eastern Base Section	5,429,000 sq. ft.
	Central Base Section	174,905 sq. ft.
	Total	34,636,905 sq. ft.

N.B.—Southern Base Section was practically identical with Southern Command, but did not include the Bristol Area which was in Western Base Section. Western Base Section corresponded with Western and Scottish Commands, Eastern Base Section with Eastern and Northern Commands, and Central Base Section with the London District.

Hospitals 94,000 beds increased later to 124,000 beds by means of tented expansions.

5. British Difficulties

British difficulties as regards labour and materials have already been mentioned and it has to be remembered that on their side they also had an accommodation problem of no small magnitude.

In order to receive U.S. troops in the Southern and Western Commands much accommodation had to be surrendered and reprovided elsewhere. Many training units which had been established in these locations since the early days of the war had to be turned out and homes provided for them elsewhere. This work was called "*Bolero repercussion.*"

Furthermore before the operation could be mounted, the 30 Corps, consisting of the 50th, 51st and 7th Armoured Divisions, had to be brought back from the Mediterranean and established in this Country, as did also the 1st Airborne Division and many other troops.

6. American Difficulties.

From the American point of view, the policy that the British should provide all the accommodation required created many problems and difficulties which had to be solved and overcome. The principal of these were :—

(*i*) *Scales of Accommodation.* American approved scales were generally in excess of those adopted by the British. Consequently a complete new set of standards for the U.S. Forces in the U.K. had to be worked out and agreed by War Office and E.T.O.U.S.A. It can readily be understood what a lot of conference work was necessary before complete agreement was achieved.

(*ii*) *The British system of Works administration* gave the Americans many a headache. As has been mentioned, the Works Service had only just been reorganized and both Q and Works Staffs had not had time to appreciate their powers and limitations. Delays therefore were frequent and many services were referred to War Office which could have been dealt with at a lower level. While it was, of course, recognized that the British system was a matter solely for the War Office, the U.S. Forces rightly felt that their work should not be hampered or wasted by any slow working of the British administrative machine.

(*iii*) *The location and acquisition of sites* for new construction, especially that of depots, caused much delay owing to the claims of other Ministries, especially that of Agriculture. Available sites were often on low land and on unsuitable soil requiring much work to make them usable. Hospitals often had to be constructed in private parks, miles from a railway, and requiring complete water and sewage disposal systems.

(*iv*) *British and American standards of construction* varied considerably and this became at once apparent when U.S. troops arrived and began working on the programme. The British were accustomed to work with brick, tile, plaster-board and corrugated iron, whereas the U.S. Forces worked with wood, and the use of British materials necessitated training schools for the Americans. Voltages in the U.K. differed from those in the States and the use of British and American equipment intermixed required additional transformers and circuits. Plumbing standards too were different and early arrivals from the States had to be supplied with British tools to which they were unaccustomed.

(*v*) *U.S. Engineer Troops* were best suited for work on large projects such as depot construction in which large masses of earth moving and concrete construction were necessary. But by the time that they arrived in force, the bulk of this work had perforce been arranged for by British labour, both civil and military. The U.S. Engineers had therefore to be dispersed over a number of minor jobs, such as expansions to camps for which neither they nor their organization were suited. It was not until the four large depots at Honeybourne, Boughton, Histon, and Lockerley were authorized that really suitable jobs on which a whole regiment could be employed were available.

(*vi*) *British store nomenclature* was entirely strange to the U.S. troops who had to become familiar with it by slow and sometimes painful experience. In the early days there was no little confusion because of the difference in names and British N.C.O.'s had to be detailed to assist in American store depots.

7. DEPOTS

A standard sized General Depot was planned and first built at Wem (Salop) at a cost of £590,000.

It consisted of 450,240 f.s. of covered storage, 1,375,000 f.s. of open storage and a camp for 1,250 men. Road and rail served, eleven (11) miles of rail and five (5) miles of road. It was started on 14th December, 1942 and completed on 30th June, 1943.

On this model, i.e., 450,240 f.s. of covered storage and 1,250 men camp, five other Depots were constructed and were commonly known at the time as "Wems." They were located at Boughton, near Ollerton, Notts., Histon near Cambridge, Honeybourne near Evesham, Lockerley between Salisbury and Winchester, and Moreton-on-Lugg, near Hereford. The amount of open storage varied of course with the site and averaged 1,450,000 f.s. and rail and road lengths worked out at an average of 11·80 and 4·70 miles respectively.

All took roughly six months to construct, the work at Histon and Lockerley being entirely carried out by American troop labour, while Boughton and Honeybourne were planned and mainly executed by British. The average labour force on these Depots was 1,500 to 2,000.

The largest Depot was at Sudbury-Egginton, near Burton-on-Trent. It had well over one million f.s. of covered storage and 9½ million f.s. of open storage, and cost £1,650,000. This was entirely built by British civil and military labour under the immediate direction of Lt.-Colonel M. H. Board, O.B.E., R.E., who was later responsible for the construction of Wem and Honeybourne, and the planning and start of Boughton. At Sudbury the civil workmen were encouraged to form a Workers Advisory Council which produced many useful suggestions for speeding up work. At a bricklaying demonstration a bricklayer succeeded in laying the colossal figure of 642 bricks in an hour in straight work (believed to be a record).

8. HOSPITALS

Nearly all new hospitals for the American Forces in the U.K. were built by contractors for the Ministry of Works acting as agents for the War Office.

They were of two types, the Station Hospital of 834 beds and the General Hospital of 1,084 beds.

The construction, though hutted, was essentially of a semi-permanent type and hardly that of a theatre of war. The standard was definitely a high one and the staff, as compared with that of a British hospital, was on a lavish scale.

Hospitalization was also provided by converting certain of the militia camps, and also by dual purpose and convertible camps, viz., camps adapted later for use as hospitals.

In all nearly 94,000 beds were provided at a cost of nearly £14½ millions. 30,000 extra beds were later added by means of tented expansions.

The Hospital provision was made as under:—

			Beds.
Existing beds			11,746
Expansions			5,597
New	35 Station	29,106	
	17 General	18,402	
			47,508
Conversions	Militia Bks.	14,929	
	Convertible (10 at 750)	7,500	
	and D.P. Camps (6,000)	6,000	
			28,429
			93,280

Original rough estimate for a Station Hospital was £187,000 and for a General Hospital £250,000.

9. CAMPS

These were mainly built in standard sizes for 250, 500, 750, 1,000, 1,250, or 1,500 men. The majority were fully hutted, or hutted expansions, but a considerable amount of tentage, both winterized and summer, was also used.

10. SPECIAL FACILITIES

The undermentioned special facilities were required and provided :—

6 Shops for the erection of railway locomotives and wagons.
3 Tyre repair shops.
3 Tank repair shops.
5 Heavy vehicle repair shops.
11 Chemical impregnating plants.

11. FINANCE

As has already been mentioned, the approximate cost of the ground force programme of the " Bolero " scheme amounted to £50 millions. This can be sub-divided as follows :

	£ *million*
Accommodation for personnel	14·8
Hospitals	14·3
Depots and Workshops	12·7
Miscellaneous and minor items	8·2

The programme for " Overlord " (liberation of the Continent) cost about another £6 million, but, of course, the distinction in classification of expenditure as between " Bolero " and " Overlord " was necessarily very arbitrary. The latter included all expenditure on concentration, marshalling and embarkation areas, vehicle reception depots, road work, hards.

12. LABOUR FIGURES

American Engineer troops, Royal Engineers, Pioneers, and civil labour were all employed on the programme.

The average monthly labour force was about 40,000, and the maximum was 56,000 (January, 1943). The maximum effective labour force produced by U.S. troops was 25,000.

The number of man months was estimated at 1,010,000.

13. LIAISON

In order to ensure the successful running of the programme it was, of course, necessary to establish a good system of liaison at an early stage. Accordingly an R.E. Officer (Major G. C. Fardell) was appointed as D.F.W.'s Liaison Officer in the Construction and Quartering Division of the Office of the Chief Engineer, E.T.O.U.S.A., in August, 1942, and correspondingly an American Engineer Officer represented his Chief in D.F.W.'s office. Majors Whitmore and Nordyke successively occupied this position. These appointments came to an end in May, 1944, when the work was practically complete. The work of these Liaison Officers was necessarily for the most part unobtrusive, but it was of the greatest value.

There were as well many other Liasion Officers of other branches of the Service.

The writer also served as a British Engineer Adviser at American Headquarters after completing the tenure of his appointment as D.F.W.

Further liaison was achieved by holding Works Progress meetings at the War Office at frequent intervals under the chairmanship of the Deputy Director of Quartering. At these, representatives of Q. Staff, Engineers, Transportation and Finance were present, together with representatives from Commands and Base Sections. At these meetings all items causing difficulty were freely and informally discussed, delays were brought into the limelight, and the general progress was reviewed. Twenty meetings in all were held.

14. Air Force Programme

Though this was controlled by the Air Ministry, and any details regarding the programme must be regarded as outside the scope of this paper, it is nevertheless necessary to make some mention of it in order to complete the picture.

By D-Day ninety (90) airfields were being operated by the U.S.A.A.F. of which fourteen (14) had been constructed by U.S. Engineers and the remainder turned over by the Air Ministry after adaptation.

A Heavy Bomber Station costs about £1 million. It requires over 400,000 sq. ft. of covered accommodation and the runways are equal to nearly twenty (20) miles of concrete road twenty (20) feet wide.

In addition to the actual airfield programme there were a host of other requirements :—

Advance Landing Grounds.
Ammunition Depots (average capacity 20,000 tons).
Tactical Air Depots.
Marshalling Areas.
Repair Depots.

The number of units of U.S. Engineers employed on the Air Force Programme in December, 1943, was :—

Parts of 6 G.S. Regiments,
24 Aviation Battalions,

and some Separate Coys. of various kinds totalling about 24,500.

The strength of the U.S.A.A.F. in Great Britain was well over 400,000 and the cost of the whole Air Force Programme may be taken as £110 million.

When one hears that the number of operational airfields in this Country jumped from two hundred and fifteen (215) in 1940 to six hundred and twenty-four (624) in 1944 some idea of the colossal work involved may be obtained.

15. Conclusion.

In conclusion it must be strongly emphasized that the successful completion of the " Bolero " programme was due to good teamwork on the part of both British and Americans. This was evident not only in the offices where the work was planned, but also in the field where it was carried out. The writer well remembers a visit to Boughton Depot where he saw Royal Engineers, Pioneers, British civilians and American coloured labour all working together in perfect harmony. This is the spirit in which victory is achieved in war, and the spirit in which peace will be ensured in the years to come.

POSTSCRIPT

REHABILITATION WORK IN LONDON

This article should not be published without a brief mention of the friendly help given by some U.S. Engineer Troops to bombed London.

At the beginning of December, 1944, General Eisenhower offered the Prime Minister the use of approximately 3,000 Engineer Troops to assist in the big task of providing accommodation, which the enemy's V-bomb attacks had made distressingly short. The initial plan was to repair damaged buildings, but later it was decided that it was more beneficial to use the bulk of the forces on emergency hutments.

Colonel Philip R. Garges, 1302nd Engineer G.S. Regiment was designated Officer i/c Project, and his regimental headquarters with three Combat Battalions and up to 1,500 men skilled in useful trades drawn from 23 units were assigned to the task.

The bulk of the force lived in Onslow Square, and worked from there to 65 different locations, the most distant being 11 miles away and the average 6·3 miles. Transport which was entirely furnished by the Americans was thus a critical problem.

Work actually began on 9th December, 1944, and continued till the end of February, 1945. During that period 601 huts were erected in the boroughs of Lambeth, Croydon, Lewisham, Wandsworth and West Ham, and 304 houses in Battersea, Camberwell and Penge were repaired.

Materials were furnished by the Ministry of Works and by the Boroughs concerned; plant and equipment was partly American and partly British, and small tools were supplied from British sources.

Two types of huts were used in roughly equal numbers.

(*a*) Uni Seco which uses panels of asbestos board with a filler of cement sprayed packing. Size 23′ x 19′ 7″.

(*b*) Curved asbestos. Size 27′ x 19′ 1″.

In each type there is the following accommodation:

2 bedrooms about 11′ x 9′.
a living room about 13′ x 11′.
kitchen alcove about 11′ x 6′.

Heat is supplied by a central brick fireplace and water, gas and electricity are laid on.

The total acreage of the sites was 38·6 acres and the following totals of construction were achieved:

5 miles of road and pathway.
5 miles of chain link fencing.
4⅓ miles of drains.
6 miles of water piping.
357 brick manholes.

In all just under 900,000 man hours were worked, for the most part in extremely unfavourable weather. Both severe frost and considerable snowfalls were encountered and hampered progress.

In spite of the fact that the design, lay out, and building standards were as required by the Boroughs concerned, thus producing considerable variations, all of which were strange to the troops, a very solid result was achieved, and the most cordial relations both with the Ministry of Works liasion officials and the Borough Councils were maintained throughout.

London owes a deep debt of gratitude to this comradely gesture in the hour of her need.

THE LAST SEAFARING OF A GREAT QUEEN

1.2.1901.

By "Spring"

THERE were about fifteen of us in the smoking room of the Royal Naval Club, Portsmouth, mostly sailors, but among them one or two soldiers, like myself, invalided from the South African war. We sat like graven images, whilst the rain drummed against the windows. The Queen was dead! We thought of those yellowing parchments, with the bold signature traced by that firm little hand, appointing us "trustworthy and well-beloveds" to her fighting services. We thought of our fathers, and our forefathers even, who had served her. We thought of the Royalties of Europe whom she had, for so long, held in her moral sway. We remembered the tales of her; how as a girl she had out-danced every debutante in London and even her Highlanders in the "foursomes" and the "eightsomes" at Balmoral; how the great romance had caught her and carried her all her life; how she had reproved the pompous; how strongly she was rooted in the trust and love of her people. We stood again at attention as she drove, with that marvellous gathering of Empire, to Westminster at her diamond jubilee. We heard again that valiant saying "the word defeat is not known in this house" during those dark days not a year and a half ago. She was dead. The world seemed to totter under us. Then, one by one, we rose, and, with the tread of one who leaves St. Paul's in the middle of the sermon, went our several ways.

Mine took me to that bachelor quarter in the R.E. office, at the entrance to Milldam Barracks. A comfortable fire burned on the hearth, and Diana—the bulldog—gruffed a welcome and came to have her ears pulled. Presently Mrs. Bradley, the caretaker's wife, arrived with the whisky and siphon. She was a kindly but gossipy old soul, but that night her eyes were red. Never a word did she say, even about Mr. Bradley's indigestion, as she poked the fire and filled Diana's water bowl. Then she took a letter marked "urgent" from her apron pocket, laid it beside me, turned down the bed, and left as silently as she had come.

It was from the Major. "The 42nd Coy., R.E. will be on duty outside the gates of Osborne the day after to-morrow. You will be in command. The company will be excused 'works' to-morrow. See that all are thoroughly drilled in the ceremonial. You embark at 7.30 a.m. on H.M.S. *Elphinstone* and a strong company of the R.G.A. goes by the same boat. Haversack lunches, for you may not be back before evening." Going to a side door opening on the barracks I called for the corporal of the guard and sent him for the Sergeant-major. Presently that wise and grizzled old warrior and I agreed upon a solution. Pipeclayed haversack straps were anathema either for tunics or for greatcoats, and it would certainly be the latter. We would take a good square meal and a bottle of beer for each man, but would load them on a handcart. Sapper Jones, that Queen's bad bargain, should be in the shafts, and the buglers should help, with drag-ropes, up the hill at Cowes. Drill-hours fixed, the Sergeant-major left, and presently Diana and I turned in.

It did not take us long next day to get word-perfect. When we play at soldiers we do a trademan's job, and besides the latest draft, fresh from

the "Square" of Brompton Barracks, was as smart as paint. By lunch time it was a case of stop or go stale. We stopped.

It was still dark as we marched down to the wharf. The gunners under Hara were already embarking, and it was good to see Tubby as one of the subalterns. We had gone to the Shop together and Tubby—not exactly an intellectual—passed out safely, but very nearly bottom of the batch, into the gunners. As we filed on board, followed by the handcart, Hara, evidently thinking himself in full command, cast a critical eye upon us. "What is all this?" he said, "haversacks and bottles on a handcart. Is this a Sunday-school treat? What do you mean by turning this solemn occasion into a bean-feast." I trumped his knave with my king. "Major's orders, sir." An angry snort was all the answer he could make.

Presently we were off, threading our way through the long lines of great warships ready to pay their last homage as the Queen, for the last time, took ship on the gateway of England. It was a wet and cold passage and the south-west wind was ominous for the coming events. Tubby was selected to go round the gunners and he and I saw that everyone was as far under cover as possible. "Hara will have your blood if you give him half a chance," said Tubby, "he thinks he's in charge of the whole caboodle," but I do not think any one of us had many thoughts to spare for minor worries that day. The world seemed out of joint.

In an hour or so we were disembarking on the east wharf at Cowes. A battalion of volunteers was falling in behind us as the gunners marched off. Giving the latter ten minutes start I marched the 42nd Company up the hill, and quickened the pace to get blood back into chilled fingers and toes. Sapper Jones and two buglers brought up the rear with the handcart. Then we were in position, on the left of the gunners, in two ranks facing inwards. An infantry battalion from Newport was just falling in on our left when the Submarine Miners from Fort Monckton, under John, arrived to take that place. The gunners, on our right, completed the line up to the gates of Osborne. Falling out the Section N.C.Os. I went through the ceremonial once again with them, and then, by signal, rehearsed the Company for the last time. As we stood easy John came up on one side, saying "Just run through my lot once will you," whilst an acid voice from the other said, "Don't you think it would be in the interests of the Service if the Corps learnt its duties before, and not during, so solemn an occasion." "No doubt you are right, sir," I replied and went off with John to repeat the performance. Then we pooled the men's lunches, for the Submarine Miners were also well found, formed a small commissariat inside the drive of a house behind, and saw that all was ready.

A small group of infantry officers joined us. They had had word that the procession was not to start from Osborne for another two hours, and they, imagining all would be over before noon, had brought nothing to eat with them. It was not till then that John and I remembered that we had not either. The men were well provided, but we had totally forgotten ourselves! There is a time for thought and a time for action, so slipping quietly away I went up the drive of the villa which stood behind us, west of the road, and rang the bell. A smart maid, in cap and apron, answered the summons, and opened both eyes and mouth at the warlike sight before her. I had just asked "Is your mistress at home?" when a pleasant voice from the hall said "All right Bessie, I'll see to it." Bessie fled and I found myself facing a comely young matron. "Madame," I began—and then seeing a fleeting smile in her eye, for I was but a boy, changed-up one—"My dear Lady, there are about a dozen of us officers outside who have no food with us, and we shall not get back till late to-night. Could you give us some sandwiches?

There are still two hours before the procession." "Oh," she said, pondered, and then going to the banisters of some stairs which led below, called "Bridget! Bridget!" A chair, below, scraped over the floor, and a voice came faintly "and me wid the lunch to get, and the kettle boilin' over on me." A door opened and a large shape appeared in the gloom of the basement. Bridget mounted a step or two and, looking up, saw me at the head of the stairs. "Glory be to God" she said, "and he all in scarlet and gould." But her mistress's voice was urgent. "Listen Bridget. There are 12 officers outside, waiting for the procession. They will have no lunch to-day if we cannot arrange it. Now . . ." At it they went hammer and tongs, for they were craftswomen. Kipling's line "For Judy O'Grady and the Colonel's lady are sisters under their skins" flashed through one's mind. "There's the steak for master's dinner," I heard and then shepherd's pie and eggs and bacon got tossed from one to the other. Bridget shuffled quickly down to her lair muttering "Ach the poor craters, and they-all in their tight-lacings." "Now young sir," said mine hostess, "coffee or beer?" "Need one choose?" I interpolated. "Oh, I see," she said with smile for smile. But Bessie had been hovering just behind. "Shall I go to Mrs. Charteris," she said, "and borrow six of everything?" "Off you go, Bessie," came the rejoinder; the swish of a purposeful skirt and she was gone. "Well young sir," I was told, "come in an hour's time; meanwhile this is no place for a man."

The good news was received with rapture. I decoyed Tubby from the acidities of his chief, we saw to the men's feeding, posted scouts against possible happenings, and, the hour passed, knocked again at the door. Our hostess, all friendly smiles, greeted us, and a moment or two afterwards, divested of helmets swords and greatcoats, we sat down to an excellent lunch. As an impromptu it was indeed a masterpiece, and as we smoked the cigarette of peace and sipped our coffee I heard our hostess telling a grey-haired Colonel how greatly the Queen had filled all her life. Grandmother and mother had been the historians; she herself had been brought up as nearly as possible in that same pattern of duty and loyalty. It was incredible at the moment to conceive of a world without her. From time to time she would break off to see the better to our comfort, and nobly did Bessie second her efforts. At one time I noticed the door open a cautious inch or two to allow a round red face to gloat on the effects of the cookery.

All good things come to an end, and it was time to be on hand, so, girt about once more, we said good-bye as we filed out into a freshening shower. A stiff south-wester was bending the trees, and hurrying clouds filled the sky. I stood aside in the hopes of saying a special thank you, but, as the last before me had said goodbye, I saw our hostess stiffen as she gazed across towards Osborne House. Yes, there she lay, in none of the conventional trappings of death. She was bride again, in the yellowing wedding-dress and veil laid aside, long since, in lavender against this very occasion. A tear gathered, and, not to be denied, rolled down her nose and fell, with a plop, upon the doorstep. Groping for a handkerchief she looked up and saw me. "Be off, young sir," she said and stamped an imperious but shapely foot. I stayed not on the order of my going, and so it is that to this day I do not know her name; yet, when I think of her, I think too of the last chapter of the book of Proverbs.

Then the rain ceased. Was she to have Queen's weather for her last seafaring? Coats off anyhow, and as I walked down the line an acid voice enquired "Is the Corps actually beginning to realize the importance of this solemn occasion?" It was, but hours seemed to pass before the bell stiffened us to attention. The Shoulder, the Present, the Reverse arms, and the Rest

on your arms reversed. We stood like images and a great awe fell upon us.

Then came that simple little procession. Sailors pulled the gun-carriage of course, for this was the day of their special tribute. The white pall and the Royal Standard covered the small coffin. Then came the King, who, in all his sorrow, was not allowed to forget the office that now was his. But he was not alone, nor did he wish to claim attention. One vivid picture stands out in one's memory. A white tunic and an eagle-topped helmet, and under it, arrogant and challenging, the face of that grandson whose doom was soon to follow. It was the self-consciousness of that sweeping and half-contemptuous regard which sticks so in the eye of memory. Was he, even then, coining that famous title " A contemptible little army," as he looked at the old men and boys who were taking the place of the active and fit now in South Africa ? that title we were to cast in his teeth at Ypres and Plugstreet, and, thereafter, to wear as our proudest battle-honour ?

Then they too passed, mourning on the right, vain-glory on the left, and presently came the usual urgent staff-officer, with the usual air as of the only son of Atlas. We were to march off quickly, embark at East Cowes and get well out of the way before the Royal Yachts sailed slowly through the expectant fleet. Quietly, but swiftly, we donned our greatcoats, for the weather was worsening again, and marched off. Easy work now for Sapper Jones, with his emptied handcart.

Thick masses of cloud swept over from the sou'-west as we filed onto the old *Elphinstone*, and then steamed over to the north shore, bye-passing that great highway of waiting men of war. Grim and silent they lay in those two mighty lines.

And then the last seafaring began. Black destroyers reached silently out to sea. The *Victoria* followed, with a motionless and giant figure silent on the prow. I do not know who he was. She came with Standard half-masted, and the Royal bier amidships. The minute guns of the fleet began to thunder their last obeisance. Cowes and Alverstoke, Ryde and Portsmouth shook and echoed to that brave salute. And behind came the *Victoria and Albert*, carrying Kaiser and King, with standard at the peak, for the Queen's rear rank man had stepped up into line. Tubby nudged me " Should have been the other way round," he said. I looked at him with a new respect. Indeed yes. They were together again now. Sense and sensibility ; practice and theory ; instinct and reason ; wisdom and knowledge ; understanding and logic reunited after all these years.

The salute neared its finale : her fleet had paid its last and heart-felt tribute. It was time that the elements did likewise, and so it was that the black hurrying pall of cloud was rent, and a beam of sunlight slanting through, fell full upon the ship. In that blaze of evening glory, led by that pillar of fire, she came safe to harbour. Journeys end in lovers' meetings.

A PROPOSAL FOR ENGINEER EMIGRATION

By Lt.-Col. H. A. Macdonald, R.E.

(written in March, 1945)

THE end of the war seems to be within sight and whereas, before, we discussed somewhat flippantly in Messes and at casual meetings what we might do after the war, the tone of discussion has now taken on a more serious note as many realize that a year, or possibly less, may find them outside the shelter of the Army. They are out of touch with conditions at home and although they expect that there will be schemes to help them to find work, they are none too optimistic about the type of work they will get without prolonged investigation on their own part. Few feel that they can afford this preliminary investigation when they are demobilized and some, being in the East, are worried about the lack of opportunity to start planning at such a distance. Assuming that the war with Japan outlasts that with Germany, and that many more British Troops will come out, this problem will become increasingly serious. The soldier from the Far East may find himself too late in the search for work at home when he does eventually get there. He should however, have one asset, which is less likely to be highly developed in those who have served only in "civilized" places, and that is an adaptability to climate and undeveloped country, combined with the power to make use of natural resources for his own comfort. He will have learnt to be a colonist and pioneer. Although he may long for home now, he may find on return, as so many have done before him, that the old country looks different and has a cramped feeling. Some of the ties of sentiment will be cut. Friends and relations may have died or scattered. He would be ready to try his luck in the Dominions or elsewhere if he could be assured of some backing. The married man, in particular, would require the greatest courage to take his wife and family to an unknown land, were he to be entirely dependent on his own resources. He would in fact be almost criminal to do so unless he was assured of some form of support which would effectively guarantee employment and reasonable conditions for a man prepared to work hard. At the same time he will be loath to move abroad if there is doubt about the effect on the future of his children. Health services and education facilities are apt to be lacking in localities under development, however good such services may be in the long-established centres of the Dominions. What the ex-soldier will need will be some continuance of the leadership and confidence born of discipline on Active Service, coupled with a community "bandobast" in which he can feel he is included. The writer has for some time had at the back of his mind the germ of a scheme which, though nothing new, might be developed in a new way if taken up by the Corps of Royal Engineers. He, like many others serving, is out of touch with conditions at home and schemes for the future, but ventures to put forward an outline, half-baked though it be, in the hope that it might be of benefit to members of all ranks of the Corps if it could be planned and developed.

Mr. Cole in his admirable book on Imperial Military Geography which we studied for promotion examinations, enlarged on the untapped resources contained within the Empire, and the vast areas which are empty of our kind and a cause of envy to our neighbours. If recollection is correct, the reasons for this state of affairs were generally one or more of the following:—climate

unsuitable for European families; lack of communications; lack of interest on the part of Governments; lack of funds; lack of man power; active opposition by nations or business interests with which development might compete. Now is the time, while planning is being done in high places for a better World Order, when we should scheme to develop our latent resources and only climatic conditions should count as a major obstacle. Even this is not insuperable in the light of modern invention, but the extra cost involved in trying to make a health resort of a plague spot, would almost always be prohibitive, while the natural disinclination of men and families to proceed to such a place would also rule it out. Government funds may possibly, we understand, be made available as grants or loans to development schemes which are likely to be a source of strength to the Empire. Competing interests can be controlled by international agreement and adjustment. Communications can be improved if the money is forthcoming. What is wanted then is population fit to carry out the initial development and then to carry on the work right into the stage where a new settlement and industry has become an integral part of the country in which it is founded.

What better colonists could there possibly be, or who would have a greater chance of success than a cross-section of the Royal Engineers, Regular and War-enlisted in due proportion and complete with wives and families (if in possession)? Would it not be a splendid thing to found a permanent community, based on the traditions of the Corps and bound by ties of loyalty and friendship formed from years of work together on innumerable projects designed to serve only the purposes of war? We should fulfil two main objects:—

(*i*) To find employment and a good life for thousands of our war time strength.

(*ii*) To strengthen the Empire by helping to develop its resources and to fill the coveted empty spaces, thereby removing a cause of war.

The scheme need not be confined entirely to members of the Corps. Sister Corps and the Royal Artillery might be given a proportion of vacancies to fit in with particular requirements without prejudicing the spirit of the enterprise. As, so often, they have taken their part in essentially Engineer operations in war, so they might well co-operate in an Engineer enterprise in peace. The basic requirements of the proposal are:—

(*i*) An undeveloped but reasonably healthy area containing one or more resources in Empire or World demand.

(*ii*) The good will and support of the British Government.

(*iii*) The good will and support of the Government of the Dominion embracing the selected area.

(*iv*) A selected body of willing and determined men and women who can organize and work as a team. These can be obtained from the Corps on demobilization with such others as may be considered desirable.

The selection of the area is the most urgent problem of all and requires the most expert advice available so as to be certain, beyond all doubt, that its products will in fact be required in years to come and that it really is susceptible of development. Such advice should be obtainable from Government sources and could be checked by a reconnaissance organized and financed by the Corps. That a suitable area exists in one of Canada, Australia, New Zealand, South Africa or East Africa can hardly be in doubt.

The good will of Governments to a scheme sponsored by the Corps of Royal Engineers, or a representative Board drawn from it, should not be

impossible to obtain. Our Engineers-in-Chief and Chief Engineers have had plenty of practice in the arts of persuasion, as is evident from the goodly flow of Engineer equipment and stores to the various theatres of war. Dominions, with recollections of hordes of unsuitable immigrants after the last war, are naturally inclined to restrict fresh entry, but as this proposal is for a balanced, tried and selected body of people, it would be an unreasonable Government indeed that would refuse them.

Before we discuss personnel, let us consider broadly the work to be done. Requirements would naturally vary for the country and resources to be worked. Let us assume that we take on an already accurately demarcated deposit of a mineral which has to be mined, and which can be worked on, or near, the same spot. Assume also that the area is in Canada and that there are no communications to it except, possibly, a rough track, open only in certain seasons.

The first task on the ground is to open communications, sufficient, progressively, to allow of a detailed survey being made, to get work going on the site, and eventually to move all requirements and products of an industrial community from and to the outside markets. An all weather road will be essential; an airfield will also be needed. Railway is likely and a canal a conceivable possibility. We have personnel capable of making and operating all these things.

Power will have to be developed, whether from coal, oil or water. We have experts in mining, oil fields and hydro-electric schemes.

The development of the mine or mines is within our scope, as is also the running of them and of associated factories.

The construction of accommodation from early huts to the later houses, hospitals, churches, shops and all town requirements is a joyful prospect for our architects and builders.

We shall need to raise a lot of our own food. We are not without our farmers and there are plenty of agricultural workers in our ranks. Opportunity here too for Mechanical Equipment Operators.

We have in the ranks all manner of tradesmen capable of working all these things. In the higher Sapper strata are men who have handled the management of greater concerns and ones more complex than many so-called "big businesses." So we should not fail in that respect either.

Difficulty might at first be experienced in dealing with Government officials and other inhabitants of the country. Each Dominion, however, has its own Military Engineers. They could and should be included in the scheme and will be invaluable, apart from their Engineer qualifications, as liaison to prevent misunderstandings or clashes with local custom. We hardly like to suggest that their services might be necessary also as interpreters.

We should have to import doctors from outside our ranks, but unless we are much mistaken, padres and schoolmasters would not be difficult to produce from among us.

Planning staffs for war must by now be beginning to see the end of their labours. Could they not now (the Engineers among them are many) turn their attention to planning for Engineers in peace? It is a big job and worth the best brains we have got. Nor need it be unprofitable.

Selection Boards will be necessary to sort out the volunteers one might expect for our scheme, but first some idea of the size of the project would have to be worked out, together with a rough "W.E." Such a task should whet the appetite of those who, in the war, have produced the W.E.'s of the most unlikely sounding units. But the Selection Board would have the added complication of having to select complete families and not just single

men. Major Gelignite and Sapper Trowel may be excellent fellows, but can it be left to them to say whether Mrs. Gelignite and Mrs. Trowel and all the little Trowels will be able to compete with the new life? It will take all types to make our new colony, but to achieve efficiency and a rapid development we cannot afford to have too many potential weaklings. That we must have the wives and families present within a year of the start is taken as axiomatic, for otherwise nobody would join with any idea of permanency. The whole success of the scheme depends equally on the competency and keenness of the wives to make it go, as on the technical efficiency and hard work of the men. Why should we stop at wives? More will be wanted in the future. So why not bring out the sisters, cousins and even the aunts of the men? Many of these women will find life at home dull after their war work and would be only too eager to continue a busy and useful mode of life in a new country. Their tasks would be those of nurses, canteen-workers, land-girls, elementary school teachers and many other jobs that our women have been doing during the war. The Selection Board must therefore include a woman or women and the whole, whether they employ psychiatrists or not, must be gifted with a love for humanity and be experienced in its ways. Colonel Garforth's excellent article in the December, 1944, *R.E. Journal* envisages the extension of the methods applied by W.O.S.B.'s to the selection of officers. Here is an opportunity for a very wide extension to fill the needs of a very varied set of requirements of which adaptability is probably the only common factor.

Applicants to join in our exodus would have to be prepared to accept the rules and regulations to be drawn up by the Governing Body, whether it be a Company with Directors responsible to Government, or an organization with the civil equivalent of a G.O.C. and staff. Each man should contribute as deposit a sum of money proportionate to his late Army Pay and this sum, which will also assist in the financing of the project, should be sufficient to ensure that he does not lightly desert the community. Such a deposit would probably be insisted on by the Governments concerned before they would help with grants or loans. It is worth considering whether the deposit should ever be returned at all. The writer thinks not, as the participant would stand to benefit all his life from the community to which he has made his initial contribution and there is no reason why he should not pay cash down for the opportunity. Rates of pay will have to be worked out which will depend on the type of work undertaken, the conditions in the receiving country and, most important, on the extent to which Government is prepared to finance the undertaking. Each original member should feel that he had an active share in the concern as a whole, no matter whether he is a field worker or a director of the industry. To foster this spirit a bonus system would be adapted whereby all such members reported efficient would receive, apart from pay, an equal share of such profits as may remain over and above the regular loan repayment to Government.

To start such a scheme there must be meticulous planning, careful recruiting, much struggle and toil. But successful settlement has been done before by soldier communities, left to themselves in a foreign land with no assistance from a forgetful public after a successful campaign. They were not Sappers and presumably developed the land first, simply in order to feed themselves. With the advantages possessed by members of a Corps such as ours and backed by a beneficent Government, there should be no limit to what can be achieved.

What planners are ready to work on such an outline and give a start to a Corps emigration scheme? Will any of the Corps "Fathers" try sounding for loans or grants or otherwise give his blessing to the idea?

THE JAPANESE ENGINEER

By Col. J. V. Davidson-Houston, M.B.E., R.E.

1. General

THE Japanese engineers have a high *esprit de Corps*, regarding themselves as fighting rather than as technical troops. Technically they are inferior to the engineers of other Great Powers, but the Japanese Sapper is a handy-man, an adept at improvisation and at the use of local materials, especially wood and bamboo. In common with other arms of the Japanese Army, the engineers are characterized by great flexibility in organization and equipment. This article is a brief description of the engineer troops and equipment encountered in the South East Asia Command.

2. Divisional Engineers

The Divisional Engineer Regiment, commanded by a Lt.-Col. and comprising some 850 of all ranks, consists of a H.Q., three field companies and a field park unit. The H.Q. is equipped with W/T and L/T, and includes a medical detachment. Each field company is composed of a H.Q. (including a Stores section) and four platoons of four sections. On occasions one of the field companies is replaced by a special unit for special types of operations, such as a bridging company. The field park unit is about 80 strong and carries engineer stores.

Although at first sight this organization is more centralized than that of the British division, in practice the Japanese are prone to split up their formations into small mixed forces, and engineer companies or platoons may be put under infantry commanders for long periods. During the invasion of Manipur in 1944 the divisional engineers were largely employed in facilitating the movement of the Japanese columns over difficult country, and finished up by fighting as infantry.

The weapons of the field companies are the rifle, L.M.G., hand grenade, and man-pack flame thrower. Officers and warrant officers carry swords and pistols. The maximum use is also made of captured weapons, explosives and mines.

Transport varies with local conditions, but usually includes both M.T. and A.T. In Burma use was made of impressed bullock-carts and elephants.

Tools are almost all hand-operated although compressor pile-drivers and power-saws have been identified.

The bridging material with the division is normally limited to a supply of steel wire rope, wire, clamps, dogs and nails; in Burma there was no difficulty in obtaining timber locally. Boats and pontoons are issued for specific operations, but are not carried as part of the divisional equipment.

Approximately one ton of high *explosive* is carried by the engineers of the division.

The training of a sapper in peace-time occupied 7½ months, a high proportion of which was devoted to infantry work, and the man was considered then to be a fully trained infantryman as well as an engineer. Top priority was given to watermanship, assault engineering and bridging, in that order. The defensive occupied a very low place in all arms of the Japanese service. As regards field works, it is interesting to note that the Sapper was expected to excavate 140 cubic feet of earth in 4 hours.

War-time training occupies only 3 months, of which 40 days are given to engineer work, the rest being devoted to assault tactics and other combat tasks.

All Japanese engineers, including those of the division, are trained to fight in assault detachments. These vary in size from a section to a platoon and are divided into an obstacle-clearing party, an assault party (armed with grenades and explosive charges), a support party (giving covering fire) and a reserve. No infantry is included in these detachments.

River-crossing doctrine in the Japanese Army is that the duties of the divisional engineers are normally confined to helping the other troops to ford or ferry; local craft and materials are adapted whenever possible, and bridging is regarded as a last resort.

Water-supply is not the responsibility of the engineers, but belongs to the divisional Water-Supply and Purification Unit, which is a medical organization.

3. Bridge Companies

Two types of unit are known to exist for the purpose of holding a mobile reserve of bridging material.

These are the *Bridge-building Materials Company* and the *River-Crossing Materials Company*. These are engineer units, but do not themselves execute bridging operations.

4. Regimental Pioneers

These are known to have been improvised in the South-West Pacific by forming units some 200 strong from the infantry of a regiment. Their object is to dilute the engineers with semi-skilled men, and they perform work analogous to that of British Pioneer Platoons. Similar methods are used in South-East Asia, but the details are not known and probably are as variable as most Japanese organizations.

5. Equipment

River-crossing equipment appears to consist of boats and pontoons; no equipment bridges have been encountered in dry gaps. Three-men rubber boats are employed for reconnaissance, while larger boats, holding a dozen men, may be of the pneumatic or folding type. These boats are frequently made up into rafts capable of taking all divisional loads, and are sometimes propelled by outboard motors. The Japanese are adept at making rafts and bridges of local craft, and crossed the Chindwin by these means during their invasion of Manipur last year. Their pontoons are of metal and undecked; they are probably designed to carry up to divisional loads in bridge.

Demolition equipment bears a general resemblance to the British, except that the chief explosives used are Picric acid and T.N.T., in blocks varying from 4 to 14 ounces in weight. The Japanese also employ a form of plastic explosive. Their detonators contain a mixture of fulminate of mercury and tetryl.

Anti-Tank mines have been found containing 2lbs. of picric acid and resembling the Teller in outward appearance. The diameter is $6\frac{3}{4}$" and D's. are welded to the circumference so that the mine may be drawn by wires across the path of a tank. The sensitivity depends upon the thickness of the shear-wire, a supply of which allows the mine to be laid in an anti-personnel or anti-vehicle role.

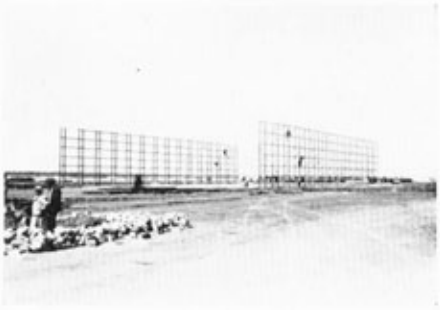
Magnetized mines are $4\frac{3}{4}$" in diameter and have four poles on the circumference, enabling them to be stuck on the plates of a tank. The fuse gives 4 to 5 seconds delay and the penetration is about one inch of armour.

Bangalore torpedoes are frequently employed by the Japanese, an interesting adaptation being the use of stout bamboos filled with explosive.

AIRCRAFT FOR RUSSIA

Arrival of camels at Abadan.

Camel cart arriving at Abadan.



Assembling Belman Hangars.

Aircraft for Russia opp p 201

AIRCRAFT FOR RUSSIA

By Major P. R. A. Millar, R.E.

THIS is not a technical article, but a brief account of one or two small jobs carried out by the writer, and some of the difficulties and amusing incidents encountered during their execution. While admitting that many bigger and better military installations, have since been constructed in the same locality, my excuse for writing this is that it was I who turned the first sod, metaphorically speaking no doubt, as, in point of fact, it was all sand!

The proceedings open with the arrival of a C.R.E. Works (Indian) at Basra during the latter half of November, 1941. It was still unpleasantly hot, and as we leant over the rail and gazed down on those sweltering quays and warehouses on one side of the ship, and at an endless shimmering vista of palm trees on the other, we all wondered just what this "Land of the two Rivers" held in store for us.

The war still seemed very far away, because we had not even sailed from Bombay in convoy, but I well remember reading in our disembarkation instruction that "in the event of an air raid, unloading parties would proceed to the slit trenches." Just where those slit trenches were, none of us ever discovered. Those of us who were not required for unloading spent that night in the local R.E. Mess. The building actually belonged to the Basra Port Authorities, but had been used as a Sapper Mess during the last war, a large wooden grenade hanging in the dining room bearing evidence to the fact.

I only spent one night there, and a sleepless one at that, for there was a ship discharging cargo just outside the door. Next morning I received instructions to proceed to Abadan forthwith and instal myself as G.E. It appeared that the immediate object in view was the construction of a tented camp required for a thousand British and Indian personnel of the I.W.T.

The following afternoon, we, that is the writer, an Indian S.D.O. and two half-trained babus arrived on the scene of action. Our share of the "G 1098 stuff" brought from India was a typewriter, a bicycle and some stationery, to which was added a slide rule and the *R.E. Pocket Book*.

It was obvious from the start that, if any progress was to be made at Abadan, those in a position to afford help, where it was needed, were the Anglo Iranian Oil Company, referred to hereafter as the "A.I.O.C." To one starting a job from nothing, and knowing little about the habits of local Arabs and Persians, their help and advice were invaluable, but more about that later.

Work on the camp had been put in hand by the A.I.O.C. engineers in the shape of roads and tent plinths, but it was a dreary looking patch of desert which met my gaze that first evening. The first objects of immediate interest were some pill-boxes on the river bank hastily constructed by the Persian Army that summer while engaged in their Gilbertian occupation of defending the British residents of Abadan against the invasion of the Indian Army! Another never-failing source of interest was the stream of tankers of many nationalities passing up and down the river alongside us.

The usual preliminaries of recce. and appreciation did not take long and, stores having been promised, the next step was to get in touch with a local contractor. A visit to the Contracts Manager of the A.I.O.C. was all that

was necessary, and a suitable man was forthcoming immediately. He was an Armenian Jew and must have been one of the biggest rascals who ever walked, but he could produce labour, and his personal supervision of work in progress consisted of standing behind his men with a whip. He had a way with him though, and the men didn't seem to object. Actually this contractor had been an employee of the A.I.O.C. and, having done pretty well out of them, had set up a business on his own. After a certain amount of argument, he and I arrived at an amicable solution of the payment question, and some stores having meanwhile arrived, work on cook-houses, latrines, water supply, etc., was started. Right here we were up against our first spot of trouble. The requisite number of men turned up at the specified time, but with no tools, I having, quite wrongly, assumed that Persian Contractors, like their brothers in India, would produce their own, but it appeared that the A.I.O.C. for whom all the contractors usually worked, provided just everything. The difficulty was soon got over, as my friend, the contractor, said that if he could have half a day off, he could "arrange tools." He was as good as his word, and all the tools were stamped "A.I.O.C."

Once the preliminary difficulties had been overcome, this camp was a perfectly straightforward job, as far as the structures went, but the big difficulty was to lay on an efficient drainage system, as the site was dead flat, about 3 ft. above high water and half a mile from the river. Soakaways were quite out of the question, and so was any sort of waterborne system, because, even if there had been sufficient fall, no suitable material was, at that time, available. The only solution seemed to be to collect "the stuff," and carry it away on wheels; so, a promise of transport having been obtained from "Q," concrete sumps adjacent to all cook-houses and latrines were constructed. Water from bath-houses was disposed of partly by soakage (a very small part) and partly by surface evaporation.

The transport duly arrived and turned out to be four-wheeled carts drawn by camels, half of which set out from H.Q. L. of C. by road, but were hastily recalled when somebody discovered that Abadan was an Island. The camels with their carts and drivers eventually arrived by water on a craft* consisting of four flat-topped barges lashed together and normally used as a car ferry further up the river, but borrowed for the occasion. The whole contraption was moved alongside one of the A.I.O.C. jetties, a crowd collected and the fun began. One of the cargo superintendents of the A.I.O.C. openly declared that he had handled most types of cargo in his life, but camels—never! Meanwhile the tide was ebbing fast and the slope of the gang plank becoming accordingly steeper every moment; two camels made it after much roaring and blowing of bubbles, but that was all. Our efforts to get the rest ashore by the same method failed dismally. People shouted advice and encouragement, camels fell down, got up and blew more and bigger bubbles, but it was no good, the camels won, and were finally hoisted ignominiously ashore by a hastily improvised rope sling. Meanwhile a crane had dealt with the carts, and no time was lost in limbering up and moving off to a previously prepared and tactfully selected position! We caused quite a stir by leading the camels in procession past the windows of the general office of the A.I.O.C.

The camels fulfilled their role of carriers of bitumen drums filled with sullage water, etc., but it was a painfully slow business, as the journey to the dumping place and back took as much as six hours, including a period for rest and refreshment for both camels and drivers, but they were

* This craft has been previously referred to in the late Major Radcliffe-Smith's article "A Field Company in Persia and Iraq" in the June, 1943 issue of *The R.E. Journal*.

all we had, and we could not have got on without them. Recollections of those supercilious looking beasts drawing their obnoxious loads at a steady two and a half miles an hour through streets crowded with lorries, buses, cars and mechanical equipment of all sorts, will ever remain.

The next job we had to tackle was tented camps for two R.A.F. Fighter Squadrons and an Indian Staging Section. These sites were about twelve miles from where we had originally built the I.W.T. Camp, so wishing the Commandant of that camp luck, and bequeathing him a few useful stores, we packed up and departed to the other side of Abadan. Here as before the A.I.O.C. had done some useful spade work for us in the shape of roads, bunds, storm-water ditches and tent plinths. We finished these camps before the occupants arrived, but they came in very handy for our own use, as will be explained later. As regards the construction of these camps, there were no new problems, though the one of drainage reared its head again, and was likely to go on doing so. Sumps and camels was again the answer. We had one common trouble with all these camps. Those responsible for their layout had gone in for rather a generous measure of dispersal, for instance a camp for an R.A.F. Fighter Squadron, strength about 750, was half a mile long. This was all right if the R.A.F. didn't mind a bit of walking, but to the engineers building the thing with a dire shortage of transport, dumping stores where they were required was a long job. As far as I remember, we only had three lorries at that time—one borrowed from the A.I.O.C. and two hired from the " bazaar."

Three days before Christmas, 1941, I returned to the bungalow where I was living about lunch time on a pouring wet day to be confronted by a deputation consisting of the D.C.E., D.A.Q.M.G., and two American Officers. A bottle of beer all round and a sodden blue print produced by my guests elicited the information that an aircraft assembly plant was required, and required very urgently, for assembling aircraft shipped from the U.S.A. via the Cape and then to be flown to Russia.

Here are a few details of what was required :—

(1) Bunds and ditches to keep the site from flooding.
(2) Three Belman type hangars with concrete floors.
(3) Concrete parking and assembly areas with connecting taxiways all to be 18" above desert level.
(4) Three miles of meter gauge railway for transporting crates and small parts from the dockside to the assembly plant. The aircraft minus wings and tail were to be towed by road.
(5) Eight small buildings for use as workshops up to 60 ft. in length and all with 12 ft. span.
(6) A tented camp for 500 American civilian engineers, who were to assemble the aircraft.*
(7) A hutted camp to replace the tented one to be constructed of wooden sectional huts, which were being made in R.E. Workshops, Rawalpindi.

Both the camp and assembly plant were to be in the vicinity of the existing airfield belonging to the A.I.O.C.

To get back to the events of that wet, cold and muddy day. It can rain in the Persian Gulf, and on this occasion it did, for three days and nights without a break It is an extraordinary climate, as you can die from heatstroke or pneumonia, whichever you fancy. We started off after lunch in a station wagon on a recce. of the assembly area and camp sites

* The tented camp was never constructed as it was hoped that, by the time all the preliminary work, which would be required for any camp, was finished, the huts would have arrived. This turned out to be the case.

and promptly slid gently off the road into the ditch. I think the presence of a large American Officer in the stern of the car was partly responsible but, in any case, the driver—a Pathan—had never driven in such conditions. The writer was not at the wheel as the D.C.E. was in the car, and officers were forbidden to drive. After this incident it was decided that regulations might be relaxed a little. None of us who were present will ever forget that recce. All we could see were sheets of water fading into the distance, with water lapping round the sides of latrines and other camp structures, a forlorn and dreary sight to any engineer with an urgent job on hand. We looked at the ground, or rather the water, and attempted to site our installations by reference to "that point over there where those waves are breaking." It was obvious from the start that this job was rather outside the compass of my contractor friend. However, the watery and muddy interval of the next three weeks afforded an opportunity for making an appreciation and deciding on a plan of action.

Just about that time, I had a rather amusing conversation with a young American Engineer on the subject of camp sanitation. I described the usual Indian methods, in which kerosine tins cut lengthwise figure prominently, to which he replied—"I guess our guys won't stand for that sort of set-up." I enquired politely what he was going to do about it, to which he gave the, to me, astounding reply that he proposed to instal "flush-toilets." I laid a small bet that he wouldn't in under six months, and I lost, though I regret to say that I have never seen him since.

Leaving the water a little more time to evaporate, and the mud a chance to dry up, here is an account of a small incident which occurred about that time, which, although it had nothing to do with the work we were engaged on, is a good example of how a seemingly simple operation can go wrong if details are not attended to. A dragline excavator was urgently required at a place called Bandar Gulf at the top of the Persian Gulf, and about thirty miles by road from Basra. Base Movement Control there loaded it on to an ordinary river barge, and despatched it to us with a chit attached "for onward transmission to Bandar Gulf." The Liaison Officer to the A.I.O.C. got on to Base Movement Control and pointed out that neither he nor the G.E. were in the shipping business, but that we would see what the A.I.O.C. could do to help. Their shipping manager promised to load the excavator on to the first ocean-going barge they had going down the Gulf. As it turned out, arrangements were made at very short notice, and the excavator was loaded aboard, but could its crew be found? The barge sailed, the crew were run to earth shortly afterwards, and despatched by road, and we thought that the whole affair had passed out of our ken for ever. Not a bit. A day or two elapsed, and then we heard that as soon as the shore crane at Gandar Gulf felt the weight of the excavator, it started to lean over gently towards the sea. Back went the excavator to Basra whence it had started, there to await an ocean-going ship with derricks capable of off-loading it. All this time the thing was very urgently required in connection with Port development at Bandar Gulf. Eventually it arrived for the second time at Bandar Gulf, but minus its jib! Weeks passed, and this was eventually located in somebody's workshop, with chalk marks on it all ready to be cut up by oxy-acetylene for another job. The lessons from this sad little story are so obvious that it is hardly necessary to point them out, but adequate liaison, and an appreciation of all the "factors affecting" were, it seems, somewhat lacking.

By about the middle of January, the mud, which has to be seen to be believed, had dried sufficiently for us to start work in earnest. The target date was April 1st, for both assembly plant and accommodation. We were now reinforced with two Indian Artisan Works Coys. and they were housed in the

camps we had built for the R.A.F., which were luckily still vacant, as there was no other accommodation and no time to build any. The arrival of an A.G.E. and another S.D.O. plus thirty Iraqi steel erectors, completed our team. These Iraqis were invaluable as they knew the correct location of every bolt in a Belman hangar, but I noticed that a good many of them had chits with recommendations written in German. Work was now organized something like this. One A.W. Coy. took on the camp for the U.S.A. personnel, while the other was put on the foundations for the hangars, and construction of small workshops. Each Coy. was reinforced by about four hundred Arabs supplied by my contractor friend. They relieved the engineer personnel of all the pure "coolie" work. The Iraqis were employed exclusively on the steel work of the hangars, and the A.I.O.C. came along with excavators, Scammels, dumpers and rollers for the earthwork. In addition they provided eight concrete mixers and also gave me the free run of their scrap yard. I believe I was the first "outsider" to get inside that place with a lorry, but it really was a Sappers' Mecca. I originally got in on the pretext of requiring firebricks, but came away with quite a lot more.

The arrival of the hangars by river provided us with a little problem in transport. Three "bazaar" lorries were all that could be spared, and it took them between two and three weeks to cart all the pieces, and innumerable sacks of bolts from the river to the site, a distance of about three miles. We had a certain amount of pilfering of small stores about this time, but we were working over a large area and it wasn't possible to provide sufficient guards; however, nothing really vital ever went. Nails were always a great problem, as there was a universal shortage, and the bazaar prices were, of course, astronomical; however, "improvise" was the constant watchword, and we made the trusses for the small workshops by lashing the joints with binding wire.

One evening, just as I was leaving the site, I met my Armenian contractor riding a motor cycle along the road and looking very pleased with the world. I stopped him and asked him what it was all about, and he said that the police had broken into his home and taken all his things. I enquired what he was going to do, and he replied "rob the police, Sahib," and away he went.

Work on the hangars and workshops was now progressing fairly well, and the Coy. on the camp were busy building dwarf walls for the wooden huts, in addition to camp structures. The next big event was the arrival of the huts from India. I boarded the ship on which they had come and one look down the hold told a sorry tale. It looked more like a consignment of firewood. These huts had never been constructed with a view to really rough handling, and as they had already been loaded on to and off a train, and then on to a ship, their condition was not to be wondered at. Working continuously in shifts it took two A.W. Coys. three days and nights to shift the lot. Thereafter, for the next two weeks, practically the whole of one Coy. was employed stacking, sorting and repairing where possible. As the dwarf walls had already been built, erecting the huts was quite a quick job, though the earth filling required to bring the floors up to the level of the 18" dwarf walls took a long time. It was all done with one scraper and about two dozen donkeys. No doubt these huts were all that was available at the time, but they were not suitable for either transporting long distances or for the climate of the Persian Gulf.

One evening I was rung up by the A/Q, and the conversation went something like this:—

A.Q. Is there any provision for Russians in that camp you are building for the Americans?

Me. No sir, I think they usually bring their own.

A.Q. Bring their own! What do you mean?
Me. Well I think they like their own better than ours.
A.Q. Like what?
Me. Their rations.
A.Q. What are you talking about?
Me. Rations.
A.Q. Well I'm talking about Russians.

We had many visitors about this time, including Sir Claude Auchinleck, then C.-in-C. Middle East Forces, but the visit of one very important person sticks in my memory. He got out of a launch into the car, made himself comfortable, and lit up a large cigar. Our first port of call was the General Manager of the A.I.O.C. and on the way we passed several large notices saying "NO SMOKING." We passed two of these with the cigar doing nicely, and then we came to a really large one just near the refinery area. The Important Person saw this, and remarked "I suppose I shouldn't be smoking." I hinted that we had already passed two such notices, when somebody in the back of the car remarked that smoking was not allowed in military vehicles anyway, but to no avail.

By about the middle of March the job was taking definite shape. The metre gauge railway had been constructed, and the concrete approaches and culverts leading from the main road to the assembly area put in. There were not many trimmings on this job as a whole, our aim roughly speaking being to get the aircraft to the site by the target date, provide parking areas, and cover and accommodation for the men to live in. It was a race against time, but it looked now as though we might just do it. There was nothing left to do now but urge people to greater efforts. A response was always forthcoming.

The first aircraft was off-loaded at Abadan on April 4th—four days after target date, and some of us watched its progress through the residential part of Abadan to the assembly area. Towed by a tractor driven by the Transport Manager of the A.I.O.C., it was quite an imposing sight, nor was the operation quite as simple as it sounds, as the aircraft with only stub wings was still some thirty feet across, and several trees had to be removed and fences taken down to afford free movement on this, the second stage of its journey to Russia. The Manager of the Douglas Aircraft Coy. now arrived with his staff, and seemed quite pleased with what he found, as he was under the impression that he would have to tackle the job of assembling the aircraft in the bare desert. I think he was able to step up his production forecasts right away, which was good news to us. I did not see the first aircraft fly away to Russia, as I had departed elsewhere by then, but there is irrefutable evidence that it, and many more like it, did!

I cannot end without putting on record our appreciation and thanks for all the useful advice and material help afforded us by the various departments of the A.I.O.C., for without them the job could not have been done to time. People always came to our rescue with enthusiasm when help was badly needed, and of these I should like to mention three. They were Mr. J. L. Browning, Chief Consulting Engineer, Mr. P. S. Bates, Estates Engineer, and lastly the kind person who let us into his scrap yard, but I must apologise to him, because at the moment I cannot recall his name.

MEMOIRS

BRIGADIER-GENERAL E. H. BLAND, C.B., C.M.G.

EDWARD HUMPHREY BLAND was the third son of Maj.-Gen. E. L. Bland, R.E., of White Abbey, Co. Antrim. Born in 1866, he was commissioned from the R.M. Academy as a Lieutenant, Royal Engineers on 9th December, 1884.

The first years of his service were spent at Chatham and with the 7th Field Company at the Curragh, but in 1889 he went to India, where he joined the Bengal Sappers and Miners at Roorkee and served in two campaigns—Miranzai 1891 and Isazai 1892, receiving the India medal and clasps.

Promoted Captain in 1894 he served for two years at Cork and then joined the Ordnance Survey at Bedford and later at York. In 1897 he became Adjutant of the Monmouthshire Militia at Monmouth and (during the S. African War) at Aldershot. Then in 1902 as a Major, he took command of the 18th Fortress Company at Halifax, Nova Scotia, till he was moved to Esquimault as O.C., R.E., where, as the senior officer, he was in command of the small British Garrison. Home again in 1906, he commanded the 26th Field Company, R.E., at Borden Camp, until on promotion to Lt.-Col. in 1910, he was appointed C.R.E., Pretoria District, South Africa, moving to C.R.E., York in 1913.

When the Kitchener Armies were formed in 1914, Bland was made C.R.E. of the 11th Division at Newark and in May, 1915, when a group of Divisions was sent to the Dardanelles, he was made Chief Engineer of a Corps in the New Armies with the rank of Colonel and served with distinction in the Dardanelles Campaign.

When the force was withdrawn to Egypt at the end of 1915, he became a Chief Engineer with the Egyptian Expeditionary Force and was in Engineer charge of No. 1 Section of the defences of the Suez Canal. For his services he was given the C.B. in 1916 and also received the order of the White Eagle of Serbia.

When the armies in Egypt were reorganized later, in 1916, he returned home to be Chief Engineer, North Eastern Coast Defences, and in 1918 became Chief Engineer Northern Command, which he held till 1920. He was awarded the C.M.G. in May, 1919. In 1920 he was Chief Engineer, Gibraltar and held this appointment till his retirement under the age rule in 1923.

During his service he had many opportunities of studying the system of Field Engineering and had a fine record in command of the 26th Field Company at Borden, and used this experience successfully in the Dardanelles and Egypt. He died in February, 1945. He married in 1894, the daughter of J. Fletcher Moore, Esq., D.L., of Manor, Kilbride. They had two daughters.

W.B.B.

BRIGADIER F. W. T. HARDS, C.B.E.

THE news that " Daddy " Hards had been lost at sea in the Mediterranean on the 21st February, 1945 came as a great shock to many Sappers, for he had many friends. A man does not easily acquire, nor long retain, the nickname of " Daddy " unless he has some endearing qualities and, besides the strength of character and singleness of purpose that marked him from his school days, Frank Hards, possessed a charm and honesty of mind that will never be forgotten by those who knew him.

Few men of his build are great athletes, but few can have been more enthusiastic than he in every branch of sport which he took up. In any game he played he applied himself with that particular brand of solemn perseverance which is one of the most delightful memories we have of him. " Daddy's " carefully expounded theories on ski-running and ski-jumping, on rugger, golf and cricket, which he conscientiously put into practice, will be affectionately remembered by all those who accompanied him on the mountains or playing fields. He radiated kindness, good humour and the soundest of common-sense; this last all the more valuable because behind it lay a first class brain.

He left the Shop in 1916, served in Egypt and Salonika in the last war and, after a spell at Chatham, went back to the Eastern Mediterranean, where he served in Palestine from 1920–22, and where he gathered material for some of his most famous biblical stories.

After a supplementary course he became Assistant Adjutant for Weapon Training at Chatham, where he did much to raise the standard of R.E. rifle shooting. From 1927 to 1931 he was an instructor at the Shop, where his influence will have been fondly remembered by hundreds of Sappers and Gunners. From 1932 to 1936 he was in India with the Bombay Sappers and Miners, afterwards returning to Cambridge, where he stayed until the outbreak of the present war. At the time of his death he was Chief Engineer of British Forces in Greece.

A school fellow who shared a study with him writes, " Fortunately, in view of the small size of the study, he was not unusually big in those days. He only acquired his outstandingly large stature later. At school he was a boy with a first class brain, so thoroughly sound and such a good mixer that he was always popular, and these characteristics followed him into his life as a man. His judgment soon matured and, although slow to express an opinion, what he said was always carefully thought out and worth remembering. No man can deceive his subordinates and his success as an Instructor at the Shop has been proclaimed again and again by G.Cs. of that time and there can be no surer praise.

'Daddy' was a keen and proficient golfer and an enthusiastic skier. Although he was a good steady runner, when he did fall in soft snow, the crater would have done credit to a large bomb, and the size of his skis had to be seen to be believed. For a man of his size to take up ski-jumping, when not in his first youth, requires considerable courage, and at an age when many give up jumping he used to do a few jumps every day in order to improve his balance and to conquer the fear that so easily sits on a skier's back. Although never a racer he put up a creditable performance in the Parsenn Derby. On a tour he was a reliable and charming companion.

His unfailing good humour, imperturbability, and sound judgment will be sadly missed by his friends and they include all those who have worked with him."

He leaves a widow, Sylvia, the daughter of Mr. and Mrs. Brereton of Cambridge, whom he married in 1942.

R.H.B.L.

Brigadier F W T Hards CBE

Archibald F Cumberlege OBE

COLONEL ARCHIBALD FARRINGTON CUMBERLEGE, O.B.E.
1870-1945

A. F. CUMBERLEGE, who died on 5th May, 1945, was born at Landour in India on 2nd September, 1870, the son of an Officer in the Royal Artillery. He was educated at Blundell's School, Tiverton, and at the Shop, whence he was commissioned as a 2nd-Lieutenant, R.E. on 27th July, 1889, in Colvin's batch.

After the usual two years at the S.M.E. he was posted to the Military Works Department at Ootacamund in the Nilgiris, being promoted to Lieutenant in 1892 and in the same year was transferred to the Burma Company of the Queen's Own Madras Sappers and Miners. Less than twelve months saw him back in the M.W.D., at Madras.

In 1893 he was transferred as Assistant Engineer, 2nd Grade, M.W.D., to Bellary. He served there for two years during which time he officiated as Executive Engineer 4th Grade. 1895-1900 he spent in Bangalore, latterly as Garrison Engineer Military Works Services, and received his Captaincy on 27th July, 1900, under the eleven years rule.

About the latter date he first saw field service as Assistant Field Engineer of the China Expeditionary Force against the Boxers. On return from that campaign he was posted as Garrison Engineer M.W.S. to Wellington, in the Nilgiris, whence in 1902 he was transferred in the same capacity to Rangoon. In 1903 he attended the Indian Class at the S.M.E.

For a period of over nine years he was then employed in the office of the Director General Military Works at A.H.Q., Simla, being promoted Major on 27th July, 1909, again according to rule. During the next two years he officiated as Assistant C.R.E. at Jhansi and at Mhow up till the World War in 1914, shortly after the outbreak of which he proceeded on field service to Mesopotamia with India Expeditionary Force "D."

Here he was actively employed in Townshend's advance on Amara in May–June, 1915, and with Maj.-Gen. Sir George Gorringe's force on the Euphrates, assisting at the capture of Nasiriyah in June–July of the same year. For his services in these operations he was twice mentioned in Dispatches and was promoted Brevet Lt.-Col. on 1st January, 1916.

Later on during the Mesopotamian Campaign he held the appointment of C.R.E. of a Division, being promoted substantive Lt.-Col. on 26th August, 1917. After the close of hostilities in Mesopotamia he returned to India, being again posted to A.H.Q., Simla, as Deputy Director General M.W.S., which appointment he held until his retirement on 17th October, 1922.

He was gazetted O.B.E. on 9th September, 1919, and promoted full Colonel on 1st January, 1920.

He married, in March 1898, the younger daughter of Colonel W. B. Warner of the 1st Madras Lancers, at one time commanding the troops at Mandalay. Mrs. Cumberlege survives her husband, as do her three children—the eldest an officer in the Royal Australian Air Force, the second now Mrs. Metcalfe and the third at present officiating in command of a regiment of R.A. in Burma.

Cumberlege's capabilities as a field engineer are incontestably proved by his war record in 1915–16. His success in the field was, there can be little doubt, largely due to his imperturbable disposition and to his straightforward simplicity. He was of a most helpful turn of mind and was universally popular with everyone. Among the members of his batch at Chatham he was always known as "the Cherub," a soubriquet suggested as much by his natural amiability as by the unvarying cheerfulness of his personal appearance.

During his latter years he suffered from heart trouble to a considerable extent and finally succumbed to an attack of acute bronchitis, in a nursing home at Southbourne. W.H.B.

BOOK REVIEWS

(Most of the books reviewed may be seen in the R.E. Corps Library at Brompton Barracks, Chatham.)

THE FUNDAMENTALS OF MECHANICS

By MORTON C. MOTT-SMITH, Ph.D. and MARJORIE VAN de WATER, Science Staff Writers for the *Infantry Journal*, Washington, U.S.A.

(188 pp. demy-8vo. 135 Illustrations. Paper Covers. 25 cents.)

Warfare having become so highly mechanized it is obviously desirable for all ranks to have an elementary knowledge of the principles of Mechanics and Physics. This excellent little book will go a long way towards providing this knowledge.

The contents are approximately as follows:—Properties of Materials 48 pp., Measurements 12 pp., Mechanics 63 pp., Hydraulics 10 pp., Heat and Heat Engines 37 pp. In conclusion 6 pages are devoted to a consideration of the Motor Vehicle in which practically every mechanical principle finds application.

The subject matter is presented in an interesting and eminently readable manner throughout and no more than a primary school education is required to follow the reasoning. Everyday experience is drawn upon liberally to illustrate principles and only the most elementary knowledge of mathematics is required.

At the end of each chapter a number of simple experiments are suggested, which can be carried out with very meagre apparatus, and a questionnaire is given to enable the reader to test himself. All the questions may be answered by reference to the subject matter in the book.

Although written primarily for the man with no Mathematical or Mechanical background, the fully qualified Mechanical Engineer will be surprised at the profit and pleasure he will derive from reading the book.

W.M.

A MANUAL OF SURVEYING AND DRAWING

By J. LEES HARRISON, I.F.S.

(Published by The Forest Research Institute, Dehra Dun. Rs. 4/4)

In his preface the author states that the book should be regarded as a guide to students, and as a limited reference in connection with lectures and field work; there is no doubt that he has achieved just that much.

It does cover a very wide range from geometric definitions to adjustment of instruments, but the student who may wish to follow the subject step by step will be disappointed because the author has necessarily staggered and spaced his stepping stones widely in order to cover the range in one volume.

On the other hand it is a compact and concise reference work in clear

type, containing much information of real practical value to refresh the memory of student or instructor who is content to find his way by means of the limited but adequate index.

The book is well provided with clear diagrams; unfortunately it is difficult to place such diagrams to read well with the text in such a small volume, but they do serve to amplify it to the extent of doubling its informative value.

A good reference book, of particular value to one returning from Service duties to resume studies, and with an inclination towards Forest or similar surveys.

L.D.C.

INCOME TAX FOR H.M. FORCES AND DEMOBILISED PERSONNEL—1944-45 EDITION

By Capt. G. B. Burr

(Publishers Jordan & Sons, Ltd., Chancery Lane, London, W.C.2. Price 2s.)

This is a useful pamphlet showing very clearly the application of the Income Tax rules, with special reference to members of the Forces.

Chapter I gives the general Income Tax rules very briefly.

Chapter II gives useful tables showing which items of pay and allowances are assessable and which are exempt. It also gives some details regarding Income from civilian sources.

Chapter III gives in more detail particulars of the various exemptions and allowances made in respect of Income Tax.

Chapter IV deals with the basis of assessment, and the effect of changes of appointments and alterations in Income during the year. It explains the difference between the civilian P.A.Y.E. system and the service system which also deducts tax from pay at the time of issue. This chapter is of special interest to members on first joining the service from civil life.

Chapter V gives particulars of Returns of Income, including that from civilian sources, and shows a specimen completed return.

Chapter VI deals with adjustments, errors, amended claims and repayment claims.

Chapter VII deals with service abroad and Foreign and Dominion Income.

Chapter VIII deals with miscellaneous matters including particulars of Sur-Tax assessments.

Chapter IX gives some particulars of the effect of Demobilization, Retirement and return to civil life on Income Tax assessment.

The pamphlet has plenty of examples which explain the text very clearly. Anyone reading this book carefully should be able to arrive at a correct assessment of the tax due from him without much difficulty. To get the Income Tax authorities to agree to the calculation or to recover overpayments from them is another matter.

C.C.P.

MAGAZINE REVIEWS

EMPIRE SURVEY REVIEW, April, 1945

Surveyors who attended the Empire Survey Conference in 1931 will remember the excellent exhibition of cadastral maps and records shown, in connection therewith, at the Science Museum. Sir Ernest Dowson and Mr. V. L. O. Sheppard, who were responsible for that exhibition, give a most interesting account, in *Work of the Cadastral Survey and Lands Records Office*, 1932–45, of its development into a permanent collection, first housed by the Royal Geographical Society, and now under the care of the Director General, Ordnance Survey, in London. The collection includes not only maps and forms, but information about various matters connected with land tenure, the legislation of various countries, and technical and administrative regulations. The value of the collection has been greatly enhanced by a Cadastral Analysis, or abstract of the salient features of the systems of land record in different countries, which has been made by Mr. Sheppard.

Under *Notices* there is a most interesting account, taken from the October, 1944, issue of *The Canadian Surveyor*, of a remarkable feat in map production. A single sheet map, 1/25,000 scale, 10 by 15 km. area, was required at short notice for the invasion of France, 50 copies to be printed in 3 colours. By special organization and methods this was accomplished in 29 hours from the receipt of the air-photos. This remarkable achievement, in less than half the time estimated by the Air Survey Committee (Prof. Paper No. 8) for such work, was the result of experiments in rapid map production initiated before the present war, and reflects the greatest credit on the Canadian Air Survey Organization.

In Correspondence, Maj.-Gen. MacLeod deals with Brig. Winterbotham's criticisms on the adoption of the metric grid on O.S. maps, and Lt.-Col. Thompson investigates the cost of plans of properties on the new and old systems, according to their size and position on the plan.

E.M.J.

GEOGRAPHICAL JOURNAL, September-October, 1944

K. de B. Codrington concludes his *Geographical Introduction to the History of Central Asia*. To quote the President, this paper is "packed with knowledge and learning and expert research," and is illustrated by first-rate photographs.

It may be news to some readers that surface mining of both iron and coal has been carried on in this country on a large scale for many years. W. D. Evans gives a most interesting account of *Opencast Mining of Ironstone and Coal*, and incidentally of its development and great value during the war years. A notable point is that, given proper treatment and restoration, the value of the land for agricultural purposes is not impaired, and may even be enhanced. The article is illustrated by excellent photographs and diagrammatic drawings, and includes a valuable description of the excavating machinery used.

A note by the late Secretary of the Society, A. R. Hinks, of whose recent death his many friends in the Corps have been distressed to hear, appears on *Some New Effects in Map Projection*, being a review of a number of recent American publications, some of which are of special interest to the cartographer. The article is marked by his usual extensive and precise knowledge.

E.M.J.

THE ENGINEERING JOURNAL

(Published monthly by the *Engineering Institute of Canada*)

February, 1945.—This issue begins with an article on the *Inductive Co-ordination Aspects of Mercury Arc Rectifier Installations.* The author discusses the methods adopted to minimize the inductive interference on communication circuits caused by Mercury Arc Rectifiers which are rapidly replacing other forms of Converting Machinery.

The Engineer and the Community forms the subject of the next article. The author reminds us that the functions of the Engineer are not so well known as those of the other professions. We say "my doctor," "my lawyer," "my baker" but never "my engineer." Modern conceptions of town (or community) planning require the same kind of reasoning as that adopted by Engineers when designing a machine or a structure.

Post-War Projects for the Prairies are then explained. The Prairie Farm Rehabilitation Act of 1935 applies to nearly 125,000,000 acres in the three prairie provinces which have become practically depopulated after years of drought. The choice of the most suitable crops and the best methods of agriculture and irrigation are of particular interest just now in view of the imminence of demobilization.

The March, 1945, issue opens with an interesting paper on *The Welding and Fabrication of Canadian Light Armour.* The author describes how the difficulties encountered due to the air-hardening properties of the special steels have been largely overcome. He deals with face-hardened, homo-hardened and machineable quality steels and explains the uses and limitations of austenitic, ferritic and mild steel electrodes.

The Need of Research in Canada is then emphasized. Some figures of expenditure on research in Russia, U.S.A., Great Britain and Canada are given and the comparisons are not very flattering either to Canada or Great Britain.

Power Supply in the Steep Rock Mining Area.—This is a description of the Power Supply Transmission System for the Steep Rock Mines described fully in the January issue.

The Importance of Design in a Tax Structure.—In this article the author describes the Canadian System of National and Provincial Taxation and considers that a greater proportion of the Revenue should be collected by direct taxes (7% only is collected in this way at present) to ease the burden on Industry.

The April, 1945, number starts with a paper on *Farm Electrification—A New Service.* Canada's prosperity depends upon half the population living in rural areas and it is therefore necessary to improve the amenities in these areas to encourage the younger generation to leave the towns. An important factor will be a liberal supply of Electric Power and the author discusses some of the economical and technical aspects.

Post-War Plans for Rural Electrification in Alberta.—This deals with the same subject as the last article but applies specifically to Alberta.

The Engineer in Administration.—This paper again draws attention to the fact that about 5 years after leaving college nearly 50% of engineering graduates find themselves in non-technical appointments and the necessity for more appropriate University Engineering courses is again urged.

British Engineering Education and Training.—The various methods of acquiring professional status as an Engineer in Great Britain are described.

Canadian Engineers Part in the War.—General the Hon. A. G. L. McNaughton describes some (but far from all) the contributions of the Canadian Engineering Industry to the War Effort. W.M.

JOURNAL OF THE UNITED SERVICE INSTITUTION OF INDIA, JANUARY, 1945

Penny Wise, Pound foolish, the winning gold medal essay, is a rousing answer to the question " Should our forces be trained to operate over any kind of country, in view of the experience gained in the present war ? " The author envisages one service, navy, army and air force, with the same uniforms and the same titles for equivalent ranks. The C.-in-C. will be H.M. the King, and the Defence Minister the Premier—but, we may ask, will every premier be suitable ? Army units will move from one training ground in the Empire to another, from mountain warfare in Scotland to jungle fighting in Assam ; the air force will do similarly. It will cost money, says the author, but it will be a wise insurance against another world war in 20 to 30 years time.

Britain's Post-War Army is a report of a debate in the House of Lords, in which Lords Trenchard, Mottistone, and Strabolgi and the Earl of Cavan took part. One point made by the last-named was that in the next war, Britain will be attacked first ; therefore it is essential that some Home Guard system should be ready at an hour's notice. Lord Selborne, replying for the Government, said that the chief factor in the situation would be the world security organization to be set up after the war, and the contribution the Empire would make to it.

Malaria Control in the S.W. Pacific is by a M.O. who went from the Burma-Assam front to study the methods employed in New Guinea by the Australians and Americans, for whose measures, especially those of the former, he had unstinted praise. The secret of the remarkable success obtained in New Guinea is mepacrine, combined with strict discipline : thus an officer whose command shows unfavourable malaria returns may be deprived of his job. Conditions are, the author admits, rather simpler for malaria control in New Guinea than in Burma.

The First Burma Campaign deals with the operations of 1942–43 up to the loss of Rangoon. It is a plain historical account of events, and for that reason all the more welcome. At the outset a British force of little more than a brigade was fighting two Japanese divisions. Stress is laid on the exact knowledge of jungle tracks possessed by the enemy. The article is to be continued.

Peace Terms is a thoughtful attempt to fix punishment and define safeguards. Probably the author's opinions have undergone a radical change since the revelations of concentration camps.

C.I.D. in khaki. The modern British army is a cross section of the population, and contains no more and no less than its proportion of the criminal classes. A very useful special investigation branch of the C.M.P., manned by C.I.D. men, has come into existence as a counter measure and deterrent. It has done useful work in the detection of crime, for example frauds on N.A.A.F.I. in India and elsewhere.

Post-war Careers for young Officers is deserving of study by all such, whether they hope to remain in the army or not. A good deal of profitable thought can, the author argues, be given to the matter while the officer is still in the service.

Some further reflections on Waziristan has two tentative suggestions towards the solution of the ever-present problem of that country. One is the enlistment of more Mahsuds in the I.A., and the other, which is certainly novel, is to give them sheep of good breeding. The Mahsud is largely pastoral and the presentation of useful stock to improve the breed could do no harm and might do a lot of good.

Thoughts on the functions of air landing troops. These are distinct from

airborne troops, in that they penetrate more deeply into enemy-held territory and stay there longer; their peculiar problems are ably discussed, as are those of the enemy confronted with a well trained and well armed force close to their vitals.

There are some valuable suggestions in *Water-supplies in the Field*; among them are—units must be capable of holding and carrying not less than a third of their daily water ration in *pakhals* fitted to light trailers, towable by jeeps or hauled by mules; each division to have a pool of 25 water-trucks each carrying one 200 gallon G.I. tank; the *pakhal* to have a better shaped-pourer; three gallons of pure water per man per day to be aimed at, not an excessive amount for drinking, cooking and perhaps washing in a tropical climate.

F.C.M.

THE INDIAN FORESTER

February, 1945.—*Water-supplies.* An excellent summary of the subject dealing briefly with all aspects thereof. Army methods of sterilization are quoted.

Consumption of timber in India has increased fivefold since 1940; it is now 1,274,000 tons annually.

The *November*, 1944, issue of the *Indian Forester* contained an article on "grass that fights snakes and malaria" growing in South America. The grass has been tried in southern India and found to have no effect whatever on *anopheles* mosquitos.

The S. of S. for India has stated in Parliament that the construction of 400,000 miles of roads was to be undertaken at a cost of Rs. 450 crores (£35,000,000) odd, increasing the length of the existing system by 65%. It is estimated that such an improved system will save the rural population over Rs. 50 crores annually on the cost of bullock cart transport only. A pilot survey by Chief Engineers of presidencies and provinces estimates that Rs. 100 spent on road development, including maintenance, brings in a return of Rs. 277 to the community through increased earnings. One hesitates to accept these optimistic figures, but in view of the fact that the revenue obtained in British India from motor taxation, even in war time, exceeds by over 50% the expenditure on road construction and maintenance, an extensive programme of road development would seem to be amply justified. The estimated cost of roads per mile, including presumably cost of acquisition of land, works out at Rs. 12,500 per mile, or say £930.

March, 1945.—Timber can be protected against the attacks of powder post beetles by a mixture of creosote and fuel oil, applied externally, for at least nine months; a coating of lime wash gives immunity for three months.

An artisan works company of the I.E., has built a pre-fabricated boat-bridge, 700 feet long, on the Arakan L. of C., in 20 days. It was so designed that every piece could be carried on a jeep. The O.C. Coy. is Maj. G. G. Layton, I.E., who seems to have had a hand in the design also.

The annual report of the Director of Forestry, New Zealand, states that by using log frame saws instead of circulars for cutting up timber, there is a saving of 19%. Translated into terms of acreage of woodland per annum, this means that the produce of 235 square miles of timber in the Dominion is saved.

F.C.M.

INFANTRY JOURNAL

(Published by the U.S. Infantry Association)

February, 1945.—*How Much Infantry?* Determining the proportion of Infantry, Artillery or Air Force is one of the most difficult problems. Different types of warfare require different proportions of the various arms, and even during any war the original proportions will probably require amendment.

The whole question of the proportion of Infantry required for the future will require very careful consideration after the war, when we have been able to assess the real value of our intensive bombing of German industries and communications. The development of "robot" planes will be another factor which may effect the solution.

Battle Facts are continued and include *Saipan Cavemen* describing how the Japs were cleared from the many caves which provided a series of natural pillboxes. *Divide and Conquer* is a description of street fighting in Sicily. Also *Plan your Patrols*, *Supplying the Seventh Army*, *Direct Fire Support*, and *All-around Defence*. This last article by Capt. J. W. Westbrook, comments on and questions the advisability of true all-round defence as discussed in an article by Maj.-Gen. J. F. C. Fuller in the May, 1944, *Infantry Journal*.

March, 1945.—*Battle Facts* are continued with interesting articles entitled *Why not Tanks?* which stresses the view that the Infantry Cannon Coy. should consist of tanks as being the most suitable close support weapons. *No Close Air Support Please* by Lt.-Col. R. E. Cushman lays down that close air support should never be ordered on less than a divisional basis. If carried out on a battalion front adjacent battalions will probably suffer owing to inaccuracy of bombing along the line of flight and also because of possible last minute alterations in the position of other battalions. *The Indian Army* by Lt.-Col. James W. Bellah points out the necessity for Americans to get to know something about the Indian Army, which may be fighting alongside them in the future in the Pacific. The article has good photos showing the different types of men enlisted. It speaks very highly of the efficiency, *esprit de corps* and joy in the profession of arms of the only completely volunteer army left in the world to-day.

April, 1945.—*Forest Fighting* by Lt.-Col. M. L. Rosen gives details of the special features of this type of fighting. It is interesting to note that a battalion at first had only one platoon of engineers attached to it, but a whole Coy. was at once demanded and considered essential. The engineer tasks were removing obstacles, corduroying bad stretches on secondary roads, delousing mines, etc.

Rescue at Cabanatuan by Lt.-Col. H. A. Muller is an interesting account of the rescue of allied prisoners from the camp near Manila by 6th Ranger Battalion of the American Army.

Battle Facts are continued including the following brief articles: *Shoot, Soldier*, stressing the importance of Infantry always firing their weapons, when fired at, unless for special reasons they are ordered to withhold their fire. *Psychoneurosis and Leadership* stresses the importance of dealing with the psychological effect of war on some men within the unit by the regimental officer. Much wastage of manpower can be saved in this way.

Preparing the Mind for Battle is another article on the same subject and states ways of overcoming the effect of nerve strain in battle.

German Machine Guns by W. H. B. Smith is a very well illustrated article giving particulars of the German Machine Guns Nos. 34 and 42.

C.C.P.

THE MILITARY ENGINEER

(Published by the Society of American Engineers)

February, 1945.—*The Role of American Engineers in World War II* by Maj.-Gen. Eugene Reybold, Chief of Engineers, an address delivered to the Engineers Club, Philadelphia, in November, 1944, gives a "brief but accurate report" on the role played by American Engineers in general and by Army Engineers in particular in the war.

The report falls into three parts viz. :—the build up, the turning of the tide and the drive to victory.

The first deals with the emergency construction programme required to enable great numbers of men to be trained and vast quantities of war material of all kinds to be produced. By the summer of 1942 the amount of new construction being put in place every day was given as £4,000,000 worth.

This was followed by recruitment of skilled specialists for military duties overseas.

Side by side with this the provision of engineering equipment was tackled.

The second part, the turning of the tide, was mainly made possible by the successful planning and execution of the build up and Gen. Reybold instances how the Japanese, with their "picayune" installations, were incapable of supporting their forces by failing to realize the vital importance of engineering works. The third, the drive to victory, tells of the achievements of some of the units of the Army Engineers on landing beaches and the hundred and one other "assigned missions."

The claim made by Gen. Reybold that "specializing through peace time years in river and harbour and flood control work, we had an administrative organization which took in its stride the challenge of planning and supervising history's greatest construction program and had functioned is good engineer organizations should" are points of great interest in connection with that hardy annual, the best organization for the R.E. in peace time.

Physiography and War in Burma by Irving B. Crosby (not the crooner but an eminent consulting engineer geologist, who has made special studies of the unusual physiography of Burma) gives a full description of the physical features of that country with special reference to their influence on both Japanese strategy and our own. Burma is divided into five regions the characteristics of each of which are described and their influence on the conduct of the campaign discussed.

Students of the Burma campaign will be much helped by this clear article.

Defences of the Normandy Peninsula gives a résumé by Lt.-Col. S. B. Smith, one of the officers who assisted in the surveying of these fortifications, of a report completed by the Chief Engineer E.T.O.U.S.A. Though incomplete, the defences were formidable, but their theoretical value was nullified, partly by the preliminary aerial bombardment, but mainly by the inherent mistake of relying on static defence along the coast to stop an invasion at the beaches.

The fact that the defending troops were not of first quality also had its effect, but failure is bound always to occur when such bad strategy governs a plan.

VII Corps Engineer Bridges presents seven photographs of work carried out with various kinds of equipment.

The Ugly Duckling by Col. Hall, Corps of Engineers, describes how a "demolished" steel truss bridge, which had been cut in the middle, was successfully made serviceable, by filling in the dip with rubble. A lesson in how not to "demolish" a bridge.

The last paragraph of some notes with which this issue ends is a good example of sound advice given in typical American vein. "When sweeping

roads, kick that shrapnel off the road. It is better than buying a war bond, as you save a tyre already in the battle zone, while a war bond only buys one to ship here months later." Advice by Capt. H. L. Williams, 121st Engineer Combat Bn. B.L.A.

March, 1945. *German Mines and Booby Traps* by Ernest Mayer and O. W. Wilson, of the Office of the Chief of Engineers, makes no attempt to describe in detail all these devices, but representative and common examples of German equipment are described, to give a cross-sectional picture of the dangers due to mine warfare. The writers then describe some of the anti-tank mines, viz., Tellermines which are fully described with illustrations, and their evolution to the T.Mi. 43 (mushroom) is traced.

Wooden box mines, including the Italian 4-fuse A.T. mine, and R mines, the German linear type are also described.

The clearing of these anti-tank mines is nowadays almost certain to be complicated by the incorporation of anti-personnel devices added to make their lifting more hazardous.

Some of the anti-personnel mines are next described, including the S. Mine, Z 35, colloquially known as Bouncing Betty, which, though easy to locate with detectors have been the cause of many casualties in conditions which obtain in the earliest stages of an attack. Their effectiveness has been greatly increased by the use of electro-chemical-pressure-spikes which, spread out round the mine itself, when stepped on send a current to the detonator and so greatly increase the danger area.

The Schumines, made of non-metallic substances, though hard to detect have very local effect, each mine can only hope to cause one casualty.

The firing mechanisms for different types of booby trap are also described.

These devices are of many kinds, the principal types are those actuated by pressure, by pull on a wire and by electricity. The writer points out that the items described cannot be more than a cross section of what the Germans use.

He stresses the necessity for training not only the Engineers but every soldier in " delousing " areas captured from the enemy.

Blitzed Runways Made New by Squadron-Leader Vernon Noble describes the various methods employed to make damaged airfields fit for use in the shortest possible time.

The Red Army Improvises by Maj. R. B. Rigg tells of some of the methods used by the Russians to cross the many serious water obstacles met with by them in their advance to Germany, when standard equipment was not available.

The importance of the time factor has been fully realized and consequently no effort has been spared to make use of all kinds of material available near the site of a crossing and also of civilian labour, often with far reaching results, which would not have been achieved had the crossing been delayed until standard bridging equipment arrived.

Considerable use was made of artificial fords, which have the advantage of being hard to discover from the air.

The method of constructing under-water bridges, both for tanks and Infantry, is described; an interesting type for the latter is the semi-floating suspension bridge which can be carried in sections on the backs of Infantrymen.

The truly amazing advances by the Russians are said to be due to a greater extent than is realized to their ability to " patch up an unexpected situation out of the humblest things."

A.R.A.I.

AN COSANTÓIR

(Journal of the Eire Army)

April, 1945.—Opens with an interesting original article by a Bn. Cdr. suggesting a new organization for the Inf. Coy. The novelty is really the grouping of most of the L.A's. in a " Bren Pln." containing six Bren gun teams (1 N.C.O. and 3 men each). The H.Q. Pln. contains the Admin. personnel and Anti-Tank Section (no mortars apparently)—and the remainder form three Assault Platoons. The latter consist of Pln. Cdr., 3 runners and two Assault Sections. The Assault Section contains 1 Sgt., 1 Cpl. and 9 men —of whom 2 form a Bren gun team. This organization is said to give a unit very easy to control and very effective (and flexible) in battle. The grouping of the bulk of the Bren guns has obvious advantages—while the Assault Platoon is strong enough to carry a real punch in attack or defence—while it has enough " unencumbered " rifle men to get about and do things in a way impossible for a more heavily loaded man.

Col. Garforth's article on British W.O.S.Bs. is reprinted in full from *The R.E. Journal.* An article describing a night run at a Searchlight Station is now of interest only to historians, so much have methods of locating and dealing with enemy aircraft developed of recent years.

Maintenance from a Command Standpoint—from the U.S. *Military Review*—deals with M.T. vehicle maintenance, stressing the responsibility of the non-technical, regimental officers in this respect. It very rightly points out that the regimental officer need not try to be a technical expert himself, though he must learn enough to be able to talk intelligently on the subject with the expert.

May, 1945.—Sean Tracey is the " leader " whose biography opens this month's issue—there is little of direct military interest.

The Generals say . . . (in the U.S. *Military Review*), mainly a lot of platitudes adequately covered by the official manuals. But they make one good point when stressing the unreality of so much training which results from the urge to " rush " a situation in a few hours, which might take as many days to develop in actual warfare. Probably it is the Engineers who suffer most from this, as Commanders fail to appreciate the importance of their work in the real timing of battle operations. The effect of demolitions and time taken in clearing minefields etc., is so often slurred over in exercises.

An original article on *The Art of Concealment* is excellent in its way, but is chiefly concerned with the training of the individual infantryman. An illustration of what to avoid, said to be based on an incident which occurred outside Ireland: " Division H.Q. Sir ? Yes, Sir—about half a mile on. It's the only camouflaged building in the place, Sir. YOU CAN'T MISS IT."

The Military Roads of Ireland is dealing with the prehistoric period. It will be news to most that corduroy roads across bogs—with oak planking deeply worn and patched as the result of the wheeled traffic using them—have been found under many feet of " bog " suggesting a date about 1250 B.C.

Armament officers would be interested by a survey of *The Evolution of Small Arms Accuracy and Range* from the American *Rifleman ;* a long article from the Russian (via U.S.) of the *Organization of River Forcing Operations* has nothing of real interest.

June, 1945.—Richard McKee is the subject of the biography ; though only 27 when shot, he had risen to a high executive position. The article contains more " action " than most and illustrates many points of interest in the organization of an underground " resistance " movement.

Scrutiny and Patrolling (from the U.S. *Cav. Journal*) shows how easily the regulations for " Roger's Rangers "—the 18th century formation which gave its name to the U.S. counterpart of our " Commandos "—can after translation into modern terms, be applied immediately to present day training.

D.R.ff.M.

CORRESPONDENCE

ABBREVIATIONS

May 10th, 1945

The Editor, *The R.E. Journal.*

Sir,

J.Ps.
M.Ps.

so why

Cs.R.E.
D.Cs.R.E., etc ?

This puerile pedantry has now infected the rest of the Army and we now see O.s C., G.O.s C. and the like.

Incidentally, where do the purists put the " s " in D.A.A. and Q.M.G. ?

Now that we have won the war, for Heaven's sake let us return to sanity and the normal customs of the English language.

Yours, etc.,
W. E. BRITTEN,
Colonel.

THICKNESS OF RUNWAYS

On pages 72 and 73 of *The R.E. Journal* for March, 1945, a letter and diagram were published regarding the thickness of runways for airfields. Owing to the fact that the author, Col. H. A. Baker, was serving in West Africa at the time it was not possible to get the proof checked. Unfortunately there were a number of errors, which crept in for various reasons and would have been corrected if the author had seen the proof. Col. Baker has now been able to make the necessary corrections as follows :—

(*a*) The formula published on page 72 should read :—

$$t = -\frac{d+D}{4} \pm \sqrt{\frac{DdP}{4p} - \frac{Dd}{4} + \left(\frac{d+D}{4}\right)^2}$$

where t = thickness of runway in inches.
P = tyre pressure in lbs. per sq. in.
p = safe ground pressure in lbs. per sq. in.
D = Major Axis of ellipse formed by tyre in ins.
d = Minor Axis of ellipse formed by tyre in ins.

which assumes that the pressure P is spread evenly by the carpet at an angle of 45 ° to the subgrade, where it is reduced to p.

(*b*) The reference to the superimposed curve (7) should read 7 tons and not 70 tons.
(*c*) The name of the author should be Col. H. A. Baker.
(*d*) The revised diagram and notes published herewith should replace those published on page 73.

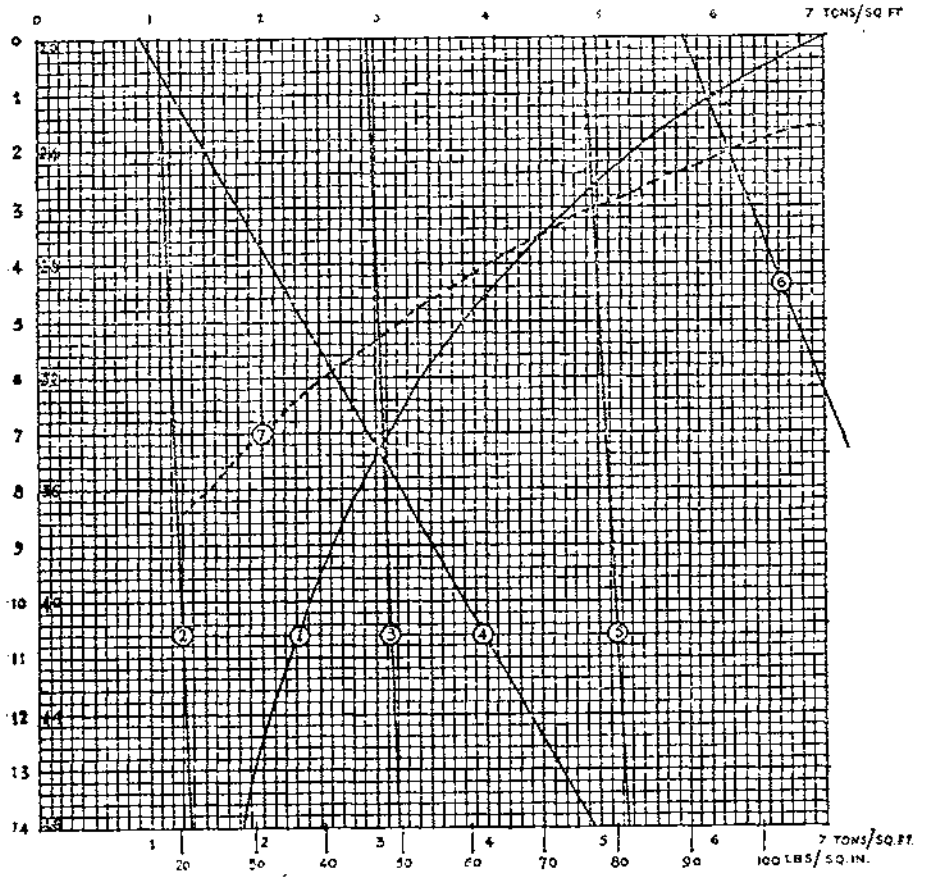
PLATE I.

FROM E.-IN-C. INDIA PAMPHLET No. I.

GRAPHS SHOWING :—

(1) PRESSURE INTENSITY ON SUBGRADE AGAINST RUNWAY THICKNESS.

(2)—(6) BEARING CAPACITY OF DIFFERENT SOILS AGAINST RUNWAY THICKNESS.



(1.) PRESSURE INTENSITY DUE TO SURFACE LOAD OF 7 TONS/SQ. FT. ON AN ELLIPSE 20" x 45" (LOAD=34·4 TONS).

(2.) BEARING CAPACITY SOFT CLAY. C=400 LBS./SQ. FT.=2·78 LBS./SQ. INCH. $\phi = 4°$

(3.) BEARING CAPACITY FAIRLY STIFF CLAY. C=1,000 LBS./SQ. FT.=6·96 LBS./SQ. INCH. $\phi = 6°$.

(4.) BEARING CAPACITY DRY SAND. C=NIL. $\phi = 34°$.

(5.) BEARING CAPACITY STIFF CLAY. C=1,500 LBS./SQ. FT.=10·42 LBS./SQ. INCH. $\phi = 8°$.

(6.) BEARING CAPACITY SAND PREDOMINATING WITH SOME CLAY. C=400 LBS./SQ. FT.=2·78 LBS. SQ. INCH. $\phi = 30°$.

(7.) CURVE EXTERPOLATED FROM COL. KIRKE'S SET OF CURVES AS PUBLISHED IN *The R.E. JOURNAL* FOR MARCH, 1944, FOR 7 TONS/SQ. FT. (ELLIPSE NOT KNOWN).

NOTES

1. BEARING CAPACITY IS FOR 20" WIDE TYRE IMPRESS ON RUNWAY SURFACE, SPREAD AT 45° THROUGH RUNWAY TO SUBGRADE.
2. "SURFACING" IS GIVEN BY RUNWAY WEIGHING 150 LBS./CU. FT.
3. WEIGHT OF SOIL 100 LBS./CU. FT.
4. C=COHESIVE STRENGTH OF SOIL; ϕ=ANGLE OF INTERNAL FRICTION

EXAMPLE. MINIMUM RUNWAY THICKNESS FOR "DRY SAND" IS 7·4", i.e., WHERE BEARING CAPACITY LINE (4) CUTS PRESSURE INTENSITY LINE (1.)

INSTITUTION OF ROYAL ENGINEERS

ALL regular officers of the Corps of Royal Engineers are eligible for Full Membership of the Institution at the rates shown below.

Officers holding, or who have held, commissions in the Royal Engineer Militia, Supplementary Reserve, Special Reserve or Territorial Army, and also those holding, or who have held, Temporary Commissions in the Royal Engineers, and those belonging to the Engineer arm of the British Overseas Forces, are eligible for either Full Membership or Associate Membership of the Institution of Royal Engineers. Civilian Garrison Engineers are eligible for Associate Membership.

The entrance fee and annual subscriptions are as follows :—

Full Membership—

	£	s.	d.
Entrance fee	1	0	0
Annual subscription, based on substantive rank :—			
2nd-Lieutenant	1	0	0
Lieutenant	1	5	0
Captain	1	10	0
Major	1	15	0
Lieut.-Colonel and upwards	2	0	0
Quarter-master, S. of W. and I.R.E.M. of any rank	1	5	0

Associates—

No entrance fee.			
Annual subscription	1	0	0

Both classes of members receive *The Royal Engineers Quarterly Journal*, *R.E. List* and *Monthly Supplement to the R.E. Journal*, and free issues of such other Institution Publications as the Council may from time to time determine.

All Institution publications may be purchased at reduced rates.

Full Members have the free use of the Corps Library, at present situated at Chatham.

Associates have no voice in the management of the Institution.

Retired officers who have been members of the Institution during their service, and who do not desire to continue to pay the full subscription, may, if they desire, subscribe to the Institution publications at the following annual rates :—

	£	s.	d.
R.E. Journal, R.E. List and *Monthly Supplement*	1	10	0
R.E. Journal only	1	0	0
R.E. List and *Monthly Supplement* ..		15	0
R.E. List only		10	0
Monthly Supplement only		5	0

SPECIAL NOTICE

The fact that goods, made of raw materials in short supply owing to war conditions, are advertised in this magazine should not be taken as an indication that they are necessarily available for export.