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MONTGOMERIE PRIZE.

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

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

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

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

The following are suggested as subjects for contributions:—

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

MILITARY WIDOWS' FUND, BRITISH SERVICE, INDIA.

THE Military Widows' Fund, British Service, was established in India in 1820 to alleviate the distress of families of officers of the British Service *serving in India*, and to enable them to return to England without unnecessary delay. Whenever an officer of the British Service, who is a subscriber to the Fund, dies, his family receives at once the following assistance, namely, six months maintenance allowance ranging from Rs 2,400 to Rs 3,600 according to the rate subscribed, plus Rs 1,500 as a donation for the widow, plus Rs 500 or Rs 300 as a donation for each child according to whether the child is over 12 and under 21 years of age or under 12 years of age. These benefits are secured by a small subscription of Rs 4, 3 or 2 per mensem, which is regulated by the amount of pay an officer draws. An officer, on becoming a subscriber, secures for his wife and children quite irrespective of his length of service in India, the full benefits of the Fund in case of his death after having subscribed for fully three months. In the event of an officer dying within that period, his case is specially considered by the Committee of General Management. Copies of the regulations of the Fund and other particulars relating thereto can be obtained from the Secretary at Simla.

NAPOLEON'S ENGINEERS.

By BRIG.-GENERAL J. E. EDMONDS, C.B., C.M.G. (*retired* R.E.).

I CANNOT recall having ever heard of or seen any book specially devoted to the engineers of Napoleon's armies. On consulting my colleague in the Historical Section, Major F. A. Becke, late R.F.A., a great collector of Napoleonic literature, I found that he also had never come across anything of the kind. He said, however, that he was the fortunate owner of a curious little book entitled, "Etat du Corps Impérial du Génie," Mai, 1808, in which there was a good deal of information regarding the organization of the French engineers. His copy is of special interest to us as it is inscribed, "Taken by Lieut.-Colonel Burgoyne, R.E., from the office of the French Commanding officer of Engineers, Madrid, 1812." The book is a small one ($7\frac{1}{2} \times 4\frac{1}{2}$) and has a preface headed "Précis de l'histoire des arts et des institutions militaires en France," written by M. Allent, *chef du bataillon du Génie*, containing a useful historical summary. From a few other books in Major Becke's possession, a list of which is given at the end of this article, some further material was gleaned. For any value therefore attaching to this investigation I am indebted entirely to him. It does not pretend to be exhaustive, but it may encourage someone else in studying Napoleon's methods to note how he employed his engineers, which it never before occurred to me to do.

Until 1793 the Artillery and Engineers of the French Army formed one Corps, as they had once in the British; it was not, indeed, until after the war of 1870-1 that the bridging trains and troops ceased to belong to the Artillery. In October, 1793, Carnot, himself an Engineer, proposed to the Convention that the companies of miners should be separated from the Artillery. The separation actually took place on 15th December, 1793 (25 Frimaire, An II), and on the same day the formation of 12 battalions of sappers was decreed. This date therefore is the birthday of the Corps of Engineers of the French Army.

In Italy in 1796, Colonel Chasseloup-Laubat commanded the Engineers. In Egypt, 1798, there were 800 sappers under command of General of Division Caffarelli-du Falga, and, after his death during the Siege of Acre, of Sanson, who will be heard of again.

In 1800 in Italy, Général de Division Marescot was Chief Engineer, where he distinguished himself during the crossing of Mont St. Bernard, and we find him in the same appointment at

the camps of Boulogne in 1805, with a staff of 17 officers and an A.D.C. By this time each Army Corps had an Engineer staff and each division a *chef de bataillon* and a company of sappers, and the recognized duty of the sappers in battle was to follow up an attack and put villages in a state of defence as they were captured; there was no better strong point than a well loop-holed building in those days. The miners were apparently specially trained in demolitions as well as in military mining.

In 1806-7 General of Division Chasseloup was Commandant-in-Chief of the Engineers, with a staff of 19 officers, including an A.D.C. The total strength of the Army is given as 335,100 on 1st April, 1807, and the strength of the Engineers as 2,382.

We now come to the Corps of Engineers in 1808 as given in the *Etat du Corps* captured by Lieut.-Colonel Burgoyne. It was then composed of a Staff, Engineer troops, and Fortress Wardens. Its organization was as follows:—

STAFF.

Chief Inspector General	1
Inspectors General, Generals of division	2
,, ,, ,, brigade	6
Total	9

Note.—These general officers formed part of the general staff of the Army.

Colonel Directors	41	
Sub-directors—Majors	8	
Chefs de bataillon, 1st class ..	58	
,, ,, 2nd class ..	8	
	—	74
Captains, 1st class		100
,, 2nd class		120
Lieutenants		40
Total		375

SCHOOL.

One examiner of the Engineers, member of the Institute.
Students, sub-lieutenants of Engineers, 30.

Note.—The students were all graduates of the École Polytechnique the number varied with the requirements of the Service.

ADMINISTRATION.

Chief Inspector-General.—His Excellency General Marescot, Sixth Division of the Ministry of War.

ENGINEER PERSONNEL.

Director.—Chef de bataillon de Caux.
Chef de bureau.—M. Lagé.

ENGINEER MATERIAL.

Director.—Colonel Director of Fortifications Senermont.
Chef de bureau.—M. Schilleman.

CENTRAL COMMITTEE ON FORTIFICATION.

President.—The Chief Inspector General.

Members.—The Inspectors General of Paris and field officers nominated by the Minister, eight in all.

Secretary.—Chef de bataillon Allent (no doubt the author of the Preface to the book).

CENTRAL DEPÔT OF FORTIFICATIONS AND OF RELIEF-PLANS OF THE FORTRESSES.

A director, sub-director and chef de bureau.

DEPÔT OF THE COLONIAL FORTIFICATIONS.

A director and chef de bureau.

ENGINEER TROOPS.

The Engineer troops were composed of five battalions of Sappers, five Train detachments, and nine companies of Miners.

Sapper Battalions.

Each Sapper battalion was organized with a regimental staff and nine companies, 612 strong on peace and 1,377 on war establishment. The regimental staff both in peace and war consisted of a chef de battalion, a quartermaster, an adjutant, a surgeon-major, an assistant adjutant (non-commissioned), a corporal drummer, sergeant-tailor, sergeant shoemaker, and sergeant armourer, nine in all.

Each company consisted of the following on both peace and war establishment:—Captain 1st class, captain 2nd class, lieutenant 1st class, lieutenant 2nd class, sergeant-major, 4 sergeants, and a quartermaster-sergeant. In the other ranks the establishment differed.

	Peace	*War*
Corporals	4	8
Master-tradesmen	4	8
Sappers, 1st class	12	36
Sappers, 2nd class	36	88
Drummers	1	2

Making a total of 67 all ranks per company in peace, and 152 in war.

How many vehicles a battalion possessed does not appear, but the battalion train detachment contained a sergeant-major, a sergeant, four corporals, a shoeing smith, a saddler, and 60 train soldiers.

The Miners had only a company organization; with the same number of officers and sergeants as a Sapper company.

	Peace	*War*
Corporals	4	4
Artificers	4	4
Miners, 1st class	12	24
Miners, 2nd class	36	56
Drummers	2	2

Total per company 68 in peace and 100 in war.

Why a Miner company should require two drummers on peace establishment and a Sapper company only one, is not apparent.

FORTRESS WARDERS (*Gardes du Génie*).

These were no doubt foremen of works. There were four classes.

1st class, warrant officers	74
2nd class, sergeant majors	74
3rd class, sergeants	150
4th class, corporals	290
	588

At the time of publication of the *État* the following officers held the higher appointments in the Corps:—

Chief Inspector General.—His Excellency General Marescot.

Inspectors General and Generals of Division:

Chasseloup-Laubat, Director General of Engineers in Italy.
Lery, Commandant of Engineers of the Army in Spain.
Bertrand, A.D.C. to the Emperor.
Sanson, Director of the General War Depôt.

There were on the strength of the Corps 9 generals of brigade; 42 colonels directors of fortifications; 7 majors, sub-directors; 75 chefs de bataillon, 330 captains, and 119 lieutenants; and the total war establishment of the Corps was 9,088.

The *Etat* gives a complete nominal roll of the officers by ranks, and in the case of the Staff, where each officer was employed. The French Engineer officer who owned the copy evidently took an interest in promotion, for he had kept the list up to date by crossing out the names of those who died or were killed, and by noting changes in rank.

In 1808 the distribution of the Corps was as under:—

Sappers.

1st Battalion Staff, Alessandria.

1st Co., Elba
2nd Co., Mantua
3rd Co., Dalmatia
4th and 5th Co., Palma Nova
6th to 9th Co., Alessandria

2nd Battalion with the Grand Army (1st Co. at Palma Nova)

3rd Battalion, Staff, Alessandria.

1st Co., Corfu
2nd, 4th and 5th, and 9th Cos., Alessandria
3rd Co., Gaeta
6th Co., Dalmatia
7th and 8th Cos., Army of Naples

4th Battalion, Staff, Juliers.

1st Co., Warsaw
2nd Co., VI Corps of the Grand Army
3rd, 5th, 6th and 8th Cos., Berlin
4th Co., Custrin
7th Co., IX Corps of the Grand Army
9th Co., Mayence

5th Battalion, Staff, Mayence.

1st Co., Danzig
2nd Co., Hameln
3rd Co., Stettin
4th and 6th Co., Erfurt
5th Co., Hamburg
7th Co., Thorn
8th Co., Spandau
9th Co., Stralsund

Miners.

1st Co., Palma Nova	3rd Co., Metz
2nd, and 4th to 7th Cos. with the Grand Army	8th Co., Mayence
	9th Co., Wesel

The list of stations indicates how thoroughly Prussia was occupied by the French, and yet she was able to organize a powerful Army.

Passing on to the years after the publication of the *État*, the following particulars are available.

In 1809 General Bertrand, A.D.C. to the Emperor, was Commandant-in-Chief of the Engineers with a staff of 22 officers.

On 30th June, 1812, on crossing the Nieman into Russia, the Sappers and Miners with the Grand Army totalled 13,932, the strength of the whole force being about 600,000. The Chief Engineer at G.H.Q. was General Chasseloup-Laubat and General Sanson was head of the Topographical Section. The Chief Engineers of Corps were: Guard, Kirgener; I, Haxo; II, Blein; III, Dodé de la Brunerie; IV, Poitevin; V, Pelettier; and VIII, Alix, who commanded both Artillery and Engineers.

No doubt the Sapper Companies gave a hand in the bridging of the Berésina in the great retreat, but the operations were in charge of General Baron Eblé of the Artillery, commandant of the bridging trains of the Grand Army and his 400 pontoneers.

In 1814 the Engineers were re-organized into 3 regiments of Sapeurs-Mineurs, each of two battalions.

In the Waterlooo Campaign, Lieut.-General Baron Rogniat, who was chief Engineer in 1813, was Commandant-in-Chief of the Engineers, and Colonel Bonne director of the Topographical Section.

The Engineers were allotted for the most part to Corps:—

Imperial Guard: Sappers, 3 Officers and 109 O.R.

I Corps (D'Erlon) C.E., Maréchal de Camp Baron Garbé—
5 Companies of the 2nd Bn., 1st Regt.=21 officers and 330 O.R.

II Corps (Reille) C.E., Maréchal de Camp Baron de Richemont—
5 Companies of the 1st Bn., 1st Regt.=22 Officers and 409 O.R.

III Corps (Vandamme) C.E., Maréchal du Camp Nempde—
2 Companies of the 2nd Bn., 2nd Regt.=7 Officers and 146 O.R.
Each of the three divisions had a half or a whole Company of these.

IV Corps (Gérard) C.E., Maréchal du Camp Valazé—
3 Companies of the 2nd Bn., 2nd Regt.=7 Officers and 201 O.R.
Two of the three divisions had a Company attached; the third Company was with Corps troops.

VI Corps (Lobau) C.E., Maréchal du Camp Sabatier—
3 Companies of the 1st Be., 3rd Regt.=7 Officers and 189 O.R.

There were thus 67 officers and 1,384 Sappers in the Armée du Nord, the total strength of which was 122,408 with 350 guns.

DRESS.

The dress was a dark-blue (apparently) tailed coatee with epaulettes, well cut-away in front and showing a buttoned waistcoat; dark-blue breeches, and high white buttoned gaiters, covering the knee. The full dress head-dress was a heavy-looking bell-topped shako with pompom and plume. There was also a double-decked field service cap. White crossed belts, one for the bayonet, and one for the pouch. A musket was carried, but apparently, unlike the modern Sapeur, no tools were part of the man's burden.

The Sappers of the Guard were distinguished by red turnbacks, facings and pipings, and wore a magnificent brass helmet, with an eagle in front and side scales. It had a tall dark plume with a white-hackle.

For sapping and close work in the attack of fortresses the Engineers had an iron pot helmet with hinged ear-pieces and back-flap, not unlike the head-dress of Cromwell's Ironsides. They were also provided with iron breast and back-pieces, which buckled together.

The Artillery seem to have been distinguished by short jackets and dark gaiters.

AUTHORITIES.—*État du Corps Imperial du Génie* (1808).—*Types et Uniformes de l'Armée Française*, 1789-1884. Détaille et Richard (1885-9).—*Historiques des Corps de Troupe de l'Armée Française*, 1569-1900 (1900).—*Les derniers jours de la Grande Armée*, 1813, 1814 et 1815. Capitaine H. de Mauduit (1847).—*Campagne de l'Armee de Réserve en* 1800. Capitaine de Cugnac (1900).—*Histoire populaire de la Garde Impériale.* E. M. de Saint-Hilaire (n.d.).

French pontoon equipment is shown in *Etudes sur le Passé et l'Avenir de l'Artillerie, Prince Napoléon et Colonel Favé.*

A SCIENCE OF INFANTRY TACTICS.

A lecture delivered at the S.M.E. on 6th Jan., 1921, *by* CAPTAIN B. H. LIDDELL HART, K.O.Y.L.I.

(*Concluded*).

THE EXPANDING TORRENT SYSTEM OF ATTACK AGAINST DEFENCE DISTRIBUTED IN DEPTH.

We have dealt so far with the principles of attack on any one body or centre of resistance of the enemy.

In modern war, however, armies are distributed in great depth, and the attackers are faced with the problem of breaking through a series of positions extending back in layers to a depth of several miles.

To this problem, an effective and scientific solution has yet to be found. Moreover, every defending infantry-unit also is itself distributed in depth in successive posts. We need to invent a system which will ensure—as far as is humanly possible—that our attack sweeps through and overwhelms the successive layers of the defence with an unslackening momentum combined with a minimum loss of men.

We have learnt by bitter experience, that it is sheer waste of force, when we come against an enemy position, to press our attack equally at all points.

We must feel and test the position everywhere, and endeavour to push in the weight of our reserves where a weak spot is found or made. This principle has been definitely established and the problem yet to be solved is our tactics when an initial breach has been made at any point in the first layer of the defence.

On the one hand, if we press forward at full speed beyond the gap without attempting to widen it simultaneously, it is risky. We lose the *weight* of our blow because we cannot push adequate reserves through a bottle neck. We lose *time* because the passage through a narrow gap causes delay and confusion. We *endanger our security* because we leave the enemy on our flanks untouched, and so able to cut off the head of our advance.

On the other hand if we halt our advance while we widen the breach, we lose *time*, the advantage of *surprise* and the *opportunity* of exploiting our initial success, thus allowing the enemy time to organize strong resistance in rear, and await us. Hence we must create a scientific system of attack which will reconcile and combine **speed with security.**

The breach must be *widened in proportion as the penetration is deepened*, by automatically progressive steps beginning with the platoon and working up to the brigade.

Such a system I have endeavoured to deduce by examining and analysing Nature's method of attack.

If we watch a torrent bearing down on each successive bank or earthen dam in its path, we see that it first beats against the obstacle feeling and testing it at all points.

Eventually it finds a small crack at some point. Through this crack pour the first driblets of water and rush straight on.

The pent up water on each side is drawn towards the breach. It swirls through and around the flanks of the breach, wearing away the earth on each side and so widening the gap.

Simultaneously the water behind pours straight through the breach, between the side eddies which are wearing away the flanks.

Directly it has passed through, it expands to widen once more the onrush of the torrent. Thus as the water pours through in ever increasing volume the onrush of the torrent swells to its original proportions, leaving in turn each crumbling obstacle behind it.

Thus Nature's forces carry out the ideal attack, automatically maintaining the speed, the breadth, and the continuity of the attack. Moreover the torrent achieves economy of force by progressively exploiting the soft spots of the defence.

By applying this natural system to battle I deduce these principles for the attack against defence in depth :—

i.—The forward sub-unit which finds or makes a breach in any of the enemy's positions should go through and push straight ahead so long as it is backed up by the manœuvre body of the unit.

ii.—The forward units on its flanks who are held up should send their manœuvre bodies towards and through the breach. These will attack the enemy in flank, destroy his resistance and so widen the gap.

iii.—Meanwhile, the units in rear press through the gap and deploy (expand) to take over the frontage and lead the advance in place of the temporarily held up units.

iv.—The held up units, as soon as they have accounted for the enemy opposing them, follow on as manœuvre units to support the new forward units.

(*N.B.* If the forward units are able to clear away the enemy opposing them before the rear units have passed through the gap they will naturally continue to lead the advance.)

Thus an automatic and interchangeable system of attack will be achieved. This system is applicable to all units and formations from the platoon upwards.

Taking for example the infantry attack : the left forward platoon of a company might find or make a gap whilst the right platoon was held up (*see Plate I.*). It would press straight ahead, whilst the company commander moves towards the gap with his manœuvre

platoons (*see Plate II*). The held up platoon is still engaged with the enemy resistance, when the company commander has passed through the gap. He will therefore send one of his manœuvre platoons forward and to the right to take over the frontage of the held up platoon and carry on the advance in its place (*see Plate III.*).

If the company commander judges that the held up platoon can destroy the enemy resistance by its own resources, he will press on at once with his remaining manœuvre platoon, to back up the forward platoons.

If not, he helps the held up platoon by a flank attack before following on.

In any case, directly the enemy has been destroyed the checked platoon would follow on as a new manœuvre platoon.

The company commander would be ready to repeat this method against each successive position of the enemy, thus ensuring the relentless momentum of the torrent. (*See Plate IV.*).

Likewise the battalion commander may infiltrate his manœuvre company through the gap made by an advancing forward company to expand the front and replace another forward company whose advance is checked or delayed.

Thus any gap in the defensive system will be progressively enlarged and deepened on the initiative of each successively higher commander.

The battle tactics of infantry will become automatic and depend less and less on fresh orders from superiors in rear. Moreover artificial geographical objectives will be restored to their right position as mere stepping stones in the advance. We shall fulfil the principle of economy of force by concentrating our efforts on the only true objective—the enemy.

Thus we see that the respective phases of **Reconnaissance, Fixing** and **Decisive Manœuvre** will be carried out against each successive resistance, whilst the "expanding torrent" will ensure that the momentum of the attack is not lost by the delay caused by the clearing of these enemy defence posts.

Maxim i. No forward unit must however press on even if it finds a gap unless it has cleared, or made arrangements to clear, all enemy resistance within its frontage.

Maxim ii. To ensure good team work in the confusion of battle every unit commander, separated from his own superior, who finds another similar unit in front of him engaged in fixing the enemy, must be ready to act as a manœuvre body to the unit in front. To this end he should get in touch with the unit in front and find out if the latter requires him to aid it by a decisive manœuvre.

Maxim iii. In the case of the platoon, its commander must remember that his sections are not tactical units. This means that they are not composed of interdependent fighting parts and so capable

of fixing and manœuvring simultaneously. They possess no manœuvre body of their own, and therefore the platoon commander must use his own manœuvre sections to help any of his forward sections which are held up, before continuing his advance.

Maxim iv. The forward section therefore which finds or makes a gap should only make a bound as far as the nearest tactical point from which it can cover and hold open the breach. It will not move on until it sees the rest of the platoon coming on to back it up.

Maxim v. In the attack against a large force distributed in depth, the expanding torrent system will abolish the need for battalion pursuit. Hence the battalion commander may use his reserve company, also, for replacing forward companies.

Three outstanding advantages of this system are firstly that an automatic continuity of the pressure of the advance is ensured, secondly that the expanding of the front of the advance rests with the immediately superior commander, thus ensuring that tactical unity is preserved instead of an unorganized dog fight to get forward, with each unit playing for its own hand; thirdly that the units which lead the advance will automatically be those which have encountered the least opposition. This will mean that the leading infantry are those which are freshest and have the most ammunition. It will be far easier to supply extra ammunition to those who have fallen behind than to those who are leading the advance.

INFANTRY IN DEFENCE.

The defence is simply the attack halted. **Any unit which halts its advance is capable on account of its open and self-contained formation of offering an immediate resistance to any hostile attack or counter-attack.**

Thus it resembles our simile of the human tank, possessing both the power of offence and defence. It only remains for it to consolidate the ground within its area so as to gain the most cover and best field of fire.

Once we have grasped this obvious truth the whole problem of tactics in general, and defence in particular, will be vastly simplified. Our previous method of creating a complex system of watertight compartments for each tactical action appears truly unscientific.

From this realization that defence is the attack halted, we deduce the truth that the five battle principles of protective formation, reconnaissance, fixing, decisive manœuvre and exploitation are equally applicable to the defence as to the attack.

A.—PREPARATION.

I.—FORMATION.

This will be generally similar to that of the attack. The company and platoon will be distributed into a forward body and manœuvre body. The battalion or higher formation into a forward body,

manœuvre body, and reserve. The reserve will consolidate a final position of resistance for the battalion, or brigade.

Maxim i. Each unit in defence should be allotted an area to hold, and not a definite point. Thus if the enemy takes a defence post at a disadvantage, by crushing shell fire, smoke or manœuvre, the commander should use his initiative to quit the post and take up a fresh position on the flanks of the post so that he can out-manœuvre the attacking infantry.

Maxim ii. One difference in regard to the formation in defence will be that the manœuvre bodies can be previously placed in readiness on a rear flank of the forward body.

They should be placed to cover with enfilade fire the flank on which it is most likely that the enemy might break through. They should take up a position from which they can best sweep the breadth of their area with fire.

Maxim iii. The actual distribution in defence will depend mainly on the frontage and the field of fire. Two sub-units forward and two for manœuvre will be normal, but if the field of fire is restricted it will be best to place three sub-units forward and one for manœuvre. The essential need is to cover the whole area with intersecting rays of fire from the posts of the sub-units. A diamond formation, modified according to the ground, is very suitable for the forward platoons in defence.

Maxim iv. It will be advisable for all forward, or stationary defence, platoons to consolidate in section posts in order to cover more ground with fire.

Maxim v. In the case of manœuvre platoons it will normally be advisable for them to consolidate in platoon posts so that they may be kept more concentrated ready for manœuvre.

The "Contracting Funnel" in Defence.

Just as manœuvre is far superior to frontal attack, so manœuvre fire which enfilades the enemy from a flank is the most damaging both in material effect and to the attackers' moral. It represents the main sub-principle of economy of force, which is surprise. Thus the defence should be so disposed as to develop their greatest fire effect to the flank. To this end it should be our aim so to dispose infantry for defence, that the attacking enemy is encouraged to penetrate into channels in which he can be raked by flanking fire.

One step towards this is to site our Lewis and machine gun posts to mutually support each other with fire, rather than to fire direct to the front.

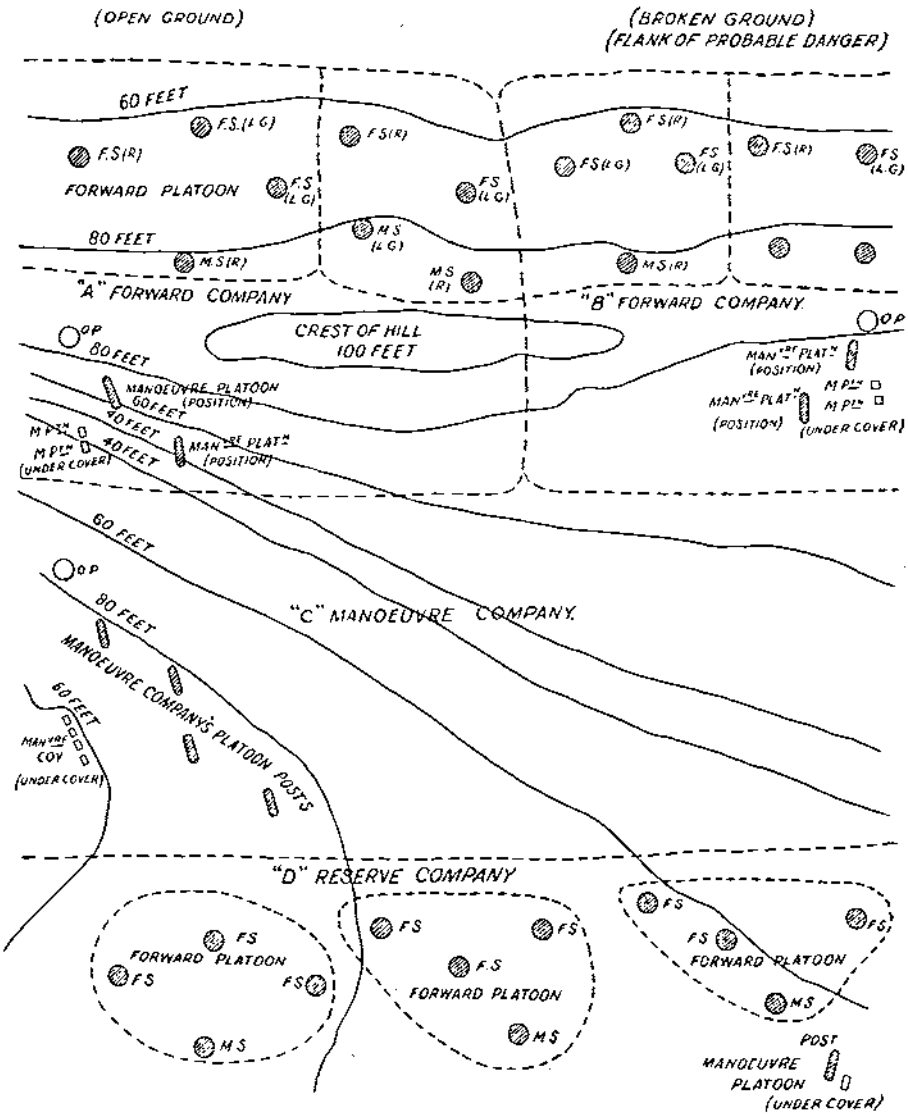
Another is the placing of manœuvre bodies so that they fire mainly to a flank.

A third way is to *echelon* backwards the posts of the manœuvre

platoons and companies along the natural channels of approach to form a gradually contracting funnel raked by fire. Thus the further the attacker penetrates the more resistance he encounters and the more confined becomes the space in which he can manœuvre.

A diagram of a battalion disposed for defence may make the idea clear.

EXAMPLE OF A BATTALION HOLDING A POSITION IN DEFENCE.



If we study such a disposition, it becomes apparent that the only effective counter to such defence is the " continually expanding torrent " system of attack.

II.—Reconnaissance.

i.—Preparatory reconnaissance will be carried out on similar lines to that for attack. Each commander both before taking up a definite position and during its occupation should study all available information, personally survey the ground and the possible ways of manœuvre, and send out company scouts on special missions.

ii.—Battle reconnaissance will be carried out mainly by patrols.

Maxim i. If not yet in contact with the enemy they should be sent out to keep watch on all likely lines of approach.

Maxim ii When in contact with the enemy as in position warfare, they will be sent out at night, in fog, or in dense country by day to keep his forward defences under observation, discover his dispositions, and give warning of a likely attack.

Maxim iii. They should usually be supplied by manœuvre or reserve bodies.

Maxim iv. In darkness or fog, patrolling is the best means of protection from surprise, and not the massing of more infantry in the forward positions.

Maxim v. Patrols and observation posts should be used by manœuvre and reserve bodies during an enemy attack to obtain information as to the situation in front and flank, and so enable instant and correct action to be taken.

III.—Fixing.

Defence in itself is one method of fixing the enemy. It is incapable of beating him, and therefore a defensive attitude will only be assumed in order to fix and weaken the enemy so that another force may be able to attack the enemy decisively elsewhere, or that you may yourself attack later when his vigour is spent.

In the actual infantry defence the phase of fixing is carried out by the forward bodies. If the forward and manœuvre companies of a battalion fail to fix and break up the enemy's attack, it will be the duty of the reserve to fix him in order to allow higher formations to decisively manœuvre against him.

Maxim i. Forward bodies holding positions should defend to the last man and the last round the area allotted to them.

Maxim ii. To instil this idea that troops who have consolidated should not withdraw, fighting patrols should be detailed from the reserve if it is desired to harass the enemy's attack before the main positions of resistance are reached. Moreover troops who have consolidated are more likely to hold on too long, and so if allowed to withdraw would mask the fire of the posts in rear when they fall back.

Maxim iii. The *rôle* of forward bodies is stationary defence by fire.

Maxim iv. The commander of any forward section must however be ready to quit the post and take up a position on its flank, if the enemy take it at a disadvantage by shells, smoke or manœuvre.

B (IV).—DECISIVE MANŒUVRE.

The manœuvre bodies carry out the decisive manœuvre in defence as in attack.

If the enemy makes a gap or effects a lodgement in the positions of the forward body, the manœuvre body will make an immediate counter-attack to throw him back, or manœuvre by fire to close the breach and destroy him in a contracting funnel.

The function of its commander is manœuvre, which does not necessarily imply assault.

The commander of a manœuvre company or platoon has a choice of two main alternatives :—

i.—If the enemy break through the forward positions quickly and on a broad front, it will be best for him to man his prepared positions to take the enemy in flank by fire.

ii.—Otherwise he should manœuvre either to assault or fire.

Maxim i. A counter-assault which fails is a sheer waste of force. Hence it should not be launched unless the enemy is engaged with other defending units.

Maxim ii. Lewis gun sections of a manœuvre platoon may be used to surprise and fix the enemy with fire while the rifle sections assault.

Maxim iii. If the company commander decides to manœuvre to fire he should move to suitable positions on the flanks of the enemy's breach from which he can enfilade them.

Maxim iv. Above all he must remember that whether he uses fire or assault, or both, it will be most effective if delivered against the flanks of the enemy's wedge of attack. In this way the flanks of the breach will be strengthened and his advance cut off.

Maxim v. A counter-attack will be carried out according to the same principles as for the attack, but a definite objective should be fixed for it, and it should never be pressed beyond the forward positions of the defence.

Maxim vi. The one great advantage which the defence possesses is that every move can be thought out and rehearsed beforehand. Every possible line of enemy advance should be reconnoitred and plans worked out for countering them. The possible routes of manœuvre and fire positions on them for each manœuvre company and platoon should also be reconnoitred and marked.

Maxim vii. A counter-attack by any unit smaller than a platoon is rarely effective. Hence fire and not counter assault is the best course for manœuvre sections to adopt.

PLATE.I

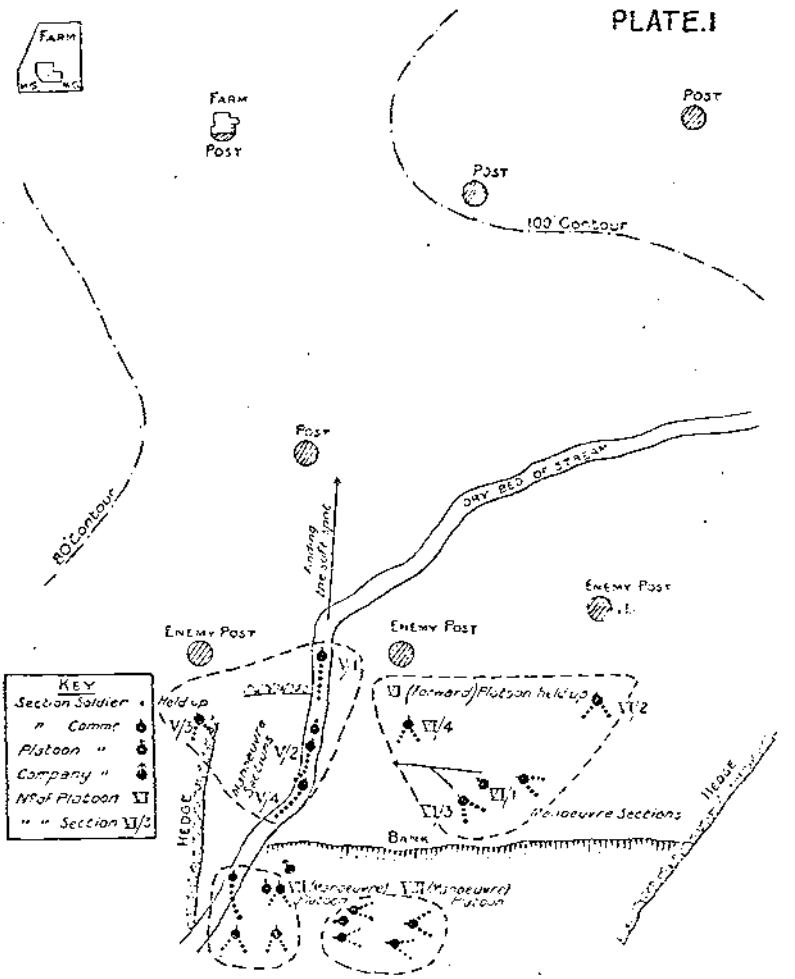

FARM
FARM
POST
POST
POST
POST
100' Contour
100' Contour
DRY BED OF STREAM
Lining the soft land
ENEMY POST
ENEMY POST
ENEMY POST
KEY
Section Soldier
" Comm.
Platoon "
Company "
No of Platoon
" " Section
Held up
Manoeuvre Sections
Manoeuvre Sections
(Manoeuvre) Platoon
(Manoeuvre) Platoon
HEDGE
HEDGE
BANK

PLATE.2

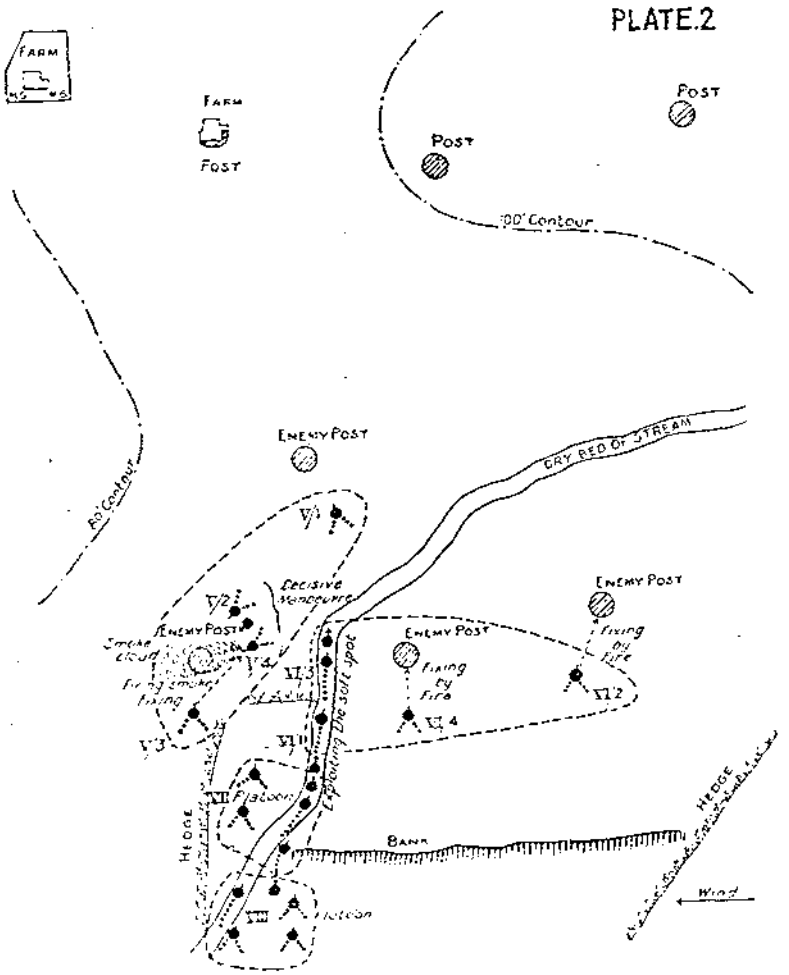

FARM
FARM
POST
POST
POST
100' Contour
80' Contour
ENEMY POST
DRY BED OF STREAM
Decisive Manoeuvre
ENEMY POST
Smoke cloud
Firing Smoke
ENEMY POST
Firing by Fire
ENEMY POST
Firing by Fire
Exploring the soft spot
HEDGE
Platoon
BANK
HEDGE
Section
Wind

PLATE. 3

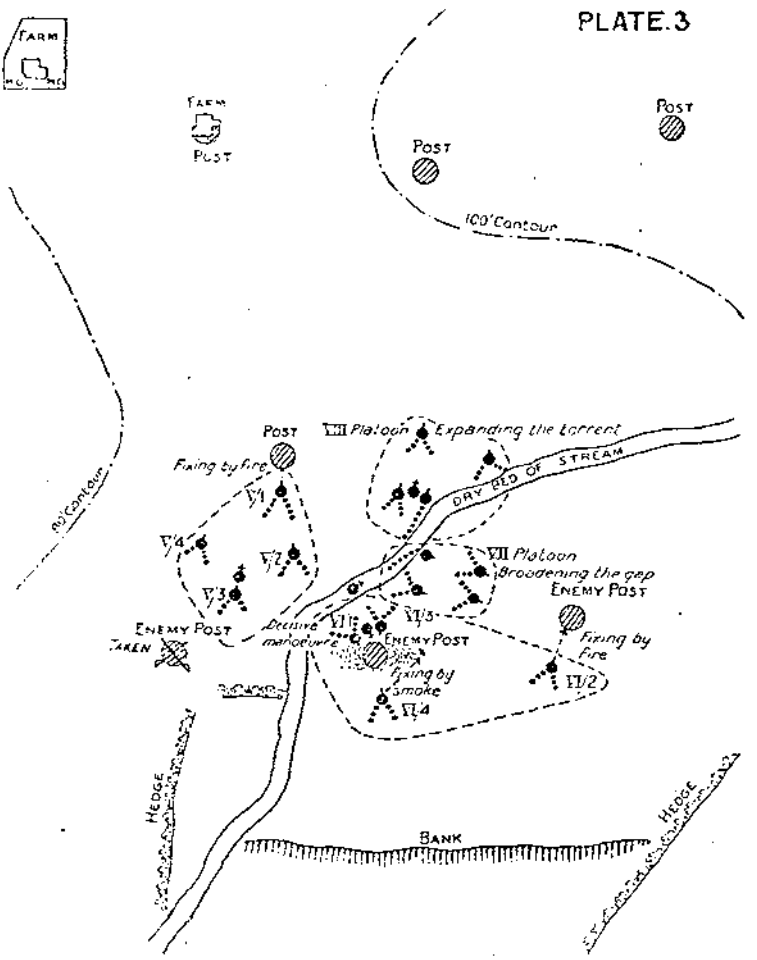
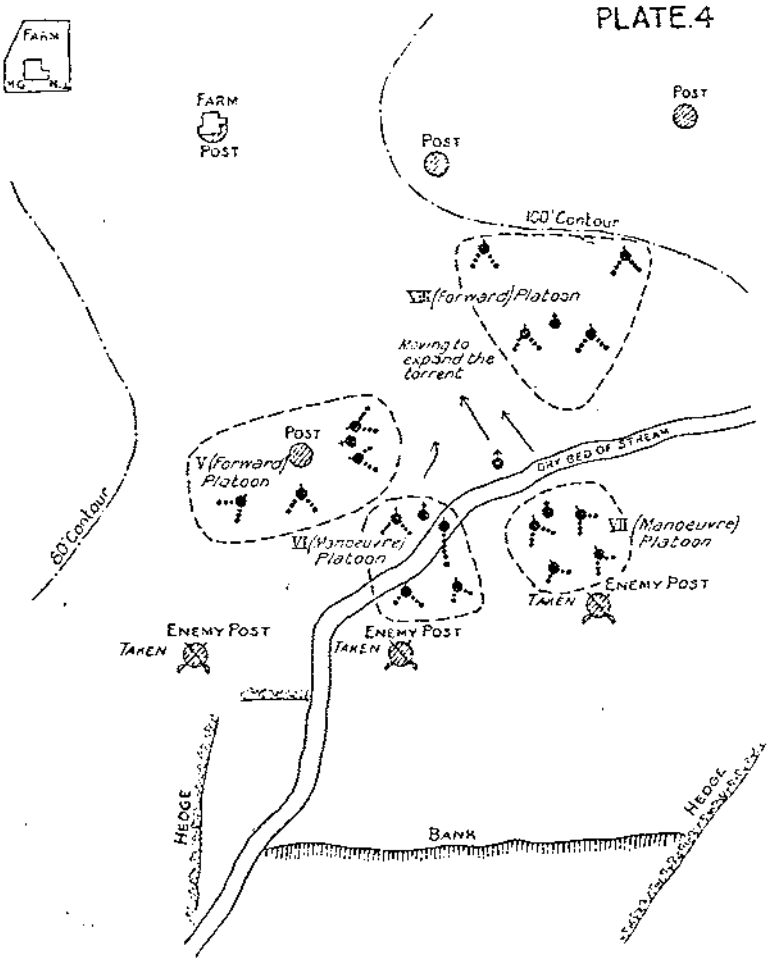

FARM
FARM
POST
POST
POST
100' Contour
80' Contour
POST
VIII Platoon Expanding the torrent
Firing by fire
DRY BED OF STREAM
V/1
V/4
V/2
V/3
VII Platoon
Broadening the gap
ENEMY POST
ENEMY POST
TAKEN
Decisive manoeuvre
VII/1
VII/3
ENEMY POST
Fixing by fire
Fixing by smoke
VII/2
VII/4
HEDGE
BANK
HEDGE

PLATE.4


FARM
M.G.
N.
FARM
POST
POST
POST
100' Contour
VIII (Forward) Platoon
Moving to expand the torrent
POST
V (Forward) Platoon
DRY BED OF STREAM
VI (Manoeuvre) Platoon
VII (Manoeuvre) Platoon
ENEMY POST
TAKEN
ENEMY POST
TAKEN
ENEMY POST
TAKEN
80 Contour
HEDGE
BANK
HEDGE

C (V).—Exploitation.

Exploitation is the counter-offensive when the enemy's attack has failed, and is therefore not true defence.

Outposts.

It should be clear from our analogy of the human tank that outposts *are* simply a temporary form of defence.

Maxim i. When contact with the enemy is unlikely the main consideration is to rest as many troops as possible. Hence units should usually be disposed with only *one* sub-unit forward and three for manœuvre.

Maxim ii. It will suffice, particularly at night, if the main channels of approach are covered by the forward bodies.

Maxim iii. With this reservation the disposition and routine duties of outposts will be similar to those for defence. Only the first stage of consolidation, that of disposition over the ground for observation and resistance, will be needed.

Retirements.

These are simply a mobile defence.

Maxim i. Hence security is the first consideration.

Maxim ii. Retirements should be carried out therefore by a series of leapfrog bounds, the forward body retiring covered by the fire of the manœuvre body to a position behind it, from which, in turn, it can cover the retirement of the manœuvre body. Thus the strain of holding off the enemy will be evenly distributed between forward and manœuvre bodies.

Maxim iii. In flat country zig-zag bounds should be used to avoid the risk that the fire of the covering body may be masked by the retiring body.

Maxim iv. If the enemy presses the retiring body too hard, a sudden counter-attack should be made by the manœuvre body to relieve the pressure.

Summary.

Thus we see that by working out our principles of tactics upwards from the elementary, instead of downwards from the complexities of large operations, we can simplify infantry tactics to a flexible framework of clear principles which are applicable to all forms of action. This frame work provides us with a sound base upon which to build up our practical knowledge of ground and weapons. It has been the hope and aim of the author to create the foundations of a true science of infantry tactics.

The above Lecture has been Published in Pamphlet Form with an Appendix and a Foreword by Lieut.-Gen. Sir I. Maxse, K.C.B., C.V.O., D.S.O., and can be obtained from Messrs. H. Rees, Regent Street, S.W.1, for 2/-.

INTERNATIONAL COMMUNICATIONS : QUESTIONS AT THE PARIS CONFERENCE AND AFTER.

A LECTURE DELIVERED BY BRIG.-GENERAL H. O. MANCE, C.B., C.M.G., D.S.O., AT THE COMMERCIAL UNIVERSITY OF ROTTERDAM ON 13th DECEMBER, 1920.

IT is necessary that I should preface this paper with the intimation that the opinions expressed therein must be regarded as purely personal and as carrying no official weight whatever.

So much has been done on the subject during the past two years that it will naturally be impossible to cover the whole ground of International Communications in one short paper. I have, therefore, had some difficulty in choosing a course which would avoid on the one hand giving too superficial a summary of the whole field, or on the other hand, too detailed an exposition of any part of it. For those who may desire to study the question in greater detail it may be useful to refer to the Chapter on Communications in Volume II of the *History of the Peace Conference at Paris* produced by the British Institute of International Affairs, which chapter I had the honour of writing, to the Reports of the Communications Section of the Supreme Economic Council dated January 1st and May 1st, 1920, which were circulated at the Financial Conference at Brussels, to the preparatory documents for the first General Communications and Transit Conference of the League of Nations which will take place at Barcelona early in 1921, and to the proceedings of the Assembly of the League on December 8th and 9th.

In reviewing general Communications questions one cannot help being struck with the inadequate recognition, by the generality of people, of the dominating influence of communications on the development of civilization. The poet Kipling had indeed said that transportation is civilization, but prior to the Great War a casual observer might well have formed the opinion that the interest of a large majority of the general public was limited to such questions as the cheapness of railway fares, or the quality of the refreshments at the Railway Buffets. The Great War, however, by the withdrawal or limitation of facilities so unthinkingly enjoyed in the past, has brought home to a far wider circle their dependence on free communications and more particularly on International Communications ; hence it was natural that at the very outset of the Peace Conference at Paris a special Technical Commission should be appointed to deal with questions of Communications—Railways,

Waterways and Ports. To this Commission fourteen States sent technical experts whose close association went far to re-establish and strengthen the spirit of cordial collaboration in international communications questions, which has been so valuable an asset to their successors. This Commission was not called upon to deal with the political aspects of the Peace Treaty but to prescribe the transportation measures necessary to render possible the general intentions of the Treaty and to enable the belligerent Nations to re-establish normal relations.

The situation to be resolved may briefly be summarized as follows :

The provisions of the Congress of Vienna regarding International Waterways, while facilitating the gradual crystalization of certain important principles of international right, had only been partially applied as regards the administrative *régime* of International Rivers ; during the succeeding century the international rivers have greatly increased in number and cover the whole world. Irrigation, reclamation, hydraulic power, fishing and other Water Rights have assumed a rapidly growing importance and have to be taken into account as well as navigation. The development of Canals, Railways, Ports, Telegraphs, Telephones and Mechanical Transport, not to mention flying, had opened up an enormous field which had never been reviewed as a whole from the standpoint of international right. Pre-war international relations regarding communications had been built up haphazard, such general conventional agreements as existed being based rather on the grounds of expediency than on established principles of international right. Moreover, in the demoralization resulting from the war there was no guarantee that after a complete break of five years the pre-war standard of transportation ethics would be recognized.

The specific problems arising out of the Peace Treaties were of great complexity, owing not only to the natural technical difficulties of framing at short notice conditions safeguarding in the future an enlightened *régime* of international communications, but also to the special problems arising out of the vast and simultaneous changes in practically all the frontiers of Europe ; access to the sea had to be assured to the new landlocked, or nearly landlocked States of Austria, Hungary, Poland, and Czecho-Slovakia ; the creation of new States, whose national interests would inevitably tend to a considerable upheaval of the economic conditions obtaining before the war, was likely in many cases to result in fundamental changes in the direction and intensity of international traffic. It was therefore necessary on the one hand to give reasonable time for the new *régime* to crystallize while shielding it, as far as possible, from adverse influences directed to political ends, and on the other hand to minimize the real risk of common economic loss resulting from too sudden changes, by assuring the necessary co-ordination between

separate parts of previous economic units. Finally, there was the necessity, during the period of re-construction, for safeguarding certain Allied interests from competition and for granting them special temporary facilities, the necessity for which was recognized in Article 23*e* of the Covenant of the League of Nations.

How then was this great task to be approached? In the unanimous opinion of the Ports Waterways and Railways Commission it was necessary to lay down general principles regarding the various means of communications before attempting to deal with specific cases, and for several weeks the Commission concentrated on the consideration of draft General Conventions on Freedom of Transit, on International Rivers and on International and Free Ports. Doubtless the texts of the Treaties could have been improved had it been found possible to proceed further with the consideration of the above General Conventions, and with a General Convention on Railways, but luckily sufficient progress had been made to enable a considerable number of articles to be transferred *en bloc* from the draft Conventions to the Peace Treaties, thereby saving a large amount of discussion and affording important "directives" for many of the other clauses; on the other hand the lack of pre-determined general formulæ on the question of railways undoubtedly added to the difficulty experienced in drafting certain of the Railway Articles in the Treaties. While the work done on General Conventions at the Peace Conference undoubtedly constituted a valuable basis, it is evident that their ultimate conclusion is a matter more appropriate for an international than for an inter-allied body.

A few words on the general procedure adopted at the Peace Conference may be of interest. The Draft General Conventions usually formed the subject of a discussion on general principles, followed by a debate on the various articles which served to bring out, and in many cases to adjust, differences in views of the various Delegates. Small Drafting Committees then gave the Conventions a detailed examination and prepared drafts based on the previous discussions. As regards articles of the Peace Treaties, it was natural that a number of claims should be brought forward in a form which conflicted either with the general principles already adopted, or with the interests of other Allies. As the Members of the Commission got to understand each other's point of view, it was found possible to reconcile, or arrive at an agreement on, all such conflicting claims; gradually it became recognized that deviations from the general principles previously arrived at would only be accepted by the Commission if, and to the extent that, they were proved to be necessary for special needs—reconstruction, access to the sea, etc.—for which exceptional treatment had been reserved. In certain cases after reducing to its simplest expression the object which it was desired to attain by a particular draft article which had been sub-

mitted, a satisfactory solution, in conformity with the accepted general principles, was arrived at as a result of the labours of informal Sub-Committees of technical experts. When possible, the principle was adopted of making clear the intention of the stipulations, leaving the details to be settled in agreement by the technical administrations concerned, subject to arbitration on any points of difference. The fact that the Commission submitted two reports, covering 64 articles all of which had been unanimously agreed to, may be regarded as a remarkable achievement, and a happy augury for future international relations in matters of transit and communications.

At the stage to which the discussion on general conventions had been carried by the Peace Conference, there appeared to be no intrinsic reason why world-wide Conventions should not be agreed upon to establish the fundamental principles of freedom, equality, and continuity in the international *régime* of transit and waterways and to a large extent in those of ports and railways. The shades of opinions advanced during the discussions varied from complete internationalization on the one hand to repudiation of any proposal which affected the slightest limitation of national sovereignty on the other hand. It had been suggested that owing to the difference in the geographical conditions, there would be difficulties in concluding General Conventions applying the same *régime* to various parts of the world and the discussions on this point brought out the essential difference between questions of international right and questions of international administration. Generally speaking, apart from international rivers where physical considerations may render a certain measure of international administration unavoidable, especially where there are several riparian States, the general trend of opinion was against international administration except in very special cases and then only in virtue of agreements to which the State or States territorially interested are parties. It is hardly necessary to mention that questions of free commercial competition between different routes or transport undertakings are outside the province of General Conventions. A most important development was the general acceptance of the principle of compulsory arbitration through the League of Nations for all disputes arising out of the Peace Treaties on Transportation questions, and the inclusion of the same principle in the draft General Conventions. Transit and transport questions are particularly susceptible to arbitration and it may well be hoped that the experience gained by the successful application of the principle to transportation questions may create a valuable precedent for its extension to other matters.

Time will not admit of an analysis of the whole of the Communications and Transit Articles of the Peace Treaties, and I will therefore concentrate my remarks on the Articles dealing with the various

international rivers, which are perhaps those of most interest to Holland.

The international rivers dealt with are the Rhine, the Danube, Elbe and Oder and Niemen, with certain of their tributaries either expressly mentioned or included in a general definition in Article 331 of the Treaty of Versailles. With the exception of the Rhine, which was specially dealt with, the above rivers are formally placed under a provisional *régime* prescribed in Articles 332-337, these articles, with the exception of the second paragraph of Article 332, having been taken *en bloc* from the Draft General Convention on international rivers. It was further prescribed in Article 338 that the above provisional *régime* would be replaced in due course by the *régime* prescribed in a General Convention approved by the League of Nations. With the exception (1) of the Rhine-Danube Canal, which may in the future have an altogether special importance in international waterway communications in Central Europe, and (2) of the German portion of the Rhine-Meuse Canal the construction of which was prescribed in the Treaty under certain conditions, no artificial canals other than those for improving the natural navigation of international rivers are affected by these provisions.

It will further be noted that with the exception of the latter part of Article 332 the *régime* prescribed does not impose any obligations which are not equally accepted by all the contracting parties affected and this also applies to the navigation provisions of the Rhine.

As regards administration, the Elbe and the Oder are to be administered by International Commissions and the Niemen may be administered by an International Commission on the request to the League of Nations of any of the riparian States. These River Commissions differ from the Commissions which were prescribed with such limited results by the Congress of Vienna in that provision is made for representatives of non-riparian as well as of the riparian States. The introduction of non-riparian Members on these Commissions has been strongly criticized but was decided after careful consideration to be essential in the general interest of freedom of navigation in order to introduce a check to prevent the strongest riparian State from abusing her predominating influence to the detriment of others. Hence it was naturally essential that no one State should command a clear majority. The functions of the Commission are limited to the practical application of the principles laid down either in Articles 332-337, or in the General Convention, and it must be remembered that the powers of the Commission in each case extend to the territory of at least one of the Allied and Associated Powers.

It is natural in the present state of development of international relations that a State should be disinclined voluntarily to agree to

any administrative arrangement which tends to limit even indirectly its sovereign powers. I can, however, hardly conceive a less objectionable form of penalty imposed in a Peace Treaty than the institution, in the general interest, of proved methods of international collaboration; this observation, while arising out of the institution of certain river commissions, equally applies to the consequential obligation for the ex-enemy States to accept both the General Conventions which it is hoped will govern International Communications in the near future and also revised regulations regarding the above-mentioned rivers which may be necessitated by such Conventions. This class of obligation was not limited to ex-enemy States in the Treaties as the creation of new States as well as the recognition of mandatory States has generally been subject to the acceptation by the States concerned of obligations to conform to generally accepted international standards in such questions as communications, and in other matters, whereby an enormous advance has been made in the recognition of international as distinguished from national interests. The development of the sanction given to such international interests coupled with the support of a gradually formed world public opinion offers, in my opinion, the surest road to the gradual abolition of war as a method of settling international disputes.

In the case of the Danube there existed already a conspicuous and successful precedent for the working of a Commission with representatives of non-riparian States, and the Danube European Commission was therefore revived with a provisional limitation of Membership to Roumania, Great Britain, France and Italy; at the same time a second Commission was formed for the whole of the international Danube system above the sphere of the European Commission, this second Commission replacing five independent pre-war Administrations. As it was felt that the whole question of the Danube was too complicated to be settled definitely at such short notice, it was arranged that a General Conference of certain Allied and Associated Powers, at which representatives of ex-enemy States would be present, should determine at a later date the permanent statutes of the Danube. This Conference has already commenced its sittings.

As regards the Rhine the situation was complicated by the existence of the Neutral riparian States, Holland and Switzerland. It was important to obtain at least an outline of the views of these two States and valuable statements were made before the Ports Waterways and Railways Commission by Delegations designated by each of these two states. The principal aim in view in this case was the same as that for the other rivers, namely, to assure the greatest possible freedom, equality and continuity of navigation to all the States of the world, but in the special circumstances it was necessary to

approach the problem in a different way. This was the more necessary as the Rhine had already for many years been governed by the Mannheim Convention, which is an extremely liberal one and needed only certain trifling modifications to bring it into line with the *régime* prescribed for the other rivers. Apart from the above modifications which were inserted as a provisional measure, it was prescribed that the Mannheim Convention should be reviewed and should conform to the General Convention on International Rivers when such General Convention shall have been adopted; the revised act of navigation will be submitted to the states represented on the Central Commission; the necessary negotiations with Holland were to be undertaken by the Allied and Associated Powers. When, however, it came to the question of considering the future administrative *régime* of the Rhine, the question was complicated both by the previous *régime* under which it would have been possible for one riparian State, and that an ex-enemy State, to exercise a clear preponderance of votes, and further by the consequential results of the transfer to France, exclusively, of certain Water-power Rights which would otherwise have been shared with Germany. France obtains the sole right to develop this Water-power subject to Germany receiving half the net value of the power obtained. This latter question is of the same order as a territorial transfer and in no way affects, by itself, the *régime* of navigation, but in view of the fact that exercise of these Water-power Rights would inevitably raise questions of the highest importance affecting the maintenance of free navigation, it was necessary, in conformity with the spirit of the draft General Conventions, that any scheme for the development of Water-power should be reviewed from the point of view of its effect on navigation by a thoroughly representative body whose opinion might be accepted with confidence by both the Water-power and the navigation interests. Hence, after very careful study, a system of votes was arrived at which was considered to give weight in a suitable proportion to the various interests affected by this important question, including the world interests of navigation as represented more particularly by the non-riparian States. It was perhaps inevitable that the question of votes should have attracted attention more from the general point of view than from the point of view of the specific question of Water-power; it is therefore important to note that, except in certain matters mentioned in the Treaty in which Germany is under obligation to confirm the decisions of the Commission, the varying number of votes has a moral rather than a practical significance in view of Article 46 of the Mannheim Convention under which the decisions of the Central Commission are only valid after approval by the respective Governments.

I have limited myself to a *résumé* of the situation regarding the Rhine up to the signature of the Treaty of Peace as the subsequent

history affects negotiations with Holland which are not yet completed. In the general interest of the development of a liberal *régime* of international communications in which all parties concerned have so pre-eminent an interest, it is earnestly hoped that a solution will not be long deferred. *

An important series of clauses designed to facilitate the resumption of normal conditions is based on the principle of equity in the adjustment of questions such as the redistribution of rolling stock and river craft and installations, resulting from territorial changes. Just as it was necessary that railways in transferred territories should be provided with their complement of rolling stock, so it is necessary to assure to the river ports of transferred territory the proportion of shipping and installations necessary for their traffic. The quantity of shipping and installations to be ceded is to be determined by an American Arbitrator with due regard to the legitimate needs of the interested parties. Holland is interested in that some of the installations to be transferred to France by Germany for the needs of Alsace-Lorraine traffic are situated in Rotterdam. The arrangements for the transfer of craft and rolling stock necessarily present problems of an intricate nature, but thanks to the general principles laid down as a basis for an equitable repartition it is hoped that the Arbitrator and the Commissions appointed for the purpose will arrive at solutions acceptable to all parties.

Among the special features of the Communications clauses of the Treaty it should be noted firstly, as already mentioned, that any disputes arising with regard to the interpretation and application thereof, are to be regulated as provided by the League of Nations, and secondly that a possible revision of many of the Articles is contemplated—in some cases compulsorily, in order to comply with future General Conventions regarding International Waterways, in other cases at the option of the League of Nations after a stated period, or again, by the contracting parties on the recommendation of the League of Nations, in the case of a permanent administrative *régime*. As it was not always possible, notably in certain general articles affecting railways, to separate or even to distinguish between the provision which should govern the permanent relations between the signatories of the Treaty and the stipulations imposing transitory obligations in favour of the Allied and Associated Powers, it was provided that failing revision by the League of Nations (for example, in order to bring certain provisional stipulations into line with the General Conventions subsequently adopted) the stipulations of certain articles can only be claimed after a certain period if reciprocity is accorded in respect of such stipulations.

* NOTE.—These negotiations have since been completed, and the first full session of the new Central Rhine Commission was held at Strassburg on February 25th, 1921.

The combined product of a number of delegations whose outlook varied with national temperament and circumstances is obviously not an ideal exposition of the views of any one of them. Nevertheless, it is believed that, having regard to the circumstances the verdict of the future will be that the section of the Treaties dealing with transit and communications is a consistent whole which is founded on the principle of the greatest possible freedom of transit and communications; that such derogations of this principle as were admitted to meet temporary conditions are transitory, and that the intentions of the framers are reflected in the stipulations assuring the flexibility necessary for ensuring that the articles should conform in the future with altered conditions, or for eliminating any features which as a result of experience may be generally recognized as being contrary to the spirit of the League of Nations.

At the commencement of the Peace Conference a large number of pressing questions had to be dealt with which did not concern the Treaties of Peace, such as questions of urgent relief in Central Europe and measures for the gradual restoration of normal conditions; it was to deal with this class of questions and to co-ordinate the efforts of the principal Allied and Associated Powers for alleviating the situation both in Allied and Enemy countries, that the Supreme Economic Council was formed in February, 1919. It was at once found that owing to the complete disorganization of communications the re-establishment of normal conditions, or indeed the execution of the relief programmes, was dependent on the re-organization of communications. A Communications Section of the Supreme Economic Council was therefore created as a consultative body to co-ordinate the voluntary efforts of the various Allied powers who were assisting in the re-establishment of normal conditions in Europe. The Section had no executive powers and exercised its functions through local Missions by personal influence and mutual arrangement with the Administrations assisted. It adopted the principle that in view of the serious situation of communications in Central Europe assistance from any quarter was to be welcomed in the general interest; that the functions of the Section were to support and not to supplant the local Administrations, and were to cease as soon as the new local Administrations had both inspired sufficient confidence to enable them to meet their essential requirements through commercial channels, and also had adopted normal international relations. The Section was able to afford material assistance by disinterested technical advice from the specialists constituting their local Missions, by the allocation and transfer of Armistice rolling stock, by arranging for credits for the purchase of urgently needed tools

and materials, and by acting as intermediary between the different administrations until such time as it was possible for them to establish direct relations.

The Committee for regulating wagon exchange in Central Europe pending the definite allocation of the rolling stock of the old Austro-Hungarian Empire, was created, under the disinterested Presidency of M. Leverve, on the initiative of the Communications Section as an indispensable preliminary for winding up their work.

The Communications Section were recently responsible for convening the technical Conference held at Paris in July last for the improvement of postal, telegraph and wireless communications in Europe and for initiating the rough census of rolling stock in Europe carried out on September 12th. It is evident that the matters dealt with by them were bound to become more and more international in their nature, and arrangements are in operation for handing over the outstanding functions of the Section to the Provisional Communications and Transit Committee of the League of Nations.

The principal difficulty which the Communications Section has had to contend with has been the lack of goodwill between the various States in Central Europe, this in turn being partly due to mutual suspicion pending the uncertainty of the Peace terms and the delay in their ratification. One of the limiting physical factors is undoubtedly the lack of a sufficient supply of coal and a further vital need in each country has been the question of repairs to locomotives and rolling stock. The lack of repair material was to a large extent got over by the credits referred to above, but both locomotive and rolling stock repairs and the output of coal suffered from the general disorganization of labour output. Finally, the complete administrative re-arrangement necessitated by the Treaties involved in places the creation of entirely new administrations for which eligible high officials were lacking, and this presented a handicap which it will greatly redound to the credit of certain States to have overcome.

As soon as the Peace Treaties were disposed of, the question arose as to the further consideration of the Draft General Conventions. On the one hand it was considered that these Conventions would more properly be elaborated by the League of Nations: on the other hand the League of Nations was not even yet in existence and it was important not to lose the advantage of the special knowledge and of the spirit of co-operation acquired by the representatives of the Allied States as a result of some months of close association. In the circumstances the French Government took the initiative by convening a Commission of Enquiry on Freedom of Communications

and Transit to which certain Neutral States (including Holland) as well as the Allied Powers were invited to send representatives; it was clearly stipulated that these representatives would not bind their Governments in any way, the object of the Commission being to prepare the ground for the League of Nations. That this object was attained was evinced by the fact that the Commission of Enquiry was invited in February last to act as the Provisional Communications and Transit Committee of the League of Nations, in which capacity it has drafted proposals for the Permanent Communications and Transit Organization of the League of Nations, and Conventions on Freedom of Transit, International Waterways, on the International *Régime* of Railways, together with a resolution relating to an International *Régime* for certain Ports. These draft proposals, which were the result of several months' hard work, will be submitted to the forthcoming General Communications and Transit Conference which is to be held at Barcelona not many weeks hence. The adoption of the Conventions by the Conference would constitute an outstanding land-mark in the development of international relations; the conventions, once adopted, will be binding on those States which ratify the same, including several States which have already contracted to adhere to them in the various Treaties resulting from the War.

Time will only admit of the briefest of observations with reference to the contents of the various Draft Conventions.

Speaking generally, these Draft Conventions have only been rendered feasible by the creation of an advisory body in the organization of the League of Nations. The existence of such a body renders it possible to utilize certain essential though very general expressions such as "legitimate," "reasonable," "valid reason." But for the existence of an advisory body these expressions could not be invariably relied on to convey a definite meaning, but thanks to it they can in every particular case indicate clearly the intention of the Conventions with regard to their interpretation.

The Freedom of Transit Draft Convention is the embodiment of a principle of vital importance to civilization, and this principle is perhaps one of the highest conceptions which has been crystalized as the result of the war. Divested of all extraneous additions, the principle is that every country should enjoy the same material conditions of communications with any other country or with the sea across the territory of one or more intervening states as it would have enjoyed if such intervening State or States did not exist. These conditions should not depend on the nationality, origin, importation, starting point or ownership of the traffic or means of communications or conveyance.

Among the obstacles to the complete adoption of the principle is the practice which has grown up especially in countries with State

railways, of using railway communications as an instrument of fiscal policy. The proposal was indeed made that every country should undertake to purge its railway policy of all protectionist factors while allowing full liberty of commercial competition between various lines. It was contended that differential railway rates based on fiscal considerations interfered with the natural working of transport undertakings, vitiated indirectly custom *régimes* and disturbed the application of commercial Treaties. The time was not, however, ripe for the general acceptance of this doctrine which, however, is essential if the principle of freedom of transit is ultimately to be assured in its entirety.

Similar considerations will affect the future scope of any Railway Conventions affecting international traffic other than transit traffic. For the present it has only been found possible in the Draft Railway General Convention to lay down certain guiding motives which should regulate the conclusion of special Conventions for dealing with various matters, to forbid discrimination in tariffs based on the nationality of passengers, on the ownership or commercial origin of goods, or upon the flag or ownership of the vessels which have been or are to be employed either before or after their transport by rail, and to apply universally the principle laid down in the Berne Convention preventing discrimination by rebates in favour of individuals. Perhaps the most important article is that which brings international disputes on railway questions under the machinery of the League of Nations.

As regards the Draft General Convention for International Waterways, greater difficulties were found in drafting a world-wide convention than in the case of the other conventions. I propose only to draw attention to a few out of many points of interest which might have been mentioned. Reference has already been made to the necessity for taking account of other uses than navigation, for the water of international rivers and in the Draft Convention even the extreme case has been provided for under which the unanimous decision of all of the States which are riparians of an international waterway, or represented on the International Commission if there is one for such Waterway, might result in the total suppression of the use of the river for navigation. Such a case may well arise among the Waterways which would technically be defined as international under the Draft General Convention.

The obligation on each riparian State to maintain a waterway in its existing condition as prescribed by the Congress of Vienna has been maintained subject, if necessary, to an allocation of expenses between the States concerned proportionate to their respective interest in the said work, always provided that special agreements do not exist on the matter. An innovation that has been proposed is that any interested State may require the execution of works of

improvement to the navigation at its own expense provided that these works would not prejudice the legitimate interests, other than those of navigation, of a State territorially concerned.

One of the few instances in which the Provisional Committee did not arrive at an agreement was on the question of *petit cabotage* or local transport on international rivers between the ports of the same State and this question was therefore excluded from the scope of the Draft Convention. The matter does not affect the Rhine where absolute freedom of *petit cabotage* is already accorded to all the nations.

The definition of an International Waterway has provoked lengthy discussions. The canalization of the head waters of many rivers renders it necessary to define more closely the meaning of the word "navigable" in the river enactments of the Congress of Vienna, and the expression "naturally accessible from the sea" was adopted to this end. As an agreement could not be obtained to include in the definition the purely national tributaries of international rivers the resulting definition is somewhat complex and can only be understood by reference to a diagram.

It is important to note that in a limited degree the Draft Preamble extends to national waterways certain principles and stipulations referred to in the convention without, however, subjecting the disputes arising therefrom to the jurisdiction of the League of Nations.

An ideal worth striving for would be the establishment of a *régime* of free communication on the great waterways uniting Western Europe with Northern and South-Eastern Europe corresponding to the liberal *régime* which now prevails on all Dutch waterways. The attainment of this and similar ideals will depend on the League of Nations Communications and Transit Organization establishing itself in the general confidence to such an extent that uniformity of *régime* can be achieved through the use of this organization for conciliating disputes.

Happily we are not now in the dark when referring to this League of Nations Communications and Transit Organization, as it was outlined by the Council of the League of Nations in their resolution of the 19th May, and confirmed with certain modifications by the Assembly on December 9th, while the detailed scheme has been worked out by the Provisional Committee and will be submitted for the approval of the forthcoming General Conference. Briefly, the proposed organization consists of General Conferences to be summoned when necessary by the Council, comprising representatives of all the members of the League with an Advisory Committee, which would prepare for sessions of the General Conference and take any necessary steps to watch over the execution of its decisions. The Advisory Committee would also act as a consultative and technical

organ to the Council of the League, and would have important functions as regards the conciliation of disputes arising out of the Treaties of Peace and the General Conventions, the ultimate appeal being to the Permanent Court of International Justice which alone would have power to impose or authorize any penalties on defaulting states. The Committee is intended to represent the members of the League as a whole, and its members therefore would not represent or receive instructions from the Governments by which they were nominated, and could not be removed during their tenure of office. The selection of States to designate members of the Committee was naturally the object of a considerable discussion. The total number of members of the committee is not to exceed one-third of the number of members of the League. It is proposed that each state permanently represented on the Council of the League should nominate one member, the other members being chosen by election at the Conference. The tenure of office will be four years and it is suggested that half the elected members should retire every two years. In order to obtain a certain rotation only half of the States which nominated the retiring members will be eligible for re-election.

It is hoped that this solution, which was at once the simplest and fairest which could be devised and was agreed to unanimously by the Provisional Committee, will meet with the approval of the General Conference.

It will, I suppose, be generally agreed that the improvement of communications, by rendering possible centralized administration, by facilitating the exchange of ideas and latterly by binding different parts of a country closely together by common economic interests, has largely contributed to the consolidation of peoples up to the limits of nationality. In the case of the United States of America, where development of communications proceeded simultaneously with the settlement of peoples migrating westwards from Europe, it has recently been suggested by Lord Ashfield, in his presidential address to the British Institute of Transport, that inter-communication was the principal factor in preventing the establishment of separate nationalities such as resulted in Europe from the earlier migrations from the East. It is pertinent to ask how far these same factors may tend to operate as between nations, and how far unity of interest brought about by improved communications may gradually overcome the further barrier of nationality and lead to common regulation of international relations in such a way as to prevent the action of any one nation interfering with the freedom of communications of the rest of the world. It is evident that any steps which it may be found possible to take in this direction will tend towards the elimination of many potential causes of friction arising from the existence of national frontiers. This fact is recognized by the framers of the Covenant of the League of Nations in Article 23*e* in which the Member States

undertake to make provision to secure and maintain freedom of Communications and Transit and equitable treatment for the commerce of all Members of the League.

Too much prominence has perhaps been given to the political aspects of the League of Nations and to its responsibilities as a definitely established organ of international relations and not enough emphasis has been laid on the necessity for the League itself to build up from its very foundations the solid supports of international opinion and international interests necessary for such a superstructure of responsibility. One of the most important of these supports, and perhaps the one which can first be taken in hand, is the creation of a more liberal *régime* in questions of communications and transit. It has been the object of this brief *résumé* to review the development of the measures which have been taken during the last two years to achieve this end, culminating in the passing only a few days ago of the resolution of the Assembly of the League of Nations which confirmed the creation of a Communications and Transit Organization of the League of Nations, and enjoined the convocation of a General Conference at Barcelona at an early date to elaborate the details of such organization and to consider the Draft General Conventions to which I have alluded. Communications will, in the future as in the past, lead the way in the development of international collaboration. Without such collaboration the development of communications in their latest form—by air and by wireless—would be strangled in its infancy. Without such collaboration the economic reconstruction of Central Europe would seem an impossible task. It is not too much to say that the success of the League of Nations itself will depend in a large measure on the Freedom of Communications and Transit. This fact alone confers, both on the transportation experts of all countries and on the principal users of international transportation, a great opportunity and a great responsibility at the present juncture when so much depends on a spontaneous impulsion in the various fields of activity towards applying the spirit of the Covenant in the regulation of international relations.

BOOKS ON CIVIL ENGINEERING.

(Continued from February R.E. Journal).

ERRATA.

It is regretted that the prices given in the portions of this list already published in Jan. and Feb. numbers *R.E.J.*, in many cases were wrongly stated. Most of the books have now increased in cost about 25 per cent. The prices given below are correct.

10. STRUCTURAL STEEL AND STEEL BRIDGES.

ENGINEERING CONSTRUCTION IN STEEL AND TIMBER.—By W. H. Warren, M. Inst. C.E., Challis Professor of Engineering, University of Sydney. Published by Longmans Green and Co. Part I., 30/-. Part II., in the Press.

Chapter I., Stress, Strain, Working Stresses; Properties of Steel. Chapter II., Timber and its Properties. Chapter III., Determination of the Stresses in Structures. Chapter IV., Bending Moments and Shearing Stresses, Influence Lines. Chapter V., Moments of Resistance and Intensity of Shearing Stresses in Beams. Chapter VI., Bridges and Viaducts of Small Span. Chapter VII., Examples of Graphical Statics. Chapter VIII., Braced Girders with Parallel Chords. Chapter IX., Bowstring and other Trusses. Chapter X., Slope and Deflection of Beams. Chapter XI., Continuous and Cantilever Bridges. Chapter XII., Strength of Columns. Chapter XIII., Riveted Joints, Pins and Eye-Bars in Bridges, Timber Joints. Chapter XIV., Wind Pressures, etc. Chapter XV., Stresses in Braced Piers. Chapter XVI., Approximate Weights of Girders and Trusses, Live Loads, Concentrated Wheel Loads. Chapter XVII., Plate Web Girder Bridges. Chapter XVIII., Pratt Truss Bridges. Chapter XIX., Design of a Parker Truss Bridge for a Single Line of Railway. Chapter XX., Swing Bridges. Chapter XXI., Arched and Suspension Bridges.

THE DESIGN OF MILL BUILDINGS AND THE CALCULATION OF STRESSES IN FRAMED STRUCTURES.—By M. L. Ketchum, C.E., Professor of Civil Engineering, Colorado University, Consulting Engineer. Published by the Engineering News Publishing Co., New York. 1 vol.; 8vo.; 3rd. edition; 1913. 25/-

Part I.—Loads. Chapters I.—IV., Dead, Snow, Wind, and Miscellaneous Loads.

Part II.—Stresses. Chapter V., Graphic Statics. Chapter VI., Stresses in Framed Structures. Chapter VII., Stresses in Simple Roof Trusses. Chapters VIII.—IX., Beams. Chapter X., Stresses in Bridge Trusses. Chapter XI., Stresses in Transverse Bent. Chapter XII., Stresses in Portals. Chapter XIII., Stresses in a Three-Ringed Arch. Chapter XIV., Stresses in a Two-Hinged Arch. Chapter XV., Combined and Eccentric Stresses. Chapter XVI., Graphic Calculation of Deflection in Beams.

Part III.—Design of Mill Buildings. Chapter XVI., General Design. Chapter XVII., Framework. Chapter XVIII., Corrugated Steel. Chapter XIX., Roof Coverings. Chapter XX., Side Walls and Masonry Walls. Chapter XXI., Foundations. Chapter XXII., Floors. Chapter XXIII., Windows and Skylights. Chapter XXIV., Ventilators. Chapter XXV., Doors. Chapter XXVI., Shop Drawings and Rules. Chapter XXVII., Paints and Painting. Chapter XXVIII., Estimates of Weight and Cost.

Part IV.—Miscellaneous Structures. Description of various Buildings, Specifications, Problems in Graphic Statics and Calculations of Stresses.

"The book is intended to provide a short course in the calculation of stresses in framed structures and to give a brief discussion of steel mill construction. It is meant to supplement the elementary books on stresses on the one hand and the more elaborate treatises on bridge design on the other. Much of the matter will apply equally well to all classes of steel frame construction." The author has a large consulting practice and considerable teaching experience. The book is well illustrated and there are several worked out examples.

THE THEORY AND PRACTICE OF MODERN FRAMED STRUCTURES.—Designed for the use of Schools, and for Engineers in Professional Practice. By the late J. B. Johnson, C.E.; C. W. Bryan, C.E.; Chief Engineer of the American Bridge Company; and F. E. Turneaure, C.E., Dean of the College of Mechanics and Engineering, University of Wisconsin. Ninth edition re-written by F. E. Turneaure and W. S. Kinne, Assistant Professor of Structural Engineering, University of Wisconsin.

Published by Wiley and Sons, New York (Chapman and Hall, London) 3 vols., ; 8vo. I., 1914, 21/-. II., 1911, 27/6. III., 1916, 27/6.

Part I.—Simple Structures. Chapter I., Definitions and Historical Development. Chapter II., Elements of the Analysis of Framed Structures. Chapter III., Analysis of Roof Trusses. Chapter IV., Analysis of Roof Trusses for Uniform Loads. Chapter V., Analysis of Bridge Trusses for Concentrated Loads. Chapter VI., Lateral Trusses, Trestles, and Towers. Chapter VII., Deflection of Structures and Stresses in Redundant Members.

Part II.—Statistically indeterminate Structures and Secondary Stresses. Chapter I., Continuous Girders. Chapter II., Swing Bridges. Chapter III., Cantilever Bridges. Chapter IV., Arch Bridges. Chapter V., Suspension Bridges. Chapter VI., Miscellaneous Problems in Statically Indeterminate Structures. Chapter VII., Secondary Stresses.

Part III.—Design. Chapter I., Styles of Structures and Determining Conditions. Chapter II., Working Stresses—Tension Members. Chapter III., Compression Members. Chapter IV., Combined Direct and Bending Stresses. Secondary Stresses. Chapter V., Riveted Joints. Chapter VI., Plate Girder Bridges. Chapter VII., Design of Truss Bridges. Chapter VIII., Design of a Pin-Connected Railway Bridge. Chapter IX., Riveted Trusses. Chapter X., Design of a Riveted Highway Bridge. Chapter XI., Design of Steel Roof Trusses.

Appendix A.—General Specifications for Steel Railway Bridges.

Appendix B.—Tables and Standards.

Appendix C.—Unsymmetrical Bending.

This is the standard advanced text book and reference work on the subject in the United States. Though it deals with American practice it is about the best book obtainable either here or in the States.

BRIDGE ENGINEERING.—By J. A. L. Waddell, C.E., D.Sc. Published by Wiley and Sons, New York (Chapman and Hall, London). 2 vols.; 8vo.; 1916. 66/-.

Volume I.—Chapter I., Evolution of Bridge Engineering. Chapter II., The Bridge Specialist. Chapter III., Ordinary Materials of Bridge Construction. Chapter IV., Alloy Steels in Bridge Work. Chapter V., Dead Loads. Chapter VI., Live Loads. Chapter VII., Impact Loads. Chapter VIII., Centrifugal Force and Other Effects of Track Curvature. Chapter IX., Wind, Vibration, and Traction Loads. Chapter X., Methods of Stress Computation. Chapter XI., Secondary Temperature and Indetermediate Stresses. Chapter XII., Deflections. Chapter XIII., Combination of Stresses. Chapter XIV., Intensities of Working Stresses. Chapter XV., First Principles of Designing. Chapter XVI., Detailing in General. Chapter XVII., Shopwork as affecting Bridge Design. Chapter XVIII., Classes of Traffic and Provision Therefor. Chapter XIX., Floors and Floor Systems. Chapter XX., Laterals and Sway Bracing. Chapter XXI., Plate Girder and Rolled I Beam Bridges. Chapter XXII., Simple Truss Bridges. Chapter XXIII., Trestles, Viaduct, and Bridge Approaches. Chapter XXIV., Elevated Railroads. Chapter XXV., Cantilever Bridges. Chapter XXVI., Arch Bridges. Chapter XXVII., Suspension Bridges. Chapter XXVIII., Movable Bridges in General. Chapter XXIX., Swing Bridges. Chapter XXX., Bascule Bridges. Chapter XXXI., Vertical Lift Bridges. Chapter XXXII., Riveted *versus* Pin-Connected Trusses. Chapter XXXIII., Dimensioning for Camber. Chapter XXXIV., Protection of Metal Work. Chapter XXXV., Wooden Bridges and Trestles. Chapter XXXVI., Draw Bridges and Protection. Chapter XXXVII., Reinforced Concrete Bridges. Chapter XXXVIII., Foundations in General. Chapter XXXIX., Cofferdams. Chapter XL., Open Dredging Process. Chapter XLI., Pneumatic Process. Chapter XLII., Piles and Pile Driving. Chapter XLIII., Piers, Pedestals, Abutments, Retaining Walls and Culverts. Chapter XLIV., Shore Protection and Mattress Work.

Volume II.—Chapter XLV., Expedients in Design and Construction. Chapter XLVI., Data required for designing Bridges, Trestles, and Viaducts. Chapter XLVII., Locating of Bridges and Preliminary Surveys. Chapter XLVIII., Borings. Chapter XLIX., Determination of Waterways. Chapter L., Requirements of the U.S. Government for Bridging Navigable Waters. Chapter LI., Hydrographic Surveys for the Bridging of Navigable Waters. Chapter LII., Æsthetics in Design. Chapter LIII., True Economy in Design. Chapter LIV., Determination of Lay-Outs. Chapter LV., Weights of Steel Superstructures. Chapter LVI., Quantities for Piers, Pedestals, Abutments, Retaining Walls, and Reinforced Concrete Bridges. Chapter LVII., Estimates. Chapter LVIII., Office Practice. Chapter LIX., Inspection of

Materials and Workmanship. Chapter LX., Triangulation. Chapter LXI., Engineering of Construction. Chapter LXII., Erection and False-Work. Chapter LXIII., Maintenance of Traffic. Chapter LXIV., Bridge Examination. Chapter LXV., Reconstruction, Maintenance, and Repair of Existing Bridges. Chapter LXVI., Status of Highway Bridge Building. Chapter LXVII., Bridge Failures and their Lessons. Chapter LXVIII., Specifications in General. Chapter LXIX., Contracts. Chapter LXX., Reports. Chapter LXXI., Administration of Construction. Chapter LXXII., Arbitration. Chapter LXXIII., Promotion of Bridge Projects. Chapter LXXIV., Bridge Engineering Fees. Chapter LXXV., Some Business Features of Bridge Engineering. Chapter LXXVI., Responsibility of the Bridge Engineer. Chapter LXXVII., Ethics of Bridge Engineering. Chapter LXXVIII., General Specifications Governing the Design of Superstructure of Bridges, Trestles, Viaducts, and Elevated Railroads. Chapter LXXIX., General Specifications for Manufacture and Erection of Superstructure, Substructure, and Approaches, etc. Chapter LXXX., Glossary of Terms (243 pp.), Index (224 pp.).

This is a very valuable book, and well worth reading even by other than bridge engineers, for many of its chapters are interesting essays in themselves. The book is written in an almost conversational style, with many touches of personal experience which make it very readable. The author, who is a well known American consulting engineer, states his aim to be "to give to his readers, concerning every branch of bridge work, all the information he has been able to accumulate during a practice of 40 years. Nothing of any value has been omitted, except such matter as can readily be obtained from other books, because he has never been a believer in the pseudo-economic idea that what has cost so much labour and money to discover and record should be utilised only for one's personal gain. On that account there appear for the first time in print all the diagrams of weights of metals, quantities of masonry costs of construction, economic functions, etc., that this book contains."

The book has been very favourably received. It contains 2,200 pages, including a useful glossary of 243 pages, a full index, and very many plans, diagrams, and tables.

11. TIMBER STRUCTURES.

STRUCTURAL DETAILS: ELEMENTS OF DESIGN OF TIMBER FRAMING.—By H. S. Jacoby, Professor of Bridge Engineering, Cornell University. Published by Wiley and Sons, New York. 1 vol.; 8vo.; 1914. 20/-.

Chapter I., Fastenings. Chapter II., Joints. Chapter III., Wooden Beams and Columns. Chapter IV., Wooden Roof Trusses. Chapter V., Examples of Framing in Practice. Chapter VI., Timber Tests and Working Stresses.

A very useful book on the designing of timber work, with much information on the strength of nails and bolts and the strength of joints. Well illustrated with dimensioned drawings. The book is frequently quoted in the United States.

TIMBER FRAMING.—By H. D. Dewell, Assoc. M. Amer. S.C.E., Chief Structural Engineer for the Panama-Pacific International Exposition. Published by Dewey Publishing Co., San Francisco (D. Van Nostrand and Co., New York). 1 vol. 8vo.; 1917. 14/6.

Chapter I., Introduction. Chapter II., Mill and Yard Specifications, Grading Rules. Chapter III., Working Stresses. Chapter IV., Washers and Pins; Compression on Surfaces Inclined to the Direction of the Fibres; Resistance of Wood to Metal Pins; Sheer Pin Joints. Chapter V., Spiked, Screwed, and Bolted Joints; Lateral Resistance of Spikes and Nails, Common Wood Screws, Lag Screws, and Bolts. Chapter VI., End Joints. Chapter VII., Intermediate Joints. Chapter VIII., Tension and Compression Splices. Chapter IX., Main Members of Trusses, Compression Chords and Struts, Laminated Truss Chords, Timber Tension Member, Tension Rods. Chapter X., Bracing Trusses; Details of Howe Roof Truss, Lattice Trusses, Truss Connections to Posts. Chapter XI., Theory of Columns; Tests of Timber Columns. Chapter XII., Column Splices and Girder Connections; Floors; Joists; Joist Hangers; Mill Construction. Chapter XIII., Foundations. Chapter XIV., Miscellaneous Structures. Chapter XV., Wind Pressure; Working Drawings. Chapter XVI., Specifications for Timber Framing.

An up-to-date book treating fully and practically a subject which is hardly discussed at all in other books, with the exception of the previous one by H. S. Jacoby. The author has had eleven years' experience of timber work on a large scale.

12. HYDRAULICS AND WATER SUPPLY.

HYDRAULICS.—By F. C. Lea. Published by Edward Arnold, 1908. Price 18/-.

Chapter I., Fluids at Rest. Chapter II., Floating Bodies. Chapter III., Fluids in Motion. Chapter IV., Flow of Water through Orifices and over Weirs. Chapter V., Flow through Pipes. Chapter VI., Flow in Open Channels. Chapter VII., Gauging the Flow of Water. Chapter VIII., Impact of Water on Vanes. Chapter IX., Water Wheels and Turbines. Chapter X., Pumps. Chapter XI., Hydraulic

Machines. Chapter XII., Resistance to the Motion of Bodies in Water. Chapter XIII., Stream Line Motion.

This book deals with the subject in a comprehensive manner. To assist the engineer in the choice of a formula for the flow of water in pipes and channels, some attention is given to the historical development of the various formulæ and particulars of the data from which the constants were determined. The whole subject is treated clearly and the book is thoroughly recommended.

WATERWORKS DISTRIBUTION.—By J. A. McPherson. Published by B. T. Batsford 2nd edition. Price 7/6.

Chapter I., General arrangement of Supply to district of distribution. Chapter II. Notes upon System of Distribution. Chapter III., Details of Method of Laying Out Distributing Mains. Chapter IV., Pipes and Fittings upon Distributing System. Chapter V., Meters and Measurement of Water, and regulating and recording Apparatus.

This is a small handbook which gives good information on the supply of water to cities and towns. It is well illustrated.

MODERN METHODS OF WATER PURIFICATION.—By J. Don and J. Chisholm. Published by Edward Arnold, 1913. Price 16/-.

Chapter I., Introductory. Chapter II., Sources of Supply. Chapter III., Storage. Chapter IV., Construction of Reservoirs and care of Filtered Water. Chapter V., Sand-Filtration. Chapter VI., Management of Sand-Filters. Chapter VII., Mechanical Filters. Chapter VIII., Purification of Ozone. Chapter IX., Water-Softening and Household Appliances. Chapters X. and XI. The Testing of Water. Chapters XII. and XIII., The Problems of Distribution. Chapter XIV., Recent Advances in Sterilization.

This is an up-to-date book giving complete information. It is well illustrated and contains a Bibliography and an Appendix of useful tables.

SMALL WATER SUPPLIES.—By F. Noel Taylor. Published by B. T. Batsford, 1911. Price 7/6.

Chapter I. Properties of Water and Sources of Supply. Chapter II., Wells and Well Sinking. Chapter III., Flow of Water in Channels and Pipes. Chapter IV., Pumping Waters. Chapter V., Storage and Distribution.

This is a practical little work and is intended to give the information needed for planning supplies for estates and country property. For this reason, it will be useful to the engineer who has to arrange for supplies to a small community, although much of the information given is very elementary. A large portion of the book is devoted to pumping apparatus. There is good information on the measurement of the flow of small streams by means of notches.

13. DRAINAGE AND SEWAGE DISPOSAL.

SANITARY ENGINEERING.—By Col. E. C. S. Moore. Revised by E. J. Silcock. Published by B. T. Batsford, 1909. Price £2-4-0. O.P., new edition in preparation.

Volume I.—Chapter I., Conservancy Systems. Chapter II., Sewerage. Chapter III., Sewage Lifting. Chapter IV., Construction and Materials. Chapter V., The Flow of Liquid in Pipes and Open Channels. Chapter VI., Hydraulic memoranda and Tables. Chapter VII., Application of Formulæ. Chapter VIII., Sewer and Drain Ventilation. Chapter IX., Traps. Chapter X., Apparatus—Latrines and w.c.'s. Chapter XI., Apparatus—Urinals, Lavatory Fitments, etc.

Volume II.—Chapter XII., Surface Water Collection. Chapter XIII., Subsoil Drainage. Chapter XIV., Sanitary Notes (Drain Testing, Disinfection, etc.). Chapter XV., Sewage Disposal.—The Problem. Chapter XVI., Sewage Disposal.—Methods of Treatment. Chapter XVII., Sewage Disposal.—Artificial Bacteria Methods. Chapter XVIII., Sewage Disposal.—Sludge. Chapter XIX., Description of existing sewage purification works. Chapter XX., Reports of the Royal Commission on Sewage, and requirements of the Local Government Board. Chapter XXI., Destructors. Chapter XXII., Construction of Chimney Shafts for Destructors.

Appendix I.—Trade Effluents.

Appendix II.—Sewage Fungus.

Appendix III.—Local Government Board Requirements with respect to Sewerage and Sewage Disposal (Revised 1909).

A comprensive book which is very well illustrated. It is provided with a good index and is thoroughly recommended.

It is not, of course, sufficiently modern to include the Activated Sludge process of Purification.

14. ROADS.

MODERN ROADS.—By Percy Boulnois. Chairman of the Council of the Roads Improvement Association. London. Published by Edward Arnold, 1910. 16/-.

Chapter I., Effects of great increase of heavy traffic since 1907. Formation of, and activites of the Road Board. Chapter II., Traffic Statistics. Questions brought

to the fore by the evergrowing use of self-propelled vehicles, such as best widths, gradients and camber. Chapter III., Water-bound Macadam Roads. Suitable Materials and Tests. Types of Rollers. Specifications and Instructions issued by Road Board. Standing Orders for Road Gangers. British Standard Specification for Broken Stone. Chapter IV., Tar treatment of Surfaces. Specifications and Instructions for Surface Tarring. Tar Spraying Machines. Specifications for Tar. Chapter V., Bituminous Roads. Specifications for "Pitch Grouting." Reports on Trials of different Methods of Construction. Various Patent Materials and Processes. Chapter VI., Bituminous Carpets or Asphalted Surfaces. Various Specifications. Chapter VII., Waves and corrugations. Opinions of Different Authorities as to their cause. Chapter VIII., Paved Streets. Granite Setts and Wood Blocks. Rock Asphalte. Brick Paving. Chapter IX., Concrete Roads. Pros and Cons. Specifications for Materials and Processes. Reports on various Trials. Chapter X., Slippery Streets. Cause and Prevention of Skidding.

The majority of books on Modern Road Construction are from the pens of American writers. The author claims to be the first writer on current English practice.

CONCRETE ROADS.—Published by "Concrete Publications, Ltd." Price 8/-. Chapter I., Concrete Roads in the U.K. (Metropolitan Roads). Chapter II., Concrete Roads in the U.K. (Provincial Roads). Chapter III., Concrete Roads in Industrial Wales and Military Camps. Chapter IV., Concrete Roads in other countries. Chapter V., The growth of Concrete Roads in the U.S.A. Chapter VI., Mechanical devices for making Concrete Roads. Chapter VII., Concrete Curbing. Chapter VIII., Specifications. Chapter IX., The use of Concrete for Road Accessories. The book is well illustrated with diagrams and reproductions of photographs illustrating various roads during and after construction and is well worth studying. Chapters I., II., III., and IV. give useful and detailed information of various roads of plain and reinforced concrete, showing the method of construction, cut, nature of traffic and the resultant wear. Chapter VI. has description and illustration of labour-saving machinery, for excavation, grading, tamping, concrete mixing and depositing, etc. Chapter IX., deals with accessories such as culverts, pipes, fence and gate posts, telegraph and lamp posts, etc., in concrete.

TEXT BOOK ON HIGHWAY ENGINEERING.—By Arthur H. Blanchard, C.E.A.M., Professor of Highway Engineering, Columbia University, New York, and Henry B. Drowne, C.E. Instructor at above University. Published by Chapman and Hall, 1914. Price 27/6.

A book for Instructor and Student.

Chapter I., Historical Review. Chapter II., Location. General considerations of Foundations, Drainage, Widths, etc. Traffic and Censuses. Chapter III., Surveying and Mapping. Organization and duties of Survey Party. Preparation of Plans and Profiles. Chapter IV., Design. Layout of New Townships. Effects of Traffic on Design. Suitable Widths and Grades. Formulæ for Camber. Estimates of Earthwork. Chapter V., Drainage. Subsoil Drainage. Side Ditches and Gutters. Culverts and Catchbasins. Chapter VI., Foundations. Classification of Soils. Artificial Foundations. Foundations of broken Stone, and Concrete. Chapter VII., Earth and Sand Clay Roads. Use of Ploughs, Scrapers and Drags. Special Grading Machines. Maintenance. Chapter VIII., Gravel Roads. Requisite Qualities of Materials. Specifications. Methods of Construction. Chapter IX., Broken Stone Roads. Classification of Rocks. Tests for Road Metal. Quarrying—Drilling, Blasting and Crushing. Description of Process of Construction. Maintenance—Causes of Wear. Implements and Machines. Chapter X., Bituminous Materials. Asphalts and Rock Asphalts. Manufacture of Tar. Tests for Bituminous Materials. Chapter XI., Dust Prevention by Palliatives. Water, Calcium Chloride, Light Oils. Chapter XII., Bituminous Surfaces. Preparation of Road Surface and Application of Bituminous Materials. Mechanical Distributors. Advantages and Disadvantages of Bituminous Surfaces. Causes of Failure. Chapter XIII., Bituminous Macadam Specifications for Asphalte Methods of Construction. Pros and Cons. Maintenance. Causes of Failure. Chapter XIV., Bituminous Concrete. Specifications for Bituminous Cement. Methods of Construction. Various Specifications for Construction. Various Patent Materials and Processes. Mechanical Appliances. Maintenance Pros and Cons. Chapter XV., Asphalte Pavements. Specifications for Materials. Methods of Construction. Mechanical Appliances. Maintenance. Causes of Failure. Chapter XVI., Wood Block Pavements. Decay and Preservation of Woods. Manufacture of Blocks. Construction and Maintenance. Chapter XVII., Stone Block Pavements. Manufacture and common sizes of Blocks. Construction. Chapter XVIII., Brick Pavements. Composition of Suitable Clays. Manufacture of Bricks. Abrasion Tests. Methods of Laying Bricks. Expansion Joints. Chapter XIX., Concrete Pavements. Methods of Mixing. One and Two Course Methods. Grouting. Method. Chapter XX., Miscellaneous Roads and Pavements. Burnt Clay, Straw, Shells, Slag, Clinker and Cobblestone Pavements. Chapter XXI., Street Cleaning

and Snow Removal. Organization in Various Countries. Sweeping and Cleaning Machines. Chapter XXII., Tramway Tracks. Chapter XXIII., Conduits for Water, Gas and Electric Cables. Chapter XXIV., Comparison of Types of Roads and Pavements. Chapter XXV., Sidewalks, Curbs and Gutters. Chapter XXVI., Bridges, Culverts and Guard-rails. Chapter XXVII., Economics, Administration and Legislation.

ELEMENTS OF HIGHWAY ENGINEERING.—By Arthur H. Blanchard (497 pages). Published by Chapman and Hall, London. 1915. Price 19/-.

An abridged version of the Text Book by Blanchard and Drowne.

Chapter I., Historical Review. Chapter II., Economics, Administration, Legislation and Organization. Chapter III., Preliminary Investigations—Location, Drainage, Width, etc. Chapter IV., Surveying, Mapping and Design. Chapter V., Grading, Drainage, Foundations. Chapter VI., Earth and Sand Clay Roads. Chapter VII., Gravel Roads. Chapter VIII., Broken Stone Roads. Chapter IX., Bituminous Materials. Chapter X., Dust Prevention and Bituminous Surfaces. Chapter XI., Bituminous Macadam Pavements. Chapter XII., Bituminous Concrete Pavements. Chapter XIII., Sheet and Rock Asphalte Pavements. Chapter XIV., Cement Concrete Pavements. Chapter XV., Wood Block Pavements. Chapter XVI., Brick Pavements. Chapter XVII., Stone Block Pavements. Chapter XVIII., Street Cleaning and Snow Removal. Chapter XIX., Comparison of Roads and Pavements. Chapter XX., Sidewalks, Curbs and Gutters. Chapter XXI., Highway Structures.

Appendix I.—Glossary of Terms.
Appendix II.—Tests for Bituminous Materials.
Appendix III.—Tests for Non-Bituminous Materials.

15. ESTIMATING.

HOW TO ESTIMATE. BEING THE ANALYSIS OF BUILDERS' PRICES.—By J. T. Rea. Published by B. T. Batsford, 94, High Holborn. Price 12/6.

Chapter I., Introductory. Chapter II., The Cost of Buildings. Chapter III., Labour. Chapter IV., Preliminary and Provisions. Chapter V., Excavator. Chapter VI., Bricklayer. Chapter VII., Mason. Chapter VIII., Pavior. Chapter IX., Slater. Chapter X., Tiler. Chapter XI., Carpenter, Joiner and Ironmonger. Chapter XII., Smith and Iron Founder. Chapter XIII., Plumber and Zinc Worker. Chapter XIV., Plasterer. Chapter XV., Painter. Chapter XVI., Glazier. Chapter XVII., Paperhanger. Chapter XVIII., Gasfitter. Appendix Memoranda.

16. WORKS ORGANIZATION.

THE PRINCIPLES OF SCIENTIFIC MANAGEMENT.—By F. W. Taylor. Published by Louis Cassier. 7/6.

Gives an outline of new methods in organizing, training and handling labour, and gives many examples of the gain in efficiency that has resulted.

For example: *Shovelling ore at the Bethlehem Steel Works.*

Old plan ... 16 tons per man per diem
New plan ... 59 " " " " "

Bricklaying.

Old plan ... 120 bricks laid per man per hour
New plan ... 350 " " " " "

Sorting Steel balls for bicycle bearings.

35 girls now do the work formerly done by 120 and with much greater accuracy. Hours of labour reduced by 2 hours a day, and in addition rest periods given during the day.

BRICKLAYING SYSTEM.—By C. Gilbreth. Published by Spon and Co. 16/-.

Motion study, showing how the motions of a bricklayer can be reduced from eighteen to five, with an improvement in efficiency from 120 bricks an hour to 350 the same time.

The method used may be used as a basis for the motion study of many other trades.

PROFESSIONAL NOTE.

HYDRAULIC MINING CARTRIDGE.

THE object of the Hydraulic Mining Cartridge is to break up stone, coal, and concrete, or other hard substances, without using explosives. Its principal application is where the shock attendant on blasting operations would be damaging and dangerous to surrounding strata, foundations, etc.

The apparatus consists of—

(*a*) A rock-drilling plant,
(*b*) A hydraulic mining cartridge.

(*a*) *Rock-drilling plant.*—The plant normally used is a 4E Temple drill made by the Ingersoll-Rand Co., Ltd., driven either by steam or compressed air. A special 5″ diameter drill is necessary. This will drill a hole 2′ deep in hard concrete in about half an hour.

(*b*) *Hydraulic mining cartridge.*—The cartridge is made in several sizes, the most common size consisting of a cylinder 19″ long and 4″ diameter in which are fixed five hydraulic rams working at right angles to the cylinder, each ram having an area of about 3 square inches. This cylinder is connected by a hydraulic pipe to a hand pump which draws water from a small tank hung on the pipe. The apparatus complete weighs about 90 lbs. and can easily be handled by one man.

The cartridge attached to the pipe and pump is placed in a hole drilled by the rock-drill, the "liners" inserted to tighten the machine and the tank filled with water. By moving the pump plunger backwards and forwards, the water is transferred from the tank to the cartridge and pressure is then applied by means of screw and handles which carries the plunger forward and forces the rams out of their chambers in the cylinder and causes the concrete or rock to crack. This crack is extended for many feet on each side of the hole as the rams advance under the continued operation of the screw and handles. The total pressure obtained by the pump is about five tons per square inch or about 75 tons on the rock or concrete.

When seen at work at Shoreditch Electrical Power Station the apparatus was being used to remove heavy concrete foundation on which a marine engine had been bedded. Heavy holding down bolts

increased the difficulty of the work. The splitting operation took less than 5 minutes, about 8 cubic feet of concrete being moved. The foreman reported that the cost of this method was about one-third of what it would have been if done by hand.

If necessary a loose face is made at the commencement of the job by the rock drill, after which, by careful placing of the cartridge holes, no further cutting should be required.

The manufacturers are "The Hydraulic Mining Cartridge Co." 115, Victoria Street, S.W.1.

REVIEWS.

THE HISTORY OF THE TWENTY-SECOND CHESHIRE REGIMENT, 1689-1849

By MAJOR-GENERAL W. H. ANDERSON, C.B. (Hugh Rees, Limited, 5, Regent Street, W.1.)

The history of the 22nd Regiment dates from the raising of the Regiment at Chester by the Duke of Norfolk in 1689 in aid of William of Orange, who had been invited in the February of that year by the Lords and Commons of England to take the place of the Stuart King James II. A short account is given of the war in Ireland and the Battle of the Boyne. The Regiment was subsequently employed at the Siege of Gibraltar in 1727 and at the Battle of Dettingen in 1743. It was at this battle that a detachment of the Regiment rallied round the King—George II—beat off an attack of French cavalry, and earned from the King the distinction of wearing an oakleaf in commemoration of their gallant conduct. They subsequently served in North America under Wolfe, and were one of the regiments that were present at the Battle of the Heights of Abraham before Quebec. They lost their Colonel, Abercrombie, at the Battle of Bunkers Hill in 1775, were present throughout the whole war of the American Revolution, evacuating New York on the 25th November, 1783, two months after the signature of the peace. In 1785 the Regiment was stationed at Windsor, where a Regimental Order of Military Merit was instituted by Lieut.-Colonel Crosbie and the Officers of the Regiment. The Order was intended to promote good conduct and discipline in the Regiment, the Field Officers, Captains, and Adjutant being members of the Order. No N.C.O. or private could become a candidate for election to the Order before he had "served His Majesty seven years with an unblemished character." The Order consisted of three degrees, which were distin-

guished as follows :—1st degree—a silver medal, gilt ; 2nd degree—a silver medal ; 3rd degree—a bronze medal. Fourteen years' qualifying service were required before a candidate was eligible for the silver medal, and "a service of 21 years with an unblemished character" was necessary in order to entitle a member to a gilt medal. This Regimental Order of Merit was not finally abrogated until 1840 when the present medal for Good Conduct and Long Service was instituted throughout the Army. From 1793 to 1815—during the whole period of the Revolutionary and Napoleonic Wars—the Regiment served in the West Indies, India, and Mauritius. After leaving Mauritius in 1819 the Regiment served at home until 1841, when they embarked for India. Here they were destined to take part on the 17th February, 1843, in the famous Battle of Meeanee under the leadership of Sir Charles Napier.

As the only European Regiment to count Meeanee as a Battle honour, the Cheshire Regiment has always specially cherished the recollection of this fight, Meeanee Day being an annual celebration. Sir Charles Napier was Colonel of the Regiment from 1843 to 1853, the present narrative closing in 1849 while the Regiment was stationed at Bombay. It is to be hoped that a future historian may be found to bring the Regimental records up to date. The present narrative is vivid and interesting, and should do much to maintain the regimental *esprit de corps* of one of the most distinguished of our old Infantry Regiments.

B. R. WARD.

THE THEORY OF DIRECT CURRENT DYNAMOS AND MOTORS.

By JOHN CASE, M.A. (W. Heffer and Sons, Ltd., Cambridge, 1921. 15/-)

This book is primarily intended for students for University Honours Degree and other such examinations, and is not intended for the designer. It seems more especially suited as an addition to the more elementary books on electrical machines, which usually deal with the theory rather briefly. The work is divided into four main headings :—

(1) The theory of induced e.m.f.'s and currents.
(2) D.C. Generators.
(3) D.C. Motors.
(4) Efficiency and losses in D.C. Machines.

the remainder treating briefly with application of D.C. Machines to Traction, Multiple Wire Systems, and Boosters. The symbols used conform on the whole with those laid down by the International Electro-Technical Commission. Commutation and armature reaction are treated very briefly considering their importance with regard to the whole subject. The references to diagrams are somewhat erratic, lettering mentioned in the text often not appearing on the diagrams ; in one case (pp. 36, 37) lettering referred to in the text as on Fig. 27 does not appear, and on Fig. 28, which is just below the text in question, the lettering is exactly reversed. Though calculations are for the most

part simple, a knowledge of higher mathematics is essential for a full appreciation of the work. In conclusion, in addition to its use for University students, the work should be useful as a reference book for those who may have to instruct others in the subject, where some knowledge of the theoretical considerations is essential, though not the complete knowledge necessary to a designer.

R.W.C.

NOTICES OF MAGAZINES.

MILITÄR WOCHENBLATT.

No. 31.—*The Draft of the Reichswehr Law.*—Some points in this are discussed. The Army and Navy Councils, which consist of representatives of all ranks, are for advisory purposes only; they have no power to decide any questions. The *M.W.B.* quite approves of this restriction, since it agrees with the principle that the best representatives of the soldier, when it comes to giving decisions, are his superior officers.

The formation of units on a territorial basis is expected to meet with many difficulties, particularly in the smaller states, but the Army Command did not feel able to oppose it.

Regulations providing for the discharge of *personnel* unfit for service are complicated. On one side the Reichswehr wishes to get rid quickly of all men not suitable for it, and on the other the Peace Treaty imposes strict limitations, so as to prevent all possibility of a reserve being built up. The *M.W.B.* says the *Entente* need not be anxious on this point because Germany is, for financial and other reasons not specified, quite unable to form any reserve. A special court is proposed, which shall consist of soldiers and shall be empowered to decide whether a man's conduct, on or off duty, renders him an unworthy member of the Reichswehr or not.

As regards politics, the Reichswehr man has the right to vote, but not to belong to any political association, or to conduct any political propaganda. He may belong to non-political associations, provided his district commander approves and may complain to the Ministry of Defence if approval is refused.

The Polish Threat against Upper Silesia.—Great anxiety is expressed regarding the alleged concentration of Polish divisions against Upper Silesia. The scarcity of all commodities and the low rate of exchange have given good opportunities in Poland for Bolshevik propaganda, even among those sections of the population which have hitherto been little inclined to listen to it, and the Polish Government is accused of trying to divert its people's attention to the desirability of acquiring Upper Silesia, with its great natural wealth, as a way out of all their troubles.

The *M.W.B.* thinks that if the result of the Plebiscite turns out unfavourable to Poland, disturbances will be arranged, so as to give an excuse for intervention, which will end in occupation. The Polish troops are not thought to be of more than moderate quality, but as Germany is, save for a few frontier police, quite defenceless, they will easily be able to carry out their plans. .

No. 32.—*A Criticism of the World-War.*—The author of this book, a German general staff officer, accuses the leaders of the German army of culpable ignorance of the real feelings and condition of their troops. He says that they continually looked at things through rose-coloured spectacles, and refused to face the true facts. General von Kuhl, who was chief-of-staff to Rupprecht's army group, declares that the accusation is unjustified. He states that every possible step was taken by the higher commanders to make and keep themselves informed regarding the condition of their men. G.H.Q. and army group H.Q. were always accessible to complaints and continually invited them by getting junior commanders to come and see them. He personally was frequently sought out by divisional and other commanders, who came with bitter complaints of the way in which their men were being worn out, and says he will never forget the impression made on him by the sight of units withdrawn from the Flanders front in 1917. Pale and hollow-eyed, coated from head to foot with mud, they dragged themselves apathetically back to their billets. Everyone knew how overdriven the men were, but their numerical inferiority and not the ignorance or self-seeking of their leaders, was the cause of it. He says that these accusations are only a part of the search for a scapegoat on whom the blame for defeat can be laid. He denies that Ludendorff only tried his great effort of 1918 because he was ignorant of the state of his troops, that the spirit with which they were then filled was forced into them, and that the only thing which made the troops willing to attack at all was the hope of making an end of all the "Schweinerei." He says that no one who saw the men before the March 1918 attack can doubt for a moment that their moral was splendid, and that to attempt to belittle it is only to rob the army of its glory.

Miscellaneous.—The Danish Government is said to be finding difficulty in filling the army establishments. In some cases only 20 per cent. of the N.C.O.'s and 50 per cent. of the officers authorized can be found, and the schools are almost empty. Better conditions of life in the commissioned and non-commissioned ranks are said to be the only remedy.

No. 33.—*Anti-Aircraft Artillery.*—The word "Flak" has been coined, from the initials of "Flieger-Abwehr-Kanone," to describe this branch of artillery, and Capt. Seydel contributes a short article on German Flak artillery. In August, 1914, there were only 18 Flak guns in the whole army and the development of the arm, as increasing demands were made upon it, met with great difficulties, which were never satisfactorily overcome. As the number and range of aircraft increased, demands for more Flak guns became so urgent that the first available weapons were pressed into use. The result was that at the end of the war there were no less than 25 different kinds of Flak guns in use. The bad effect of this lack of uniformity on training is obvious, and the

construction of range tables, sights, etc., was much complicated thereby. Flak *personnel* was frequently, but usually unjustly, blamed. As a matter of fact the demands made upon it were very great and too often these were under estimated, with the result that unsuitable men were sent to Flak units. As an instance of their activities Capt. Seydel mentions that an average of 500 telephone calls passed through his group H.Q. daily. He claims that Flak were able to make enemy aircraft fly at an average height of 4,000 metres instead of 800, and that they brought down, from May to September, 1918, a total of 420 aeroplanes, of which 125 were shot down in September. He also mentions their value as anti-tank guns.

The Disarmament of German-Austria.—The treaty of St. Germain left Austria with an army of 30,000 men and a police and gendarmerie as in 1913. As a result of the lack of public security in Vienna and in the provinces these latter have had to be increased from a total of 8,600 to 19,000. This was all the more necessary because practically no "Einwohnerwehr" system exists. The *M.W.B.* would have expected Austria, when faced with this situation, to have applied to the *Entente* for further powers, but the socialists have preferred to make party rather than national capital, and have utilized the occasion to weaken the army. The result is that the Supreme Council has agreed to an increase in the police provided that the Army is reduced to exactly the same extent, that is to say, by 11,000 men. This will leave Austria with an army of 19,000 all ranks.

A Letter from Palestine.—Frau Emma Wagner writes from Nazareth at the end of 1920:—

"DEAR——It is over two years since that terrible 20th September dawned on Nazareth. It was like a nightmare. At six o'clock in the morning there was a knock at the door and the words, 'I am an Englishman.' Everywhere the cry, 'The English' burst like a bomb among the unsuspecting sleepers. Machine-gun fire was soon heard from the Franciscan monastery and elsewhere, and, in spite of the surprise, the defence soon pulled itself together. By ten o'clock the English had withdrawn, and the Germans and Turks were able to get away. The English general who ordered the withdrawal was afterwards degraded, chiefly because he let Gen. von Sanders escape. The English were furious when they heard that he was the last to leave the town, at five o'clock in the afternoon. At last the 'conquerors' came, but with what caution! The Bedouins who had been prowling, like jackals, round the town, now gave place to the hyænas! Occupation of the town took several hours, and was then accomplished chiefly by Indians; There were very few English officers. All honourable Englishmen speak with the greatest respect of the performances of the Germans and particularly of the defence of Samakwe. The capture of Palestine cost the English quite enormous loss in human life, although they usually sent the Australians and Indians to the front, when there was any fighting to be done. Some of them boasted openly that they had bought Palestine, and one highly-placed officer even named the price. Our treatment has altered in a remarkable way, and we are met everywhere with the greatest politeness and kindness. Since it was decided in

England that German colonists in Palestine were not to be disturbed, not only the Red Cross and the English Quakers, but also the Mahomedans and Jews have behaved well to us. Nazareth, after her crowded hours of 1918 has fallen asleep again and the sleep is deeper than ever."

No. 34.—*The military and political situation in South-Eastern Europe.*—While all the so-called national states, which compose South-Eastern Europe, still view each other with deep suspicion and mistrust, a feeling is beginning to spread that this cannot go on indefinitely, and that if any recovery or progress is to be made, some sort of agreement must be reached.

Progress in this direction has been made by the states of the "Little *Entente*;" and, as Austria is no longer to be feared, economic agreements have been made between her and the Tchechs, Roumanians and Serbians. Hungary, on the other hand, has so far consolidated her military strength as to be an object of suspicion, as has also Bulgaria. Germany has concluded agreements with Austria, Tchecho-Slovakia, and Hungary, but the effects of them remain to be seen.

The Danube question is very important, but the international commission is now sitting and steps are being taken to establish canal communication between Rhine, Elbe, and Danube.

Occasionally there is talk of a Danubian alliance, under Hapsburg direction, but at the time of writing there seems to be little prospect of it coming to anything. Austria and Hungary are against it and Bavaria is not likely to cut loose from Germany.

In Tchecho-Slovakia the Army of 200,000 men, is nearly complete, but its gradual reduction to 150,000 is in view; 28 per cent. of it are Germans. Returned legionaries from Russia and Siberia form a troublesome element, as they are inclined to be revolutionary. Internal political conditions are very much as in Germany, and the economic position is not bad.

Austria's position is very difficult, and union with Germany is everywhere canvassed. Food and clothing are short and financial conditions go from bad to worse.

Roumanian demobilization is not quite complete. Soviet-Russia has not yet agreed that Bessarabia shall be Roumanian.

Jugo-Slavia is still far from settled. The Albanians are giving local trouble and the Croats are demanding a republic. The constitution of the Army has been decided; it is to have 16 divisions in first line, with similar divisions in second and third line; equipment for the third line is lacking. As in all the new states the great political question is whether a single state or a confederation shall be formed. Great efforts are being made to join the Danube by a railway to the Adriatic at Cattaro.

Bulgaria is making good progress. The Army has been reduced to the 20,000 men allowed and the Gendarmerie raised to 13,000. Conscription of labour is in force. Several Generals are to be brought to trial for their failure in the war, but the *Entente* has withdrawn its demands for the trial of war criminals. The amount of land which may be owned by an individual is limited to 30 hectares and property is

heavily taxed. Economic conditions are, however, improving and prices are falling.

Greece is in difficulties; 200,000 men are still under arms and the army is divided into Royalists and Venizelists. The nation is longing for peace and demobilization. Withdrawal of economic support by the *Entente* has caused many difficulties.

Hungary has made more progress than any other country in S.E. Europe. The state is consolidated and the army firmly built up to the size allowed.

Cost of troops in armies of occupation on the Rhine, shown in paper francs per day.

	Officers.	*Men.*	*Horses.*
French	47	13	7
Belgian	46	13	11
American	160	59	11
British	98	32	13

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

REVUE MILITAIRE GÉNÉRALE.

September, 1920.

The First Strategic Check of the German Armies. (by Capt. Koeltz).—The battle of the Sambre and the Meuse, which took place between the 20th and 25th August, 1914, was a tactical success for the Germans, but a strategic failure. The two rivers, and the Central Canal, were all crossed, but the left wing of the Allies was not outflanked as had been intended by von Schlieffen's plan of campaign. The failure is attributed firstly to von Moltke, secondly to von Bulow, and thirdly to von Haussen. Von Moltke for some reason, either excess of optimism in relying on the weight of the German force engaged as compared with the estimated strength of the opposing allies, or excess of confidence in his subordinates, or the multiplicity of matters claiming his attention, renounced the direction of the three armies on the right flank in this the most important battle of the opening of the war. He had already placed the First Army (von Kluck) under the orders of von Bulow, commanding Second Army, and during the afternoon of 20th August directed von Bulow and von Haussen (Third Army) to co-operate strictly in the proposed attack on the allied forces on the line of the two rivers west and south of Namur. Again, von Bulow, a man of little imagination, evidently entirely failed to grasp the strategic aspect of the situation, or perhaps feared the damage to his reputation which a defeat would involve, and restricted von Kluck to close attendance on the movements of the Second Army, as well as a watchful attitude in the direction of Antwerp. Von Kluck, who had known for some time that he was to command the extreme right of the outflanking movement, and had devoted much time and study to the subject, expostulated and asked for at least a corps of cavalry, without which he was unable to

feel for the left flank of the Allies, but von Bulow retained both the cavalry corps which he disposed of under his own orders, either in his own immediate front, or too far to the north-east, and only placed one corps under von Kluck's orders from the morning of the 24th. Von Bulow also hampered the movements of von Haussen. Late on the 23rd he implored the latter to come to his assistance by marching across the Meuse in a westerly direction, while von Haussen had already issued orders for an early advance next day in a south-westerly direction across the river, with the object of getting behind the French, who he knew were retiring from the line of the Sambre. Such a movement had even been directed by the Great General Staff, who on that date intervened in the conduct of the operations. Von Haussen, understanding from von Bulow's appeal that the latter was in difficulties, and not expecting such a senior general to ask for help unless he really needed it, against his better judgment cancelled the orders he had issued, although they were then in course of execution. The consequence was that the French withdrew without difficulty, while, owing to the limitations imposed on von Kluck, the English were able, by retiring, to escape being outflanked. It is possible that if the Armies of the German right wing had been grouped under a separate commander who was not also occupied by the responsibility of commanding one of the armies he would, even if a von Bulow, have had a clearer insight into the strategic possibilities open to him, and which the superior strength of his forces would have enabled him to turn to account. There is little doubt that the allied left should have been overwhelmed had the German armies been more intelligently handled.

October, 1920.

The Arrest of the German Offensive on the Ourcq in 1918. Operations of the 2nd Cavalry Corps from 28th May to 5th June, by Col. R. Bouillain.—The operations are given in detail. The Corps covered 200 to 215 kilometres in three days' forced marching, and then held a front of 12 kilometres almost denuded of other troops, in contact with two, then three, German divisions, one consisting of the Guards. This entailed five days of incessant fighting and rapid changes of position. The Corps lost one-third of its effectives, but checked the enemy offensive by its sudden and unexpected resistance, until other troops could be brought up to fill the gap and bar the road to Paris.

Some Reflections on the Military Services Act. (by Col. P. Defrasse, Reserve Artillery).—The writer advocates giving the Government sufficiently wide powers to enable it to raise, in case of need, a force larger than that normally required. The Act of 1872 (called the Five Years Act) allowed a large number of total exemptions, besides which the Minister for War was empowered to allow a proportion of those liable for service to serve for one year only, the proportion being fixed at his discretion, and the individuals chosen by lot. Service for the remainder was nominally for five years counting from 1st July, but the contingent was seldom called up until November, and was generally dismissed after the manœuvres in September of the fourth year of service, so that practically service was for 3 years 11 months

only. The elasticity of this Act is its great merit. The strength of the Army could be increased at will as the need arose (1) by calling up each contingent at due dates, *viz.*, 1st July; (2) by reducing, or cancelling entirely, the proportion allowed to serve for one year only; and (3) by keeping the whole force with the Colours for the full five years permissible. These peculiarities were no doubt recognized by the Germans, and may have had their effect on the maintenance of peace. The Three Years Act of 1889 cancelled all exemptions except actual incapacity for service, but still allowed of one year's service only for a proportion; its elasticity was much less than that of the 1872 Act. The Two Years Act of 1905 allowed of no elasticity, and on a crisis emerging had to be superseded by a new Act, which was passed barely in time to produce its effect by the dates a larger army was actually necessary. A Three Years' Act authorizing the call of the contingent later than the legal date, and allowing of leave being granted before the legal date of termination of service, would meet the case provided it creates at the same time a sufficiently strong professional nucleus to provide the frontier guards, and to train the citizen soldiers.

November, 1920.

Notes on the War in the Air near Nancy. An answer by Capt. P. Weiss to the query, "What are our aviators doing?"—The inhabitants of Nancy, after the opening of the war, never experienced a great battle, but bombardment by long-range guns and the war in the air did not cease. Early in 1917 the German long-range gun cleverly hidden at Hamport was put out of action in six hours after 18 shots directed by aeroplanes, in spite of all efforts of the Germans, and was never re-installed. Many other guns did not cause so much trouble, but one which fired on Pompey was almost impossible to locate. It had two emplacements, connected by the Metz-Delme railway, sited in a wood and fired every Sunday morning, when the wood was smothered in a smoke cloud and flashes were fired to distract the French observers. It was quite impossible to tell, except by sound, which emplacement was in use, or where the French shots fell. Although the emplacements were destroyed each Sunday afternoon the gun was regularly at work again next Sunday. The writer argues from his experience that it is impossible to prevent night attacks on a town by hostile air-craft. Guns and balloons ensure their keeping at a great height, but chases by night are seldom effectual, and though the English have several destroyed machines to their credit, such battles are exceptional. To prevent guns firing on their own air-craft at night it has been suggested that the sky should be divided into zones, in one of which aeroplanes should be given full liberty of action, while the other is left free for the artillery. The Paris defensive aeroplanes obtained no success by night chasing, and there were many accidents to returning machines on landing. The reason is, that the best pilots cannot resign the excitement of air warfare on the battle front to take up the more passive duty of guarding from attack a town on an otherwise quiet front. Second rate pilots have not the nerve and dexterity obtainable only by constant practice. The only object in allotting defensive squadrons to towns is the moral

effect on the inhabitants of knowing that their requirements in that particular have not been neglected. The squadron at Nancy, moreover, was not expected to fly by night, but only to patrol by day, and its success in this duty is proved by the almost complete cessation of German aeroplane attacks by day from early in 1917. Every week two or three captured planes were on view, and constant attacks were made on railway stations, munition dumps, workshops, etc., in the German lines, as well as photographing and reconnoitring flights. The records of the Eighth Army Squadron in 1918 are quite brilliant, it was used on every sort of air service by day. Four pilots out of twelve gained the title of "Ace," and the way the mechanics worked, often all night, is beyond praise.

Events in Upper Silesia.—An account of the occurrences in Upper Silesia from June to August, 1920, resulting in a rising of the Polish miners against the Germans. On this occurring a state of siege was proclaimed at Kattowitz, and General Gratier and M. Kuhn, President of the Allied Commission, announced that they had full power to restore order, advising the German population to remain calm. The rising spread to other places in the mining districts, and a deputation of Polish workmen, who appear to have behaved very moderately, represented their grievances to the Commission. On 25th the Allied flags, which had been torn down on 17th, were rehoisted, and on 26th the repatriation of the Sicherheitspolizei to Germany began, and work was resumed in all the mines. On 28th the terms agreed upon were published; return to Germany of the Sicherheitspolizei, and their replacement by a mixed force pending the constitution of the plebiscite police, expulsion of all persons (mostly German reservists) who had entered the country since 1st August, 1919, subject to exceptions to be adjudicated upon by a mixed tribunal, punishment for refusal to hand in firearms, and constitution of a mixed commission to prevent acts of terrorism by either side.

A. R. REYNOLDS.

PROBLEM.

PROBLEM 23. Solution (G. F. S. Hills, Esq.)

Write the division sum as follows :—

$$
\begin{array}{l}
abc\,)\times\times\times\times\times 4\,(u4vw \\
\quad g\ e\ f \\
\hline
m_1 m_2\,4\,m_4 \\
n_1\ n_2\ n_3\ n_4 \\
\hline
\quad p_1\ p_2\ p_3\ p_4 \\
\quad\ \ q_1\ 4\ q_3 \\
\hline
\quad\ \ r_1\ r_2\ r_3\ 4 \\
\quad\ \ r_1\ r_2\ r_3\ 4 \\
\hline\hline
\end{array}
$$

(i). It is clear that $p_1 = 1$, by considering the sum of the two three figure numbers $q_1 4 q_3$ and $r_1 r_2 r_3$.

(ii). If the divisor $10^3a + 10b + c$ is represented by N then clearly $4N > 10^3$ as it is equal to the four figure number $n_1n_2n_3n_4$, further $v \cdot N < 10^3$ as it is equal to the three figure number $q_1 4 q_3$, therefore $v = 1$, 2, or 3.

(iii). If $v = 3$ N lies between 250 and 334.
If $v = 2$ N ,, ,, 250 and 500.

(iv). As $q_2 = 4$ it is clear on consideration that
when $v = 3$ b must be either 8, 1 or 4,.
when $v = 2$ b must be either 2 or 7,
when $v = 1$ b must be 4.

(v). The two numbers c and w are connected by the fact that their product must end in 4, so that for each value of w there is one or in certain cases two values of c, *e.g.*, if $w = 1$ then $c = 4$.

(vi). When $v = 2$ or 3 the limitation resulting from (iii) (iv) and (v) restricts the number of possible cases to be tested to a very small number. The test to be applied is that $4vw \times abc$, which must make the six figure number $m_1m_2 4 m_4p_4 4$, must make $m_3 = 4$. The test shows that no cases exist where $v = 2$ or $v = 3$.

(vii). When $v = 1$ and therefore $b = 4$ there are a larger number of possible cases. These cases result by giving different values 1 to 9 for the letter a, and different values 1 to 9 to the letter w. The letter c is determined from that given to w by (v). The field of choice can be restricted by noting that as $p_1 = 1$, $(10 + w) N > 10^4$, so that if $w = 9$ $N > 526$, if $w = 8$ $N > 550$, and so on. As a is 5 or more referring to gef we see that $u = 1$. Further a cannot be less than 7, for suppose $a = 6$ abc becomes $64c$, and this when multiplied by 4 gives $n_1n_2n_3n_4$ and $n_1n_2 = 25$, and therefore $m_1m_2 = 26$ or 27. In this case the maximum value of $m_1m_2 4 + gef = 274 + 64c$ and this is less than 1000, but the condition of the problem requires this sum to be not less than 1000. Hence $a = 9$, 8 or 7. Further in carrying out the test $4vw \times abc$ to see whether $m_3 = 4$ it will readily be found that for any particular value of a it is unnecessary to test for more than a few values of w.

In this way the field of possible cases is much limited and it will be found that 4 cases exist.

(viii). The four cases are

$$949 \times 1416 = 1343784$$
$$943 \times 1418 = 1337174$$
$$846 \times 1419 = 1200474$$
$$848 \times 1418 = 1202464.$$

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