

## CHAPTER V

### MAINTENANCE

#### Section 1. The General System.

"THE art of conquering is lost without the art of subsisting," said Frederick the Great in 1686. One hundred and seventy years later Marshal Marmont writes: "Men brought together in large numbers have wants; the talent to satisfy these with order, economy and intelligence forms the science of administration." Yet another seventy years roll by, and the greatest war in history has been fought; the situation remains unchanged. The Commander-in-Chief of the Aldershot Command in 1926 states: "The provision of food and ammunition is a vital factor in war." Throughout history it has always been the same; the greatest strategical movements of armies have depended always upon their means of maintenance in food and warlike supplies of all kinds. In the past it was the problem of food supply which mainly exercised the great commanders; now food is only one of the many problems. Ammunition, petrol, engineer stores, repairs, road stone, railway rolling stock, shipping, and many other items have assumed an importance in connection with the maintenance of a modern army out of all proportion to anything hitherto imagined.

It is an undoubted fact that in the concluding stages of the Great War in France and Flanders, none of the armies engaged was better equipped and supplied than the British, not only with the necessities for offence and defence, but also with those things necessary for ensuring a high standard of health and general well-being among the troops. How was this brought about? What are the guiding principles of the system upon which our armies are maintained in war? A knowledge

of these principles and a study of the system are essential; for, in proportion as the problems are not studied in peace, will our troops and our efficiency suffer in the next war. The admirable results of 1918 were not produced in a day.

The importance of the moral factor in war is well known, but the very large part that good administration plays in fostering morale is not always fully recognized. Good administrative staff work ensuring the timely arrival of the soldiers' needs whether in the form of ammunition, equipment, supplies or any other commodity, produces in the mind of the fighting man the feeling that he belongs to a "good show," that he is being looked after by someone who will not let him down; in fact, that all is well with the army, and that he can get on with his business of killing the enemy; he need not worry about his next meal, it will be there all right when he is ready for it. This feeling sets his tail curving upwards right from the start and goes a long way towards ensuring success.

Again, when the hard fighting business slacks off for the time being, and the soldier finds that someone has provided him with a bath, some clean clothes, reasonably good accommodation, cigarettes, newspapers, and letters from home, he will not thank the administrative staff, but, what is far more important, he will be rested and refreshed and generally invigorated, and yet another upward curl will be given to his tail. Good administration, then, plays a big part on the side of morale in war.

The organization of our lines of communication, and the general system of movement along them, have been discussed in an earlier chapter. We will now examine the maintenance functions that the lines of communication perform for an army in the field. These functions are fourfold. In the first place, the lines of communication carry forward the whole of the army's needs in men, animals and material supplies of every conceivable kind. Secondly, it relieves the fighting formations of everything likely to impede their mobility, such as sick

and wounded men and animals, and captured or damaged material. Thirdly, it must maintain the reserves of men and material necessary to ensure the freedom of action of the field army. Finally, it provides the repair installations without which a modern army soon becomes an unwieldy and immovable mass of men.

For purposes of example, if we assume an expeditionary force of ten divisions—ten is taken merely as a convenient figure upon which to base calculations—with its proper complement of corps, army, and L. of C. troops, the daily maintenance requirements of this force will amount to approximately 4,500 tons of stores of all kinds. The provision and transportation of this vast mass of material clearly presents no small problem to those entrusted with the responsibility for the maintenance of our fighting forces. Upon what system are these problems solved?

As the result of experience in past campaigns a normal system has been arrived at for meeting the daily needs of the fighting forces in the various natures of their requirements such, for example, as food supplies, ammunition, stores, and repairs.

In the case of food supplies, the principle that has been adopted is that field units shall always have with them, or within reach, two days' rations and forage and an iron ration, and that the supply service should keep these stocks replenished by a daily delivery, within reach of the troops, of one day's supplies.

In the case of ammunition the normal system is based on the principle of the automatic replenishment of echelons which are thereby maintained at a fixed establishment.

In the case of repairs, the system is organized into front-line repairs carried out in the unit with hand tools, second-line repairs carried out in mobile workshops with light power tools, and lines of communication repairs carried out in fixed establishments on the lines of communication or at the base.

This system, though it is called normal, is essentially

clastic. War is abnormal, its conditions are continually changing; the different countries, in which British troops may, from time to time, be engaged, present an infinite variety of conditions both climatic and otherwise. Enemy action by sea, air, or land may temporarily interfere with the smooth working of one or more links in our chain of supply. Our maintenance system must be capable of adaptation to these changing conditions.

The cotton soil quagmires of a Palestine campaign, the mud of a devastated area in France or Flanders, the river communications of Mesopotamia or Egypt, the thick bush, the waterless desert, or the frozen snows of Russia, all call for improvisation and departure from the strictly normal. Changes of system to meet changing conditions have frequently to be made at very short notice. They can only be made successfully where those responsible have a thorough knowledge of the normal system and of the capabilities and limitations of the services concerned. We must know what we have got to improvise and what resources we have at our disposal from which to make the improvisation.

Diagram No. 9 at the end of this section illustrates graphically the system of maintenance. The manner in which the various natures of stores are handled between the base ports and the different railheads has already been explained in the chapter dealing with movement. Some comment may be called for on the functions performed by an advanced base, an intermediate or field supply depot, and reserve ammunition dump, shown in this diagram.

If our line of communication is a long one, and gives rise for this reason to difficulties in maintaining the regularity of supply, or if somewhere on this line there should be some vital point, such as an important railway bridge or tunnel, which might conceivably be blocked by enemy action, bombing or sabotage, then it may be advisable to establish an advanced base in front of the vital point, with its own set of depots containing a sufficient reserve to meet the emergency and from

which the daily maintenance requirements of the formations in the forward area can be provided.

Similarly, when circumstances make it advisable to maintain reserves in the forward areas either to meet unforeseen fluctuations in demands of fighting formations, or on account of possible interruption of the lines of communication, field supply depots are established. Such depots should be on the railway when possible; they are stocked from the lines of communication and from local resources and they would receive any captured supplies collected in the course of operations. Intermediate supply depots also act as reserves, and form a source of supply for the maintenance of any troops that may be accommodated in the area for the time being.

Somewhat similar conditions would call for the establishment of reserves of ammunition, either in the general railhead area or possibly farther forward in corps areas, should the tactical conditions of the operations make this advisable. Any reserve dumps of this nature would be in excess of the normal field echelons, and the principle of keeping reserves as fluid as possible necessitates their control being in the hands of the higher formation commanders as long as possible. In accordance with this principle, ammunition reserves might be established in control of army headquarters in the railhead areas, such reserves being railway fed. Corps reserves might be maintained farther forward, fed by road transport. Any dumps in excess of field echelons in advance of corps reserves should be very strictly limited and of a purely temporary nature.

To revert now to the system of movement of stores in advance of railhead. When the trains arrive at their respective railheads, the supplies are taken over by the Railhead Supply Officer (R.Sup.O.), and the ammunition by the Railhead Ordnance Officer (R.O.O.). These officers issue the stores to the Maintenance Companies R.A.S.C. serving the various formations working from those railheads, supplies being loaded in supply section

lorries at S.R.H. and ammunition into ammunition section lorries at A.R.H.

The maintenance companies, when loaded, proceed to refilling points (A.R.P. or S.R.P.) under orders from corps headquarters.

The refilling points are selected normally by the divisions in accordance with tactical requirements from day to day. In consequence it may happen that when the maintenance companies leave the railheads, the position of refilling points may not be known at corps headquarters. In this case the maintenance companies are sent to rendezvous which are notified to the divisions, where they are met and guided forward to refilling points. On occasions, as when two or more divisions are being maintained on one road, it may be advisable for the refilling points to be selected by corps headquarters; this may also be necessary for purposes of controlling the distance to be covered by maintenance company lorries, and ensuring an even balance of work throughout the various transport echelons.

Having arrived at the refilling points, the maintenance companies unload, and return again to the vicinity of railheads ready for reloading.

At the respective refilling points supplies are taken over by supply companies and ammunition by the ammunition companies R.A.S.C. of formations (second line transport). Their duty is to carry forward to delivery points, that is to unit first line transport. When operations are mobile, delivery points will be constantly changing; in these circumstances it may be necessary to interpolate meeting points, just as rendezvous may have been required for the maintenance companies. Meeting points are fixed by divisional headquarters or by brigade headquarters in accordance with the circumstances, and from these points guides from units lead the vehicles to their own first line transport, where supplies or ammunition are handed over, and the second line transport vehicles then rejoin their own companies.

That constitutes the normal system for the conveyance of the daily needs of the troops in advance of railheads. The tactical nature of the operations in progress, or the necessity for concealment from air observation, may, however, call for modifications in the detailed procedure. Again, the distances that have to be covered will vary considerably from time to time, at one time admitting of cutting out an echelon of the normal supply, at another demanding the interpolation of additional echelons. Or, again, the state of the roads, or a complete lack of them, may call for the use of pack or carrier transport for one or more stages of the journey.

With the increasing measure of mechanization now gradually being applied to our army, it is clear that the problem of petrol supply in the field is assuming considerable dimensions. On an average during mobile operations a division, as now organized, will consume about 14 tons weight of petrol daily. While a force of, say, ten divisions or more with its normal allotment of tanks, mechanically drawn artillery, etc., and a corresponding proportion of R.A.F. co-operating with it, will require a provision of petrol on a basis of approximately 100 tons weight daily per division included in the force for all services. At the beginning of a campaign practically the entire supply will have to be in tins; in these circumstances petrol is best dealt with as a normal article of supply through S.R.H. At a later stage, when railway tank wagons and bulk installations in the theatre of war become available, it may be found better to treat petrol more like ammunition: to give it a separate railhead and to allot definite units for its distribution in advance of railhead. Throughout any campaign, however, there will always be about 20 per cent. of our petrol supply required in tins for distribution to individual cars, etc., of headquarters units; this will probably always be handled most conveniently as a normal article of supply.

Another aspect of maintenance which has assumed

great importance in the equipment of modern armies is the question of repairs and maintenance of spare parts. Every unit now has its own artificers, equipped with hand tools, which admit of minor repairs being carried out in the unit; these are first line repairs. Second line repairs are carried out in Ordnance mobile workshops, or in the case of vehicles on the establishment of R.A.S.C. units they are done by the mobile workshop organization included in the various M.T. companies. Complete overhauls and heavy repairs, called L. of C. repairs, are carried out in the Ordnance Base workshops, and S. and T. Base workshops in the case of R.A.S.C. vehicles.

An important aspect of the maintenance of M.T. vehicles is the supply of spare parts. For the very large numbers and types of mechanical vehicles now included in our expeditionary force, the requirements in this connection entail the provision of well laid out and well organized base store depots, both for the Ordnance Directorate for all vehicles except R.A.S.C., and by the S. and T. Directorate for vehicles on the establishment of R.A.S.C. units. The requirements for these base installations are, firstly, ample accommodation; and, secondly, expert personnel for their management; while, for success in working, intelligible demands from the units to be supplied are essential. This last point may appear obvious, but it is by no means easy of attainment in practice.

To facilitate the problems inherent in the maintenance of M.T. vehicles, two things are required—standardization and training. Standardization reduces the number of types and natures of spares to be maintained; training reduces the casualties and wear and tear due to bad driving. But with the expansion which our Army must undergo for any war of importance these two desiderata are difficult of attainment.

With our existing War establishment a division contains some 500 motor vehicles of sorts, if the motor bicycles are included, while a conservative estimate



for a corps of three divisions, with its normal proportion of corps troops, might amount to some 2,700 to 3,000 M.T. vehicles of all types. These figures tend to increase with every advance in mechanization. It is obvious, therefore, that provision of spare parts and the organization for repair has got to be undertaken on no small scale for a modern army in the field. While the supply of the enormous numbers of skilled mechanics required is an ever-growing difficulty for the Adjutant-General's Department.

#### **Section 2. The Problem of Munition Supply.**

The work of the Ministry of Munitions during the Great War has been fully described in the official history and in a number of other works which have appeared since 1918. The object of this section is to consider how the problem of munitions supply in war affects the soldier and what the soldier's part is in connection with its organization.

When considering munitions one thinks primarily of shells and guns, but the term has a much wider meaning than that; it includes war matériel of every nature, ammunition, and provisions, and it is in its widest aspect that we must study the question.

A side of the problem, too, which is often overlooked is the restricted nature of the world's supply of certain essential raw materials for munitions manufacture. Examples of this are to be found in shellac, used in making varnish for coating the inside of shells, and jute for making sandbags, both materials which are produced only in India; then there is cryolite required for the extraction of aluminium which is obtainable only from Ivvygut in Greenland. These are examples of geographical restrictions, but cases also occur where the materials we need are also restricted in quantity; for example, shall we in the future be able to meet our enormous requirements in petrol and oil fuel? Problems with which we may be faced in war of the nature just indicated should be considered by soldiers in peace

time. In the design and specifications of our war equipment, we must remember their effect on the possibility of mass production in time of war.

For all warlike preparations we require a policy. What was our munition policy in 1914? Where did it come from? What is our policy to-day? And what is the part of the soldier in framing that policy?

The pre-war policy worked out by the general staff on instructions from the Government of the day, had been based upon the idea that, in certain eventualities, we should dispatch overseas an expeditionary force of six divisions in all, or in round numbers 150,000 men; that the Territorial Force should take over the defence of these islands; and that the Special Reserve should feed the expeditionary force. On this basis, the business of the War Office, in the event of war, was to keep the Army in the field up to strength and to perfect the arrangements for home defence.

Within the narrow limits imposed by this policy everything possible had been achieved. The prescribed supplies, exiguous, almost negligible, as they appear in relation to the vast torrent which subsequently poured across the Channel, were faithfully provided and duly forthcoming to the last detail of equipment.

Based on the policy laid down by the Government the War Office had done its part.

As events proved, our preconceived ideas on the requirements of modern war fell very far short of our actual needs. Not only were we wrong, but the French were equally so, and the Germans also, though possibly to a lesser degree in their case. The surprise of the war was the amount of ammunition that had to be expended. All the belligerent nations were surprised administratively. By the middle of September, 1914, the French were complaining that their 75's fired in days the stocks of ammunition that had been considered sufficient for months. Ludendorff says: "By mid-September the spectre of the shortage of munitions was already apparent." Our own difficulties in this

connection are well known. We cannot afford to neglect this question in peace, and, though we may base our ideas on the last war, we must remember that no two wars have ever been alike ; our provision must be capable of meeting our requirements in the next great war.

In the first case, the policy is framed by the Government, and it is the taxpayer through his Parliamentary representative who places a limit on that policy. It is the duty of the soldier to estimate the military requirements necessary to give effect to the policy of the Government and to advise on the military necessities of our national situation ; but once the policy of the Government is framed the soldiers can only make provision within the money voted by Parliament for the purpose.

The responsibility of the soldier is, however, a heavy one. The size of the army necessary for the purpose must be decided, the scale of its equipment must be laid down, the rate of consumption must be correctly estimated, we must decide on the type, pattern, and design of our essential weapons and stores, and specifications must be completed in every particular.

Prior to August, 1914, this had been done for the small Expeditionary Force then visualized. Yet Lord Kitchener in 1914 said : " There is no Army." What he meant was that not only was there no army on the continental scale, but that there was no provision for creating and maintaining such an army. Up till then it had not been our policy to provide one.

As regards our future policy. The end of the last war found us in possession of vast quantities of war matériel of all sorts. Much of this war matériel was, of course, part worn or actually worn out from use ; much of it, again, was obsolescent ; but after deducting the worn out and obsolete, there was probably enough left to equip an army of the 1918 scale with thoroughly efficient matériel, and something over for further maintenance purposes. At first sight, a very satisfactory state of affairs : we could reduce our army to

peace time dimensions while still retaining the munition equipment to expand again to seventy divisions.

But difficulties at once arose. There was no storage space sufficient to hold even a fraction of this vast accumulation; many types of stores rapidly deteriorate if held too long in stock; enormous numbers of men would be required as caretakers to look after this equipment and prevent deterioration. The very urgent cry for economy made the building of storage accommodation and the provision of caretakers out of the question. So there was nothing for it but to scrap vast quantities of our potential war reserves. Since 1919 further and considerable cuts have been made in army estimates. The soldier, faced with a financial limit to expenditure, has had to decide what was the most vital thing to retain—men or matériel—and still further reductions in our matériel reserves have had to be made in consequence. In all £681,000,000 worth of war stores have had to be sold since the war was over.

Our present policy—largely dictated by financial considerations—is one of experiment, research and standardization, to find the most suitable weapons. In so far as munitions of war are concerned, we are working up our designs and our specifications; we hope to be able to say, when the next war draws near, what our requirements will be both for immediate supply and for continued maintenance; but we are no longer in a state to send a vast army to take part in a continental war—the munition supply for such an army would again take months to organize and reach a state of mass production.

One great difficulty has, however, been largely overcome. In 1914, and indeed in 1915 and 1916, it was almost impossible, in the kaleidoscopic changes which were continually taking place, to lay down any satisfactory programme of supply, or to form any reliable estimate of what the armies' requirements might be in six months' time. Now we know, or we hope to know soon—what they would be, whether for a small war or

for a war of the first magnitude, and this is a most important step towards its provision.

If you consider the scale of equipment of our army in 1914, with its two machine guns per battalion, its complete lack of heavy artillery, without grenades, gas or tanks, with very limited supplies of signal equipment and with no H.E. shell for the lighter natures of artillery, and so on—then think what enormous demands in the way of munition supply each new invention called for, and you will see how impossible it was to make any plans for future requirements, which did not become almost useless as fast as they were made.

If we go to war again in the next few years, the soldier can say within reasonable limits of accuracy what his requirements will be for some considerable time ahead—and that is a very great step towards its provision. If you do not know what your requirements are likely to be, it is extremely difficult to make provision to meet them, and sudden extensions of demand can only be satisfied from reserves—that is, from the proceeds of earlier demands.

Reserves, of course, are held in time of peace, but, as already pointed out, financial restrictions necessitate these reserves being very small. The possibility of procuring bulk output at short notice can, in the nature of things, only be satisfied in very exceptional circumstances. The average interval which must elapse between the formation of demand and its satisfaction must be taken in the light of war experience as nearer six than three months. While to organize a new industry and to attain a scale of mass production therein must take at least a year.

To understand why it should be so long we should follow back the course of production from the finished article to its components, and from these to the raw material, with subsidiary programmes concerned with the provision of equipment (machine tools, jigs, etc.), and consider also the transportation and labour problems involved. It will then be seen what a difficult thing

the making of a programme of supply becomes, while unpunctuality in delivery at any stage may seriously upset the whole programme, as it often did during the Great War. Again, any changes in specification or design will upset the whole process of production, the preliminary stages of which are both lengthy and important. Before any new weapon, or any radical change in an existing type of weapon, can find itself in the hands of the man who is to use it in action, it must pass through the stages of design, specification, experiment or trial, settlement of scale of issue, manufacture and initial inspection, storage and issue. This is naturally a long process. If, however, the preliminary stages can be completed in peace, it will not take long to reach the state of mass production required for war.

The military machinery for the administration of munitions supply (using "supply" in its broadest sense) is grouped at the War Office under two heads, the Q.M.G. and the M.G.O.: the Q.M.G. being responsible for such items as food, fuel and commissariat stores, accommodation, and the inspection, maintenance and operating of mechanical transport vehicles for the R.A.S.C.; while the M.G.O. deals with armament, ammunition, equipment, clothing and necessaries, the production of mechanical vehicles, and is responsible for the ordnance factories requiring anything from a reel of cotton to a steam hammer.

The two main sources of supply are the ordnance factories, under the M.G.O., and the trade contractors with whom the contracts department of the War Office places the necessary orders.

The demand is formulated by the military department concerned, and either sent to the ordnance factories for completion or passed to the contract department to place in the trade; the whole being subject to financial control by the Treasury. There is a snag in this system from the point of view of the commercial firms, because the military departments are responsible for quality, for accepting deliveries, and for inspection;

the contracts department is only responsible for finding the contractors who are willing to provide what is required and for drawing up and negotiating terms and prices. The manufacturer, accustomed to deal with a single customer, finds himself dealing with an inspection authority and a contracts authority, neither of whom is competent to treat a bargain as a whole. The difficulties which arose from this cause during the war were many, and they were not finally overcome until May, 1917, when a "Surveyor-General of Supply" was appointed, who became a member of the Army Council and whose duties embraced, to quote the War Office memorandum, "all such functions as relate to the commercial side of the business of supplying the army." The Surveyor-General of Supply does not, however, exist in peace.

Our policy in time of peace, in order to provide for war, is to allocate sufficient of the requirements of the Navy, Army and Air Force to the ordnance factories to keep them reasonably in commission, the rest goes out to civil firms.

The war problem, when the contingency arises, involves the adaptation of a peace machine to a more or less unforeseen situation. It is primarily a problem of expansion, for it is quite certain the fighting forces in war will require many things that they have not got in peace, and they will want their requirements met at the greatest possible speed. To provide for their immediate war-time needs each service in time of peace holds its mobilization reserve, one purpose of which is to allow time for the industries of the country to adapt themselves to our war-time needs.

Owing to the heavy capital cost of the stores themselves and the running cost of maintenance and storage, this reserve has of necessity to be kept at the lowest possible limit, and the factor which largely determines this limit is the capacity of industry to produce. Thus, part of the essential reserve of the army is held, not in store, but in the productive capacity of the factories; in consequence, in peace time, we must keep open our

lines of communication with the trade, by giving a large proportion of our peace-time orders to civilian firms. Our national insurance for war is, therefore, represented by the ordnance factories at Woolwich, Waltham Abbey, Enfield, and Pimlico, and by the armament firms, such as Armstrong and Vickers, and a few other private firms. In addition, arrangements are made in peace time with certain civilian firms to transfer from peace to war production, on the declaration of an emergency, and for the maintenance of certain plant suitable for munitions production.

In a war which engaged little more than the regular army, it is probable that after the first pressure industry would adjust itself to the specialized and increased demand, although perhaps, on a higher scale of cost than would obtain in peace. In these circumstances peace organization and method can be readily adapted to the new situation.

But a first-class war requires the organization of the whole resources of the nation and the rapidity and effectiveness with which industry can be organized to meet the emergency cannot but have an enormous influence upon the issue of the struggle. The problems involved are many and varied, and they are dealt with primarily by the Committee of Imperial Defence, though they concern practically every department of state. The chief duty of the soldier in this connection is to prepare the details of his requirements, his specifications and designs, and his estimated rate of consumption in war in any given set of circumstances. To enable suitable preparations to be made, and in order that the organization may work smoothly, it is essential that reasonably accurate estimates should be made of the army's probable requirements for three months, six months, and a year ahead. This is the responsibility of the soldier.

From the foregoing remarks it will be seen that the soldier's task is not the only one in connection with the problems of munitions supply. Industry plays a most



important part in fitting out a modern army for war. A great war is a war of organization in which the raising of men is one very important item. It is equally important that they should be equipped, clothed, fed, and provided with guns, arms and ammunition, medical and other services. For the provision of these necessities, industry, and industry alone, has to be relied upon. In time of peace there is little difficulty in obtaining what the army requires, the resources of the whole world are at our disposal.

In time of war—a great war—the ordinary resources of the country are insufficient. Manufacturers must be assisted in every way, their difficulties of labour and supply of raw materials must be smoothed and the most careful organization is necessary to enable the manufacturers to produce to the utmost capacity of their trade. The problems involved are those of man-power and industrial mobilization; these are the statesman's problems; but the problems of strategy are so intimately connected with those of munitions supply that the soldier must study the two together if the strategy, which is his main problem, is to be effective.

### **Section 3. The Administrative Lessons of the Great War.**

The lessons of the Great War in regard to the problems of military movement, and certain lessons arising out of the difficulties of munitions supply have been discussed in previous chapters; the object of this section is to recapitulate the more important administrative lessons in their application to the broad problem of maintenance in its widest sense, and to consider what is the teaching of the Great War in this connection.

We started the Great War with a small expeditionary force of some 120,000 men and 40,000 animals; we ended with a strength, including labour and auxiliary services, of approximately 3,000,000 men and 500,000 animals. In the next great war a similar expansion will be necessary only with this difference, that the development of new methods of warfare and the advance

in the mechanization of all arms will call for fresh modifications in our system of administration and for expansion on lines hitherto untried in war.

Although next time there will be many differences in detail in the problems presented for solution, the general nature of the task will be similar to that with which we were faced between 1914 and 1918. It cannot, therefore, fail to be of value to study how the expansion of our administrative services took place, and to consider what the chief difficulties were and how they were overcome.

The static nature of the operations of the first two years of the war in France caused no undue strain on our administrative services, but with the Somme offensive of 1916 difficulties began to arise. The cumulative effects of the heavy demands made upon the transportation services in rear of the fighting troops were now beginning to tell. The railways required extensive repairs and replacements, for which both men and material were lacking; there was a serious shortage of rolling stock—congestion and delays were occurring in the various docks and base ports serving the armies; the increasing demands made by the armies in the field were throwing a strain upon the lines of communication which they had not been organized to stand. It was now becoming clear that the technical efficiency of every link in a transportation system, working the lines of communication of an army, had assumed an importance far greater than had hitherto been contemplated.

The lesson was being learnt that the problem of the maintenance of an army in the field was primarily one of movement—movement viewed as one whole and continuous process from its commencement, say, in England to the delivery of the goods to the soldier in the front line, and including also the return of the means of conveyance—ship, railway wagon, lorry or limber—to its starting point ready for a fresh load. The realization of this fact is essential for efficiency in any

system of transportation brought about the appointment, in November, 1916, of a Director General of Transportation, whose function it was to control transportation from the ports of landing to the troops, to provide rolling stock and material of all kinds, and to be responsible for railway and road construction.

Concurrently with this realization of the necessity for centralized control of all methods of transportation, there arose also the necessity for administrative control by G.H.Q. of the central reserves of all maintenance requirements of the army, whether food supplies, ammunition, or stores, the organization of which had formerly been the responsibility of the Inspector-General of Communications.

Thus we find one branch of this officer's duties passing to the Q.M.G. at G.H.Q., while his responsibilities in connection with railways and inland water transport had been taken over by the Director-General of Transportation. The appointment of Inspector-General of Communications was therefore abolished, the remaining duties formerly carried out by this officer being given to a newly appointed officer called the G.O.C. Line of Communications.

From the above we get the first big lesson of the war—namely, the necessity for the centralized control of all supply and transport services in the field at G.H.Q. In conformity with this principle, our road transport was entirely reorganized, as already explained in an earlier chapter of this book.

The next big lesson arises out of the munition question, wherein we saw that a modern army is dependent on industry for its maintenance in war, and that the soldier must assist industry by preparing clear specifications of his requirements, with an estimate of the amount of these requirements over various stated periods.

The more we consider these big administrative problems, we come nearer to the conclusion that modern wars of the continental type are no longer won by

decisive battles, but by sustained and adequate maintenance arrangements. The army requires its fighting troops, its supply, transport, medical and repair organizations, etc., but behind all this military paraphernalia it requires the entire resources of the Empire, and it requires that these shall be organized to meet the needs of the Empire in arms.

That is the big administrative lesson of the war. What, now, is the solution of the problem ?

Sir William Robertson, writing to the Prime Minister in November, 1915, said : " Victory is assured to us if only we make a reasonable and appropriate use of our superiority in men, money, munitions and ships. We cannot do this unless we have a carefully considered, complete and accepted plan." How should this plan be made ?

A maintenance system such as we now visualize cannot be improvised as a going concern on the outbreak of war. If we leave it till then we shall find ourselves left badly at the starting gate, even more so in future than we sometimes have been in the past. We must work out our maintenance project now in peace. How should we tackle the question ? Just like any other military problem : we must appreciate the situation and write the orders.

If we were called upon to write the necessary orders to set the administrative machine working, we should require first of all *intelligence*—information regarding the resources of our possible enemies and their sources of maintenance and supply ; information, too, regarding our own maintenance requirements, resources and sources of supply. Secondly, we would want a plan. What is our *intention* ? What are we going to do in support of our national Empire policy ? Then would come the *method* of putting the plan into effect, by which we shall organize our resources so as to make them available at the right time and place, so that we can concentrate the maximum force of men and materials at the decisive point.

To consider these three portions of our hypothetical order in greater detail :—

Economic intelligence is our first requirement. Knowledge of the resources of our possible enemies will give us an indication of the force behind any initial blow on their part, and also of their power of resistance to our offensive. We want to know their power of production of such strategic commodities as coal, iron, rubber, nitrogen, and so on, and the positions of their factories of all warlike stores, whether ammunition, gas or whatever their nature. We must study also their transportation facilities in connection with their munitions supply and the possibilities of war time development.

Much of this intelligence can perfectly easily be collected in time of peace. Roads, railways and shipping cannot be constructed in secret, and the financial side of big commercial undertakings must be made public to a large degree, which is an indication of the extent of development of commercial resources which are by their nature potential war resources.

Similarly, we must have sufficient intelligence regarding our own economic resources within the Empire ; we must examine our deficiencies in raw material of all kinds and make arrangements to supplement these resources from safe quarters.

We must not start another war, as we did the last, dependent on the enemy for many of our vital necessities. Prior to August, 1914, we got almost our entire supply of optical glass, magnetos, gauges required in gun and shell manufacture, and high speed steel from Germany ; we had not the means of manufacturing phosgene, mustard gas or liquid chlorine, and it was not till after the war that we discovered the secret German system of producing synthetic ammonia and nitric acid from atmospheric nitrogen which is the basis of the manufacture of our high explosives. Now we can make a hundred tons of ammonia a day, and can expand rapidly to three times that output.

All this mass of economic intelligence must be collected

and collated and kept up-to-date; it must be continually examined by the soldier, sailor, and airman to ensure that our war-time resources are adequately protected, and that we know how best to attack those of our possible future enemies. It is easy to be wise after the event; we were not wise before the event of 1914; shall we be wise before that of 19—?

War is no longer the affair of the Admiralty, War Office, and Air Ministry alone—practically every Government department has an essential part to play. On the Committee of Imperial Defence now falls the task, under Cabinet direction, of co-ordinating the efforts of the various departments of state for the collection of the necessary intelligence to be placed at the disposal of the fighting services.

So much for intelligence. We have dealt with the “information” paragraph of our War Order; we can now pass on to the “intention” paragraph.

The intention we want is that of our Government; what are we as a nation going to do in certain eventualities?

Our intention prior to August, 1914, was to send six divisions to a continental war; what do we mean to do next time? Apart from wars outside Europe which we may be engaged in in furtherance of our world-wide interests, we now have the Locarno Pact which gives us definite responsibilities as regards continental troubles. Based on this pact the part to be played by Great Britain in certain eventualities will presumably be determined by our Government. The Government policy is the intention paragraph of our War Order. It is scarcely conceivable that we shall be engaged in a great European conflict without the active support of the Dominions, though, of course, they have complete freedom of action in this respect, but our administrative arrangements will naturally include drawing on the resources of the whole Empire in furtherance of our military policy, and the attitude of the Dominions is a very important factor in framing that policy.

The part of the soldier in the preparation of this intention paragraph will be limited to the making of an appreciation of the situation which will be the military advice upon which the Cabinet will base their plan.

Now for the method of putting the plan into effect. In so far as our peace-time preparations for war are concerned this involves three big undertakings :—

- (a) Our military (including Naval and Air Force) mobilization plans ;
- (b) Our national mobilization ;
- (c) Our industrial mobilization scheme.

As regards the first of these, our military mobilization plans are, of course, worked out in time of peace. Our arrangements in 1914 worked very well, but next time it is going to be a bigger and more difficult undertaking. Unit and formation mobilization schemes call for constant examination, revision, and trial. In spite of a general success in 1914 there were many little hitches and difficulties which might have been avoided ; in our present scheme there are many items that have not yet been practically tested. Successful as we were in 1914, there were many degrees of success as between units, formations, and areas. Mobilization is a subject of great interest which concerns every officer and the perfecting of our arrangements in peace time will, when war comes, amply repay any amount of trouble taken beforehand.

The German Air Force in 1914 could not interfere with our mobilization arrangements. But to-day the situation is different. Our mobilization store depots, our embarkation ports, our troop concentration areas, our railway systems, are well within reach of the air forces of our continental neighbours. We must remember this in working out our mobilization scheme, and take adequate steps to deal with this possible form of interference with our plans.

As regards the interference that may be expected from air attack we have only war experience and conjecture to guide us. Sixty attacks were made by the Germans

during the war on Woolwich Arsenal. Only one was successful. On October 13th, 1915, six bombs fell in the Arsenal; one man was killed, four injured, and two machines wrecked. But although the material results were so meagre, the actual loss of working time from air raids or warnings of air raids, and the precautions which had to be taken in consequence was a very serious matter. What the effect may be in the next war we can only surmise.

We will pass on now to the next sub-paragraph of our method—national mobilization. Just as we soldiers have mobilization schemes, and likewise the Navy and Air Force, so also the various Government departments such as the Board of Trade, the Home Office, the Ministry of Labour, etc., all are preparing their schemes, and next time we may expect to see our Ministry of Shipping and Ministry of Munitions coming into existence on the outbreak of war with as much ease as our new divisions and so on are formed on expansion from our peace-time military organization.

In 1914 we had practically no scheme for national mobilization on these lines, but the big administrative lesson of the war has been taken to heart by our statesmen, and though our plans may not yet be perfect, we are now certainly in a far better position in this respect than we have ever been in the past. Owing to peace-time financial stringency there is little doubt we shall go to war next time deficient of much that we require, but we may rest assured that the situation will be infinitely better than it was in 1914.

The last sub-paragraph of our "Method" paragraph is industrial mobilization. This, perhaps, is the biggest problem of the lot, but the lesson of the Great War clearly points to the necessity for something of the sort. To make really effective arrangements to this end requires legislation, which is outside the province of the soldier; but it is the soldier's duty as a citizen to educate his civilian brothers in this vital question of empire defence.



The French Government has passed a law for the organization of the nation in time of war. This measure forms part of the whole scheme of national defence, and provides for the organization of services and essential supplies during war time. It contemplates in advance the setting up on a definite plan of all the varied machinery for supplies, for transport, for mobilizing or requisitioning of persons, businesses, and works which are required in war. We need something of a similar nature for our own country.

One does not visualize this country entering on a war of any magnitude without the wholehearted support of the great mass of the people; but next time we go to war we must not let our national enthusiasm run riot. Our potential officers, our skilled mechanics, our expert chemists, our miners and metal workers and skilled artisans must by some means or other have their particular knowledge or mechanical skill directed into the best channel in which to help the nation in arms. Our available man power and woman power must be mobilized from the outset.

Next we must mobilize our manufacturing plant and organize its adaptation and expansion to meet war requirements. Similarly, we must mobilize the Empire sources of raw material to ensure that all that is needed is directed to the Empire's machine shops for conversion into our essential war equipment. The big national scheme for the provision of power is a very useful step in our industrial mobilization for the next war.

Our chemical industry will need very considerable expansion to deal with the possible requirements of gas warfare.

Our staying power as a nation in arms depends very largely on how far military demands and civil supply can be harmonized. It is clear, of course, that much of this work is outside the province of the soldier; but the soldier cannot afford to neglect this aspect of war preparation entirely.

In making our own detailed military plans for

mobilization and the necessary war expansion of our armed forces, we must have continually in view the big main problem of the nation in arms ; we must not work in water-tight compartments, but build up our army with due regard to the requirements of the other departments of state.

To complete the analogy of the war order, of which the first three paragraphs have now been considered, two more headings require to be dealt with—namely, administrative arrangements and inter-communication.

Administrative instructions will be very detailed and will deal with each of the sixteen main services which are required for the maintenance of a force in the field.

The contents of these instructions will be largely technical, and the detailed requirements are being closely examined at the present time, but there is still much co-ordination work to be done. In the technical aspects of peace-time preparation the services are very severely handicapped by the financial problem. The increasing unwillingness of the nation as a whole, as their memories of the Great War recede farther into the background, to pay the necessary insurance premium towards minimizing the effects of the next war on posterity, cramps the style of the military technical expert. Research and experiment are, however, being carried on, though we could usefully do much more in this direction were funds available. With the war lesson of military dependence on civil organization staring us in the face, we must direct our energies towards stimulating the development of civil firms to produce in peace for commercial use what is readily convertible to our war-time needs. We have at the present time various committees examining into these problems, such as—

- The Royal Artillery Committee ;
- The Royal Engineer Board ;
- The Chemical Warfare Committee ;
- The Wireless Telegraphy Board ;
- The Ordnance Committee ;

The Mechanical Warfare Board .  
The Clothing and Equipment Committee ;  
The Army Hygiene Advisory Committee ;

and several others.

And a number of experimental establishments and research departments, all within the limits of the funds at their disposal are busy filling in the gaps of the administrative instructions in our War Order. The co-ordination of the work of these many committees and establishments, the interchange of ideas between the Navy, Army and Air Force, the liaison between the fighting services and civil firms in all matters concerning the equipment of our future military forces, are questions of the highest importance, not only for the Committee of Imperial Defence, but for all who aspire to high command in war. We must ensure that the work of research and experiment for the fighting services is so co-ordinated in peace as to obtain the best value for money and the highest output in time of national emergency.

Now for the last paragraph of the War Order—*Inter-communication*. On the successful working of our arrangements in this connection everything else depends. It is not proposed to deal with it here, the problem is an operational rather than an administrative one ; the Navy, Army, and Air Force are all concerned. We must keep open our communication with our sources of supply of raw materials—oil, nitre, wool, cotton, food supplies, etc., are all vital to the maintenance of our fighting forces, and we cannot get them without safe communications. This is so obvious that the subject need not be enlarged on, except to point out that in safeguarding our tactical communications with the various portions of our far-scattered armies, we must be careful not to neglect our strategical communications which are often purely administrative in their nature ; some of our essential war materials are only found in very few places in the world.

One more point—when we take part again in another

European war, we shall probably have allies on our side. The value of unity of command was proved in the last war, so was also the value of unity in control of administrative matters. We never reached a very satisfactory state in this connection; though the principle of pooling of allied resources was accepted by all, it tended in practice to sharing the resources of the British Empire without very much in the way of payment. Until, however, some arrangements had been made to this end, the competition of the allied Governments in purchasing in the neutral markets resulted in serious waste and soaring prices.

The United States of America grew rich as long as Europe had any money to spend, and then she entered the war, and prices fell.

We do not yet know who our allies will be in the next war, so we cannot very well make pooling arrangements in peace. Some arrangement of the kind will, however, need to be set on foot at the very beginning of the next war in the interest of economy and efficiency.

A few of the chief administrative lessons of the Great War have now been considered; some others will be dealt with under the heading of War Exhaustion in a later chapter. Some of these lessons are for the statesman rather than for the soldier, but sufficient has been said to show how closely related are the tasks of each. It is a duty incumbent on the soldier to advise the statesman, and to educate the people, in the broad principles of military administration and in their application to the nation's war-time needs.