

CHAPTER V

THE LINES OF COMMUNICATION

THE subject of duplicating the lines of communication to cope with the rapidly increasing strength of our forces was broached in December 1914, and the idea soon after took shape for reinforcements, a portion of whom were sent out via Boulogne in place of Havre. In February 1915 a Territorial division was concentrated on arrival at Etaples some miles to the south of Boulogne, an Ordnance staff being sent there to arrange for its encampment; and it was then decided to form large reinforcement camps and hospitals at Etaples with a permanent Ordnance depot to cater for this floating population.

Meanwhile sites were being explored for a base depot on the northern line to correspond with Havre on the southern, Calais being eventually selected; and Colonel Scott was sent out as D.D.O.S. Southern L. of C. to relieve Heron who became D.D.O.S. Northern L. of C. and was detailed to organize the new base. And excellent arrangements Heron made, acquiring, among other premises, a large timber-yard belonging to the firm of Valdelièvre with all its contents. The timber was most useful and owing to rising prices the bargain resulted in a profit of some £10,000. It was possible to inaugurate the new depot with deliberation. Demands, based on the average monthly consumption of one division and one cavalry division, were sent home in March, and a staff was formed partly from those with experience of the work at Havre. Thus when, in June 1915, Calais started to function, everything was already well organized and a good stock collected. At first Calais was not regarded as too secure, but fears on this account were soon dissipated and the work of supplying the troops at the front was distributed as evenly as possible between the two base depots, which provided as well for all other establishments in their respective zones.

There was however one class of goods of which Calais

was originally deficient. The stock of heavy artillery was so meagre that it was impossible to divide it, and no guns or artillery components were at first held. As the position improved this was gradually rectified, but now another difficulty came to light. The distribution of artillery, which depended on the tactical situation, was very variable. At one time there would be an enormous concentration in one part of the front, then would follow movements elsewhere, and these moves were usually sudden and secret. This applied even to divisional artillery, though far more to heavier natures; and resulted in constant transfers of indents and other documents backwards and forwards between Havre and Calais, the difficulty being accentuated by the fact that the stock of spare parts was never superabundant. Calais was the more centrally situated of the two, nearer to the front and to our own shore, and it was therefore decided to concentrate the whole of the artillery stores there, the transfer of the Havre stock taking place in June 1917. Armies by then had gun parks to which issues were made in bulk, and thus the process of sending small parcels of gun-fittings from Calais to a formation based on Havre by a complicated cross-country railway journey was avoided.

With the continuous increase in the volume of work, other depots were formed to relieve congestion at Havre and Calais. Blargies Sud on the southern line and Les Attaques just outside Calais on the northern, held the stock of sandbags, barbed wire, picks, shovels, etc., that were issued in bulk to Advanced R.E. Parks. Further relief was afforded by the acquisition of premises at Paris for the storage of winter clothing and blankets; and when, in the summer of 1916, an ammunition depot at Rouen was evacuated, the clothing group at Havre was transferred to the empty site.

The depot at Abbeville expanded considerably. Calais was so near the front that in case of urgency small consignments of stores could be sent up by lorry; but Havre was much further distant, and Abbeville was a

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convenient centre for keeping a small reserve of guns and machine guns for the Southern front, which proved very useful during the battle of the Somme and on other occasions. Abbeville also afforded relief to Havre by repairing wagons on its behalf, mainly for the advanced horse transport depot located there, and by making tables and forms by the tens of thousands.

While at St. Omer, G.H.Q. became surrounded by a very large colony including a training school for officers, to cater for whom an officers' shop and small depot were provided. When G.H.Q. moved to Montreuil it shed these incumbrances, and the depot came within the area of the Northern L. of C. It was there that the D.D.O.S. L. of C. North had his office, while that of D.D.O.S. South was at Abbeville.

There were, besides, a number of depots at places on the coast where various institutions existed—at Boulogne and Dieppe (to be accurate at the ammunition depot of Rouxmesnil, a few miles inland) which were ammunition ports, at Le Treport and eventually at Trouville. Marseilles remained in existence to serve troops going to and from the east, and when Portuguese troops arrived, for whose equipment we assumed entire responsibility, a small depot was installed at Brest where they landed. There was also a depot at Cherbourg, the port for what was known as the Mediterranean line of communications, which stretched by rail through France to the foot of Italy and was used for forwarding supplies to the East. This line will be more appropriately described elsewhere, but it deserves this brief mention because France was largely concerned in its organization and often had to despatch stores along this route from its base depots.

The last Ordnance establishments, apart from ammunition, that remain to be mentioned were those at supply railheads. How it first came about that the base depot had its representatives stationed there has already been mentioned, and in the summer of 1916 Ordnance officers were appointed at the rate of one per Corps to its main railhead with subordinates at its subsidiary railheads. They checked and handed over to the Ordnance officer

of the formation what arrived ; but their chief duty was to deal with goods returned from the front. If serviceable these might be kept for re-issue ; otherwise they were returned to the base after fragile goods had been carefully packed and rubbish destroyed. A further refinement on the Southern line, where the regulating stations for traffic at Abbeville and Romescamp were well in advance of the base, was the stationing at these points of a representative to intercept and reconsign goods for units which had miscarried owing to a change of address ; and to repack in bulk small lots of returned goods to set free partly loaded railway trucks.

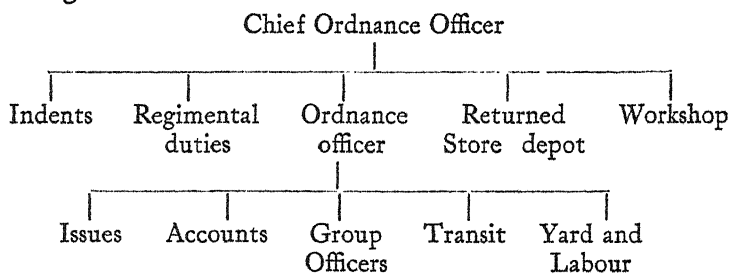
Within his respective area, which stretched from the coast up to railheads, the D.D.O.S. L. of C. supervised all Ordnance establishments, whether connected with stores or ammunition. His duties were mainly those of co-ordination and inspection, the allocation of buildings and personnel, and the consideration of plans for new installations. Apart from matters of general policy, the two main depots got their instructions from the D.O.S. These were the chief centres of Ordnance activity, where all the executive work of providing for the fighting troops was carried on and the vast majority of the Corps laboured ; and, as everything hinged on their functioning correctly, their interior economy needs a detailed description.

Starting at the foundation, at both Havre and Calais there were Provision offices under an A.D.O.S., which were in a sense detached portion of that of the D.O.S. They got their orders direct from him, being told what stocks or reserves were to be held, and they kept him in touch with the supply situation. Day in and day out the Provision officer was engaged in reviewing the depot stock, so as to cover the whole ground weekly and ensure prompt replenishment from England. One source of difficulty was the frequent shifting of divisions and units from one part of the battle front to another ; increasing the liabilities of one of the two base depots at the expense of the other. For instance, on one occasion the A.D.O.S. Provision, when examining the weekly review

sheet of clothing, was perturbed to find a serious shortage of boots, jackets and trousers of small size. The explanation proved to be that the battalion of Bantams, composed of sturdy undersized men, had been transferred from one army to another.

The purchase of stores in France, usually bought through our Paris agency, was also in the hands of this branch. However these purchases dwindled as time went on, for France needed all its own resources. The peak was reached in June 1915 with a figure of £140,000.

Apart from this, all work at the Base was in charge of the Chief Ordnance Officer, the sub-division of duties being as under :



Taking first the Indents branch. Despite the fact that whenever possible articles were demanded in bulk, the number of indents was prodigious, from one to two thousand reaching each base daily. Yet skilful organization enabled all to be dealt with on the day they were received. The first step when a batch arrived would be to pick out guns or other specially important and urgent items and pass out at once an order for the depot to make issue. Then came the detailed examination. This branch kept the order of battle showing the situation of every unit at the front and circulated information as to every change to all concerned.¹ The incoming indent would be scrutinized in case any change of address had

¹ Movements were notified by telegram from the formation Ordnance officer in the following stereotyped form : Move (code word of unit) to (code word of new formation).

occurred since it was prepared and to see that what was demanded was authorized. Then finally the document, often a telegraph form or maybe a slip of paper with a rough list of articles and quantities, was dissected and the portion appertaining to each group of storehouses transcribed on a separate issue order form.

The stock was divided into groups of so many store sections, each group a self-contained depot in charge of an officer. The group officer sent his review sheets direct to the Provision office, received his indents direct from the Indents office, and was responsible for his stock—in fact for the whole interior economy of his group. The ideal arrangement was to have a receipt bay at one end of the group and an issue bay at the other, so as to have a constant flow always in the same direction. The issue bay was divided by partitions, a separate pen for each formation, and one for local units. No sooner was a batch of issue orders received than “layers out” would set to work to get from the stock the items demanded; and next “packers,” who also labelled and addressed the packages. Every half hour the batch of orders thus dealt with would be passed to the group office for the preparation of vouchers. Finally the issue order was scrutinized and the A.D.O.S. Provision informed of any item that could not be met.

Under this system the Ordnance officer charged with the general supervision of the depot was relieved of this daily routine, his share of the work being mainly in connection with services common to all groups, such as personnel, organization, accountancy and accommodation.

Loading and despatch were dealt with by the Issue branch of his office, which received a daily return from each group showing what truckage it required. After consolidating these returns, the officer in charge of Issues arranged with the R.T.O. for trucks (a very variable quantity that might be as high as 200, though averaging about 60) to be placed at the most convenient centres for loading. “Checkers” were stationed in the trucks allotted to each formation with a list of its units, the

names being inscribed on removable slips in a wooden frame; thus, if any change in the order of battle occurred, even while the truck was being loaded, the slip could be removed and the stores transferred to the appropriate truck. The group then brought its goods and distributed them among the formation trucks, where they were tallied in by the checker to see that the packages agreed with what was shown on the vouchers and that they were being sent to the proper railhead. The preparation of the way-bill proceeded concurrently; and loading was no sooner finished than this, with copies of the vouchers, was placed in the truck, which was then sealed.

The system of store accounting differed from that which prevails in peace. At first the usual plan was adopted—a central ledger office with tallies kept by each storeholder. Transactions however were on such a vast scale and conducted at such a pace that the posting of ledgers ran in arrears; and they were useless either as a check on the tally or a record of the stock.

The tallies were therefore converted into ledgers held in the group office, where they could be more promptly posted, and the central ledger office was abolished; a plan found to answer excellently—every transaction being entered up on the day it occurred.

To guard against errors, now that there were no tallies on which entries would be duplicated and no double entry bookkeeping as in peace (when every transaction is booked up in the recipient's equipment ledger as well), the accounts branch carried out an internal audit. Its clerks checked every entry during the silent hours, to set free the ledgers for posting during the day; and a night audit staff, in addition, examined 10 per cent of the transactions, seeing that the supporting documents—vouchers, way-bills, etc.—were in order and paying special attention to matters such as issues on payment. What with our Dominions, Allies and prisoners of war there were many of these to be recorded in special ledgers, it being necessary in some cases to distinguish between initial issues and maintenance covered by a capitation grant.

It can be said with assurance that accounting was throughout extraordinarily accurate, having in mind active service conditions on this gigantic scale, and any important loss was always capable of satisfactory explanation. With the concurrence of the Financial Adviser large powers to write-off losses were delegated, and it was most exceptional to find any difference of opinion between Ordnance and financial officers. The latter at all times took a broad view and were most helpful.

While on the subject of store accounts, two other details deserve mention. Their complete abolition on service, except at Ordnance depots, was not really justified. To relieve troops fighting at the front of this burden was right enough, but the measure was a mistake for institutions on the lines of communication, such as reinforcement camps and hospitals. Not only did it encourage waste, but the Quartermaster could not do his work properly, however excellent his intentions, without a knowledge of what he was responsible for. Accounts in a simple form were therefore re-introduced for permanently situated units. Another safeguard was that adopted to prevent men from improperly disposing of their necessities. There was a ready sale for articles such as socks and clasp-knives at a port like Havre, and the soldier's kit was often not complete when he left England, so that it was easy for him to explain away a deficiency. To guard against this irregular traffic a sheet was inserted in the soldier's service and pay book detailing what he brought to France.

The Transit branch re-consigned goods that never entered any group, those for some other depot, for our allies or another front such as Italy; and salvaged materials or captured guns on their way to England. It also dealt with shipping, a subject to which a few words must be devoted, since it is one that cannot fail to concern the Ordnance officer very intimately, even if indirectly.

The difficulties caused by the manner in which the war reserves were shipped to France in August 1914, and the steps taken to overcome them, have been referred to in the first chapter; and after this matters worked

for awhile very soothly. From the time of their delivery at a depot in England until issued to the troops, the Corps never lost sight of its goods. They were loaded on rail under its supervision at home, shipped by an Ordnance officer at a port specially allotted for store-ships and taken over by the transit staff at the base depot overseas; and the process in the reverse direction was similar, the same store-ships being used. The responsibility for quantity and condition remained throughout with the Ordnance.

But, at the close of 1916, it was decided to place all shipping work in France under a Transportation Directorate, so that ports might be used to greater advantage and vessels turned round for a fresh voyage with the utmost speed. We alone were landing stores at the average rate of 1000 tons a day each at Havre and Calais; besides which there were engineer materials, foodstuffs and ammunition to be discharged. In January 1917 the loading and unloading of vessels was taken over by the Director of Docks, one branch of the new directorate, and the Corps was called on to give up a good portion of its accommodation in the docks to form transit spaces, the Director of Docks undertaking to hand over the stores, either in these spaces or at the storehouse, should it be outside the area of the docks. At Calais the construction of a new inland depot at Vendroux was taken in hand; though fortunately, before it was ready, consignments for that port began to arrive by a channel train ferry, so that trucks could be delivered direct to their destination. Meanwhile there was much congestion and delay at both bases in laying hands on goods that might be very urgently wanted.

The result of a system which co-ordinated all shipping in France under one head may have been necessary, but from a departmental point of view it was not a blessing. It pushed out depots from the quayside and thus involved additional handling, the transit spaces during periods of pressure became blocked, and stores urgently required were buried under those received later and perhaps of less importance. This was largely due to causes beyond

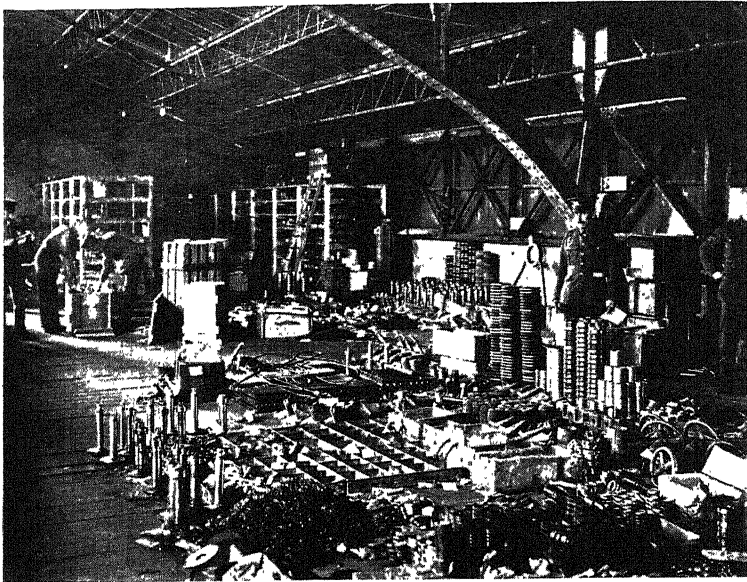
the control of the docks directorate, such as a shortage of trucks or labour. Another weak point was that the directorate acted only as stevedores, and not as shipping agents; it simply took over the goods from the shipping company (the navy) at the port of arrival and handed them over to the consignee. It took no responsibility for condition or quantity, the C.O.O. continuing to act as consignee and signing the ship's manifest. The importance of keeping a careful check was considered to be far less than that of effecting a rapid discharge; and the former had, therefore, to go by the board, the result being the frequent writing-off of considerable losses in transit.

The arrangement, which incidentally proved unworkable for ammunition, was a war-time improvisation. If it was essential to discard the method employed up to the end of 1916, the transportation directorate ought properly to have combined dock and stevedoring work with that of a shipping agency; and had its representatives on either side of the channel to take over goods at home and deliver them to the consignee overseas, accepting responsibility throughout. But from a purely departmental point of view the arrangement previously in force unquestionably worked better.

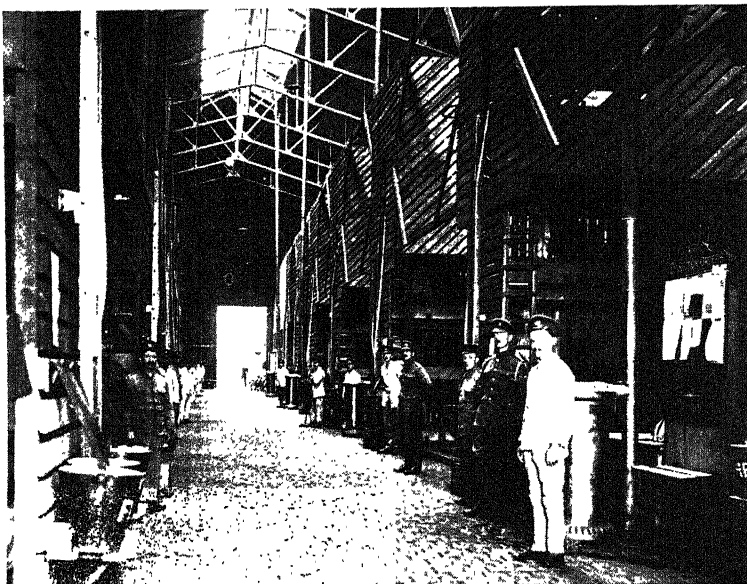
However, considering the many real difficulties that had to be contended with, the work was carried out with remarkably little friction owing to the helpful and business-like spirit in which the problem was taken up by the docks and railway directorates, and to the way in which the C.O.O.s of our main base depots adapted themselves to fresh and often trying conditions.

About the last branch of the Ordnance office, that under the Yard and Labour officer, there is little to be said. This branch was responsible for the general cleanliness and tidiness of the depot, distributed labour among the groups from the general pool, and furnished such road transport as they needed.¹

¹ A few random figures will help to illustrate the scope of work of a base depot. They relate to what was issued from Calais during the first



LAYING OUT GUN-COMPONENTS FOR ISSUE



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Turning next to the other establishments for which the C.O.O. was responsible.

Regimental work can be dismissed very briefly, being much the same in war as in peace; though a much appreciated feature not usually to be found in an Ordnance depot was the band to which the Corps marched to and from work and which helped to enliven hours of recreation by its concerts.

A detail worth recording is that Sir John Lavery, when painting a series of pictures illustrating the soldier's life in France, selected, as a model of what a cookhouse should be, that of the Corps at Boulogne, the picture being hung at the Royal Academy in 1919. At Havre a large hangar was fitted out with tiers of bunks for those working in the main depot. It accommodated 1000 men and its rent was £1000 a year—very cheap housing. Regimental work there was in charge of an attached officer, Lt. Col. Lindsay Scott, who died during the war, a most popular officer with all though a keen disciplinarian; and the Corps in his hands gained a well deserved tribute from the Base Com-

ten months of 1916, an intermediate period, and by no means one when figures were at their maximum.

- 11,000 Prismatic and magnetic compasses.
- 7,000 Watches.
- 40,000 Miles of electric cable.
- 40,000 Electric torches.
- 3,500,000 Yards of flanellette.
- 1,250,000 Yards of rot-proofed canvas.
- 26,000 Tents.
- 1,500,000 Waterproof sheets.
- 12,800 Bicycles.
- 20,000 Wheels.
- 5,000,000 Anti-gas helmets.
- 4,000,000 Pairs of horse and mule shoes.
- 447,000 Lewis gun magazines.
- 2,250,000 Bars of soap.

The officers' shop, which formed part of the depot, was as popular at the base as at the front, 12,900 visits to that at Havre being made by Officers during the above period to buy clothing and equipment. Eventually a cashier from the Paymaster's office was posted to each shop for the convenience of those dealing there.

mandant for their clean premises and smart turnout in the streets.

The Returned Store Depot must be dealt with at greater length. Judging by articles that appeared in the press from newspaper correspondents who visited Ordnance establishments in France, the point that impressed one and all was that nothing was wasted. The volume and variety of commodities dealt with, and the regularity with which they reached the troops, is barely commented on; but that an old saddle should be refurbished or an old suit of clothes cleaned and mended was apparently regarded as an astounding feat. Yet this was merely a normal duty of the Corps, expanded like every other branch of its work. Long before "salvage" became such a shibboleth, the saving of every scrap of material not absolutely worthless was being undertaken; and it was to deal with such matters that the depots at Gravelle (Havre) and Valdelièvre (Calais) was created; institutions the like of which had never been seen before.

These places served as clearing houses; what was serviceable was passed on to the group, what could easily be made fit for further use was mended, what needed skill to repair went to the workshop, what was to go home was handed over to the transit branch, what was no longer of use was broken up and the produce sold or sent home as old metal or other materials; and the residue, a very small fraction, was burnt. It was out of the question to keep strict account of all this old material and only valuable and important stores such as guns were accounted for.

Another point commented on by the Press in connection with these establishments was the extent to which female labour was employed; and it is an undeniable fact that in both these forms of economy, salvage and the saving of man-power, the Army Ordnance Corps set the example.¹ It was the first to employ French and Belgian

¹ The following are extracts from a couple of the newspaper articles in question.

The *Daily Mail* had an article headed 'Ordnance Women' dated the 30th September, 1915: "Progressively, day by day, women are being enrolled for war work of many sorts, and their capacity and readiness are

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women, not only in ordinary women's work, like sewing and washing, but on jobs such as cleaning wagons and rifles or even on unloading barges of barbed wire, long before women replaced men in England or the Women's Auxiliary Army Corps appeared in France. Girls who knew not a word of English actually undertook simple office work such as filing documents.

An important feature was the rag industry, at first confined to a small scale as the medical authorities objected to old clothes being sent back from the front lest they should harbour disease germs. An outbreak of enteric in a training ship on the Thames had been traced to the sale of old blankets at the Cape after the South African War, and the idea of sending lousy and bespattered garments back in wagons and railway trucks that might next be used to carry food was repellent.

There were laundries and disinfectors near the front where the garments of men attending at bath-houses

on the way to be appreciated ; but it is not, I think, yet known how very useful their aid is proving in France and how many are being employed within the circle of War Office departments. The Army Ordnance were, as it seems to me, the first organizers to discover the value of women within the zone of the Armies ; and the Ordnance are now steadily extending their sphere. The discovery of the scope for women by our Ordnance is indeed probably the most distinct advance in economy yet achieved. No one can visit the great Ordnance centres in France without being struck by the lead given in this direction."

Mr. Danchenko, the famous Russian war correspondent writes in *The Times* of 15th June, 1916, under the heading : "Salvaging battlefield wreckage, British Military Thrift : Never, I think, has the practical genius of the English revealed itself so strongly as in this war. We were taken to see their activity at the rear of the Army. Here some thousands of French women whose fathers, husbands, and brothers have gone to the war earn a handsome living of which they could not dream in peace time.

"It is most marvellous to see the things that are done here. Take, for instance, boots. Our boots when they are worn out are thrown away by the soldiers. We saw heaps of these cast-offs near the Russian trenches in Galicia and Poland, and indeed of what use could be that leather torn in pieces and as hard as wood ? Here, however, things are different. We saw sheds full of these old boots, piles of rubbish, and I could not understand what they were going to do with it all ; but here we saw, stage by stage, this rubbish turned again into splendid boots, soft and strong."

THE WESTERN FRONT

were exchanged and washed ; and great-coats or other articles only needed in winter were stored and renovated on the lines of communication during the summer months. But all the ordinary clothing of the fighting troops, upper or under, was for long burnt as soon as the soldier with his house-wife was unable to mend some small rent.

The process was very wasteful ; for, even if unfit for repair, the garments had a market value ranging from £50 to £112 a ton as rags. The D.O.S. on several occasions pressed for the return of this old clothing from the front ; but it was not until the spring of 1916 when the War Office, after pointing out with satisfaction how well organized and valuable was the industry established in the rearward zone, urged its extension and definitely ruled that disinfection was not essential, that G.H.Q. gave way. Hereafter old garments were returned from the front in sacks, the trucks being afterwards disinfected ; and what was beyond repair sent home.¹

But this was only one of innumerable forms of salvage. The manufacture of sacks for packing was another important industry. Web equipment was scrubbed by means of a special plant with revolving brushes, leather work cleansed and dubbed, waterbottles washed out and recovered with felt, waterproof sheets patched, mess-tins re-tinned, house-wives refilled, camp kettles scoured and

¹ How valuable was this salvage operation can be gleaned from the following statistics :

May 1st, 1916, to May 10th, 1917.

Received in England
from Overseas.

Articles.	Issued Overseas.	Quantity.	Value as rags.	Percentage returned.
Jackets	2,912,530	1,323,435	1/6	45
Trousers	2,844,150	1,306,671	1/4½	45
Great-coats	482,317	221,483	3/8½	45
Pantaloon	1,556,685	375,539	1/5½	24
Shirts	5,934,158	1,445,356	6¾	24
Cardigans	1,478,128	524,644	1/6	35
Drawers	4,907,245	1,062,854	11¾	21
Socks, pairs	12,724,340	3,883,110	3	30
Putties, pairs	3,631,899	714,166	6¼	19

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greased, cutlery polished, tentage dried and mended; tens of millions of articles being dealt with in the course of the war.

Great ingenuity was displayed in finding some use for even the most worthless materials. Laces were cut from the uppers of old boots and the residue of leather used as fuel, solder was recovered from old tins, lead from the linings of tea chests, nosebags and cooks' clothing were made from old tentage, worn-out ground sheets and waterproof capes reappeared as ration bags and cap covers, old oil drums became braziers, kerosine tins fire buckets, arm or leg baths for hospitals were made from petrol tins, and the spokes of old wheels turned into legs for tables and chairs. The blood of slaughtered bullocks was even commandeered from the A.S.C. butchery and used in place of linseed oil for making paint.¹ From this great mass of rubbish it would have been difficult to find even the squeak which is reputed to be all that is left of the pig after passing through a Chicago cannery.

Besides all this miscellaneous work Havre, and Calais also for a considerable time, had to deal with empty ammunition packages and cartridge cases which were sent home on storeships to avoid delaying vessels engaged in bringing munitions to France. The tonnage was gigantic, and a careful examination was necessary to ensure that serviceable rifle ammunition was held back and that explosives were not shipped among general cargo. This was another job carried out by French women.

Closely connected with this work were our establishments at Paris, originally the product of Heron's fertile brain, who was the first to realize the importance of organized salvage. During the winter of 1914/15 numbers of great-coats, blankets, horse-rugs, etc., found

¹ Some idea of the volume of work can be gathered from the fact that, in the first ten months of 1916, 136,000 tons of stores arrived at Calais from the front, including 1,300,000 pairs of boots and 280,000 rifles. In the same period, of 130,000 sets of accoutrements issued, all were salvaged stock except one quarter of the packs, haversacks, mess-tin covers, waistbelts and cartridge carriers; and of a million waterbottles supplied during the same period one-third came from the same source.

their way back to Havre, which, although in filthy condition, might, he thought, be made fit for further use after a drastic process of washing, disinfection and repair. The result of a trial order given to the Paris firm of Joly Fils was satisfactory, and in March a contract was entered into with this firm for washing and mending at fixed rates. The next step was to find premises in which to house the goods, the majority of which were not wanted during the summer ; and a large empty warehouse at the Quai de Javel, close to Joly's establishment, with its own railway siding, was leased. A staff of the Corps under Colonel Keddie was sent to Paris to take charge of the work, and henceforth winter clothing, blankets and horse-rugs were sent straight to Paris from the front to be renovated, stored and re-issued the following autumn.

There soon followed the installation by the London house of Debenham and Freebody of a special fur-cleaning plant to deal with sheepskin-lined coats, fur undercoats and leather jerkins. These required special treatment, being revolved in large drums with sawdust impregnated with cresyl and formaldehyde. Later on we took over this plant ourselves and largely increased the output by fitting powerful exhausts.

The Paris establishment expanded by leaps and bounds. The capacity of Joly's laundry was quickly swamped and work found for many others in and around Paris. Dry cleaning was substituted for washing in the case of service dress to save shrinkage, and what was too badly stained was dyed blue for the use of Chinese labour or prisoners of war. It was found cheaper to carry out repairs in our own workrooms rather than by contract ; and, employment in fashionable dressmakers' shops being scarce, there was no difficulty in getting *conturières* capable of even such a speciality as remaking kilts.¹

¹ Work on " *jupes écossaises* " was very popular for it was finer and the cloth softer than service dress. There was great speculation as to what was worn underneath, the true answer always leading to the reply " *incroyable* " !

A memorable occasion was when the Prince of Wales visited these workrooms where some 2000 women were employed. To be spoken to

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Trench gum-boots opened up a new line in a large garage in the district of Pantin, under a specialist officer. Work of this nature was entirely novel ; the washing was simple enough and repairs to the rubber not difficult, but to dry the insides of the boots was by no means easy until an ingenious hot-air apparatus, designed by an Ordnance engineering officer, was installed and enabled 1500 pairs to be dried in a day

In all former wars, old clothes and boots, and usually old equipment, had been treated as rubbish fit only for the scrap-heap ; and it is no exaggeration to say that the salvage operations of Havre, Calais, Paris and to a lesser extent of other depots which all shared in the work, directly saved the nation a bill that can only be computed in terms of tens of millions sterling. Enormous though the sum must have been, however, the saving cannot be in their own language by a real Prince and to be allowed to crowd round while one of their number presented him with flowers and another, an ex-singer from the Opera Comique, sang the "Marseillaise" was a treat these French girls will never forget.

Among the principal articles dealt with during the progress of the war were the following :

Blankets	10,426,000
Cardigans	1,909,000
Pairs of Drawers	3,809,000
Great-coats	1,866,000
Jackets	1,250,000
Leather Jerkins	2,342,000
Fur Undercoats	1,028,000
Kilts	115,000
Gum boots	489,000
Groundsheets	142,000

The Paris Depot balance sheet by the end of the war read as follows

To washing contractors	£ 429,067	By estimated value	£
Civil labour	180,282	of clothing, etc.,	} 8,122,526
Cost of military establishment and transport	88,435	recovered, on basis of half price	
Rent and repairs	26,424	Value of rags sent to England	
Miscellaneous expenses	68,800		
Net saving	8,194,618		
	<u>£8,987,626</u>		<u>£8,987,626</u>

measured by pounds, shillings and pence alone. Without these salvage operations all the sheep farms of Australia and all the cotton fields of America could not have produced the raw materials we needed ; nor, even had shipping been available to carry them to England, could all the looms of Yorkshire and Lancashire have sufficed to weave cotton and woollen goods for our armies and civil population besides Allies whom we clad.

The C.O.O. Paris, whose office was situated in the Rue de Vivienne at the heart of the business district, also acted as our purchasing agent, and was in touch with the French War Office, without whose permission no substantial transaction was permissible. There were often, especially at first, sudden unexpected calls for articles that could be bought without involving the delay entailed in applying to England. It is to be feared, however, that this result, satisfactory though it might be, was not popular with D.A.D.O.S. who had been glad to snatch an occasional few days' respite and pay a visit to Paris to obtain some out of the way article for which the division displayed a sudden longing.

The Corps also enlisted at Paris two recruits of very unusual calibre. In the spring of 1915 Sir Bampfylde Fuller, K.C.S.I., late Lieutenant Governor of Bengal, happening to find himself there, tendered his services to the C.O.O., and was followed soon after by Sir William Morison, K.C.S.I., another distinguished Indian Civil Servant who had been Chief Commissioner of Scinde. Both were gazetted majors and remained to help, sinking their dignity and not finding it derogatory to occupy themselves, the one with petty purchases, and the other in overhauling old clothes.

These salvage establishments, however, only dealt with special lines of renovation. Where technical skill was wanted, articles went to the workshops, the last subdivision of duties supervised by the Chief Ordnance Officer, the doings of which remain to be recorded.

When, in the late autumn of 1914, the base was transferred from Nantes to Havre, the senior Ordnance

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Mechanical Engineering Officer present was Major Davies, who had served in the South African campaign, where the extemporized shops were notoriously poor and inadequate. Profiting from his past experience, Davies saw that those now installed at Havre were amply provided for, with properly designed and large workrooms capable of expansion, the whole planned so that work could be carried out with a minimum of labour. That this step was taken from the outset was providential; had work been started on a cramped scale, the workshops would have been overwhelmed by the flood of orders that quickly began to pour in.

Calais was able to profit by the experience of Havre; by then the scope of the work was better realized and there also the shops inaugurated by Major Everett were designed on a proper basis; though even so extra premises had to be acquired from time to time at both places. These establishments, it may be mentioned, were chief among the sights that interested distinguished strangers in France and were visited by the King and Queen.

Apart from size their outstanding feature, compared with the workshops of a Command in peace, was the extent of their manufacturing operations, the reasons for which have been already indicated—the shortage in supply of gun components and the many alterations to design initiated in France, which moreover were not confined to artillery equipments. The service pattern water-cart, for instance, is an example of a article surviving years of peace and failing in war. Its elaborate system of filtration, admirable in theory, broke down under the stress of travelling. The remedy practically necessitated reconstruction, a very big item indeed seeing the many hundreds that were involved. On top of water-cart trouble came failure of the axles of travelling kitchens, an unfortunate combination.

It took long before such modifications became operative at a munition factory; and in the interim every equipment that arrived, as well as those already in the country, had to be brought up to date, the necessary materials

being made locally. Then new inventions were constantly being tried, the process usually consisting in a few being made in an Army workshop, after which, if the idea were a success, the base would be called on to manufacture wholesale, at great pressure, making its own patterns, gauges and jigs. For although the War Office might have been asked to provide, it was a lengthy business for a factory at home to switch off its regular line of repeat work and undertake a new process. 8000 anti-aircraft sights, for instance, were turned out in France before a single one arrived from home.

The first large order undertaken at Havre was for 108 95 m/m mortars and their bombs, to a design of Davies', in December 1914, all the materials being got locally. The mortars were of steel piping and the bombs were of zinc filled with gun-cotton, cut to size with an absence of peace-time precautions that fortunately led to no serious accident. There was a great demand for these bombs which were turned out at the rate of 1400 a day. In the following September a sudden call arose for 20,000 special incendiary bombs for these mortars, for operations timed to take place so soon that they had to be despatched within four days to be of avail. Sixty-two separate operations were entailed in the manufacture of each, besides which packages to hold them had to be made; and it was only by working continuous shifts night and day that this order was accomplished; an achievement which well deserved the special complimentary letter that was sent by the Quartermaster General.

This was typical of the usual course of events, first a local improvisation, next a rush order on the base and finally regular supply from home; and if it became unnecessary after a while to make mortars and bombs there was always something to take their place; stabbing knives one day, knobkerries another, braziers a third, Yukon packs, ground-strips for signalling to aircraft, or stove-pipe attachments to conceal the flash of machine guns. The manufacture of a variety of gun components was ceaseless; even for such a delicate piece of mechan-

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ism as a gun-trigger France had for long to be largely self-supporting, and items such as pistons, spring cases, and axial vents were made by hundreds at a time. Moreover, besides such special work, unconsidered trifles such as drag-ropes, linchpins and washers, special spanners or bolts and nuts, wagon poles, tent poles, wheelbarrows, handcarts, tables and forms had to be turned out by the thousand.

As for repairs, their nature was endless, and they were as a rule of an extensive character; for the lighter class of work was done by Ordnance mobile workshops, armourers' shops, etc., at the Front. This was particularly so in the case of gun equipments which usually needed complete overhaul by the time they reached the base. From delicate instruments to leather work, from rifles to wagons, the work embraced almost every category of military store or domestic utensil. The fact that the foundry at Havre had to make 17,500 castings in six months to be used for some one or other purpose may convey to the initiated some idea of the scope of operations.

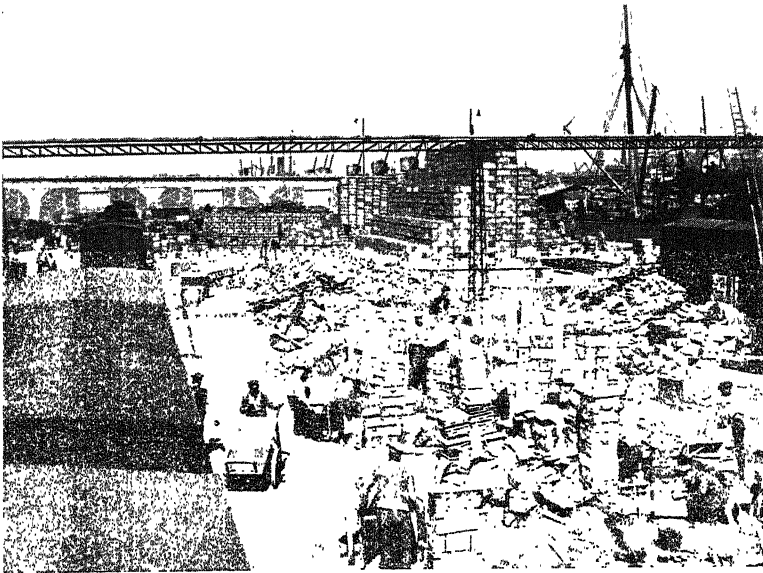
A feature of Calais was the boot-repair factory, the largest organization in the whole world of boot-making. Starting in September 1915 with a staff of 180 boot-makers and an output of 350 pairs a week, the number, including German operatives, increased by 1917 to over 800 with a weekly output of 30,000. Many of the operations, such as re-soleing and renewing eyelets, were effected by machinery, and French and Belgian women were employed in sorting out and pairing loose boots and in cleaning and oiling. Some of the hands came from the best West End London firms, and could turn out the highest class of work—even the making of surgical boots. Altogether some four million pairs of boots were made serviceable between the two base workshops.

Another special line of work at Calais, during the later stage of the war, was the overhaul and repair of the railway mountings from which large calibre guns and some of the heavier howitzers were fired, for which a 90-ton gantry was erected.

A quite novel class of work was to repair and re-impregnate the earlier types of respirator. The first device to be improvised when the Germans launched chlorine gas in April 1915 was a simple wire framework of a size and shape to cover the mouth and nostrils, and enclosing a fabric treated with a chemical. The C.O.O. Paris immediately set to work to get these made at the highest pressure. But the device was not a success, for the mask formed a pocket to hold the poison gas which was heavier than air. The Germans, when they decided to adopt this dire form of warfare, had not neglected defensive measures; and a mask found on a German prisoner a few days later proved to be better. This consisted of a bag filled with cotton-waste giving a much closer fit round the face, and the next step was to obtain all the waste procurable in the area we occupied in France. Meanwhile the first "smoke helmet" was being designed and manufactured at home, a cone-shaped structure of flannelette with celluloid eyepieces, which completely covered the head, the skirts being tucked under the jacket; and here again our Paris establishment proved of use by purchasing all the stock of cinematograph film procurable to make eyepieces.

So speedily was manufacture set about that very soon it was possible to issue an order that every man going to the front was to have one of these helmets, carried in a waterproof bag to prevent the hypo-sulphate solution with which it was treated from evaporating and the fabric from being torn. Nevertheless the chemical, in liquid form, was bound to evaporate after a few months, and the helmet was only effective against gas for a few hours; as soon as a sufficiency was available every man was given a second with a third carried in divisional reserve.

It was to re-impregnate and repair these smoke helmets that a new establishment was set up at Abbeville in June 1915, followed soon after by another at Calais, in charge of lady superintendents attached to the R.A.O.C., the first English women to be employed in France, Miss Morgan, Miss Beavor and Mrs. Barocchi.



LOADING AMMUNITION EMPTIES FOR ENGLAND



REPAIRING SMOKE HELMETS

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The work consisted of the following operations: washing, drying, repairing tears or refitting eyepieces, redipping under supervision of the medical authorities, and repacking—every helmet being dated so that it might be known when it was due for fresh treatment. The plant—boilers for washing, centrifugal drums for removing excess water, artificially heated drying rooms etc.—was installed by a temporary Ordnance officer, a specialist in laundry work, and the various processes carried out by French women.

Eventually, after various improvements had been made to the smoke helmet, a new device, the box respirator, was adopted, similar in type to the present pattern. The poison gas now filtered through a container holding chemicals in a solid state that could not evaporate, and the reimpregnating stations gradually closed down, but not before a total of 7,677,000 helmets had been dealt with.

The last new workshop was one set on foot to deal with every class of artillery equipment, including the complete rebuilding of gun carriages hitherto only undertaken at home, and was started in December 1917 at Creil, the Clapham Junction of Paris, in the works of the Cie. Gle. Electricité. Munition factories at home were organized with a view to mass production; they shirked this class of work which was mainly one of improvisation, and there is no doubt that Creil might have accomplished good work in time. But before work could be set going on any extensive scale the site became jeopardized owing to the German advance of 1918. It was then proposed to start a new factory elsewhere, but this never came into being as the armistice followed soon after.

It may be gathered from these facts that in variety of services Ordnance workshops were unrivalled in the business world. Starting with one small nucleus shop, the number grew to 73 employing more than 10,000 operatives; while overhauls to artillery equipments either at the front or the bases reached the huge totals of 56,000 guns and 65,000 carriages.

Before closing this chapter, mention is due of some of those chiefly responsible for building up the structure of the main base depots in France; a structure not only adopted in other theatres and since introduced, as far as it is applicable to peace conditions, at our larger depots at home; but one also closely copied by America, a nation renowned for its business acumen, when it entered the war. United States officers sent to study our methods could detect no flaw or see how they could be bettered. This was the more remarkable as America, with its great population and wide spaces, is the home of large departmental stores specially designed to supply customers at a distance by means of a parcels' delivery system.

None of these, however, rivalled either in magnitude or scope of operations the gigantic emporia at Havre and Calais which, between them, catered for a constantly shifting population totalling millions, and dealt with goods of almost infinite variety numbering some twenty thousand items; which had to repair, and not infrequently manufacture, what they supplied; and which had finally to extract the full residual value from what their clients wore out.

In performing these functions moreover, except the last named, speed and accuracy were vital, error or delay being likely to have very far-reaching consequences in time of war. It was further necessary that documentary records be compiled absolutely concurrently with the transactions to which they related; had they been allowed to fall into arrears, even for 24 hours, it would have been impossible—as was so often necessary—to obtain a true picture at any moment of the day or night of the stock, assets and liabilities of any particular item. In no other class of business I imagine is such a refinement of accountancy necessary, except a banker's whose account concerns one element in place of 20,000.

The first important innovation was the group system, for introducing which Heron must be awarded the palm, for he had adopted this principle at Aldershot in bygone years, and arrived in France with the idea of doing

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similarly. But, in point of fact, the base being then at Nantes, the group system was in process of evolving itself, owing to the storehouses being so scattered from lack of centralized accommodation. And when Havre was reopened Colonel Watts, as Chief Ordnance Officer, retained the group, a depot within a depot, as the main unit of the organization; a principle that unquestionably proved best for operations of such a varied character. No one would set a fitter to do saddler's work or vice versa; and though storekeeping involves a less specialized skill, still there is a great difference between being able to identify the particular fittings used with each type of gun and being able to piece together the various bits of leather that go to make up different sets of harness and saddlery, and knowing in each case the exact nomenclature.

Within his group the temporary officer could and did gain a thoroughly practical knowledge of the particular class of store he dealt with to a far greater extent than would have been possible under our pre-war system where everything was controlled from a central office; and the new army recruit, whose duties were confined to a much narrower circle, was able to do so even more thoroughly. This was the more necessary as there was but a small leaven of seasoned hands, the vast majority having no previous experience of Ordnance work.

It was also at Havre, when re-opened after the evacuation of Nantes, that the system of issuing in bulk was introduced and brought to perfection, another fundamental change that, by decentralizing the process of detailed distribution for certain standard items, gave immense relief; while other important steps, such as the system of loading trucks, described earlier in the chapter, were adopted.

The advantage of having one central branch to provide for all depots at the seat of war had been realized in the South African Campaign; and the building up of the analagous organization that proved so successful in France was the work of Colonel Bernard, the first A.D.O.S. Provision. It is impossible to overrate the importance

of this statistical branch of Ordnance work; one continually engaged in compiling and revising figures of consumption and watching that provision is made for every new contingency due to the arrival of fresh troops, fresh types of equipment, the nature and extent of operations and seasonal changes—all factors affecting rates of expenditure.

When Calais was opened as a second base, with Slade Baker as Chief Ordnance Officer, a number of new measures were adopted, profiting by the experience of Havre. It was now that group tallies, kept in loose-leaf ledger form, were converted into group ledgers, and the central ledger office system abandoned.¹ At the same time the forms on which to record assets and liabilities (“dues in” and “dues out” in Ordnance parlance) were recast and simplified and other labour-saving devices introduced—such as the marking up of indents in different coloured pencils to show at a glance their state of completion; short cuts for which Major Marfleet—who had been a group officer at Havre—was largely responsible.

The last to set his impress on the organization was Colonel Trimnell, who relieved Slade Baker when the latter joined the staff of the D.O.S. at the end of 1915, and who continued to occupy the post of C.O.O. Calais till the end of the war. Trimnell had previously been O.O., Havre, where, conjointly with Watts, he had been instrumental in effecting various improvements; he had a high degree of knowledge about departmental work, revelled in working out schemes for increasing the economy of the machinery, and was gluttonous in his eagerness to undertake extra work—expressing a light-hearted conviction that Calais could cater for the whole of the troops in France instead of a paltry half the number. Nor should his celebrated dry curries be omitted from a list of his accomplishments. Calais in fact became the more important of the two bases; for it handled the whole of the gun supply, the most difficult of all the equipments with which the Ordnance had to deal. So smoothly and efficiently was this work accomplished

¹ Calais reverted to the Central Ledger System to the end of the War.

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that the French were anxious to learn how it was done, and sent their Inspector General of Artillery to study the system.

It has, of course, been impossible in this survey to describe every dovetailing arrangement, every check and counter-check, or every device introduced to ensure the utmost promptitude and exactitude in connection with each stage passed through between the receipt of an indent and its fulfilment; a space of time, assuming no shortage in supply from England to exist, that occupied normally 24 hours. But all the main processes have been made clear; and the essence of the system may be said to be that it gave everyone, from highest to lowest, a definite responsibility, and enabled specialization to be carried to its utmost limits; the functions of each individual, at any rate in the lower grades, being confined to one particular class of transaction. Efficiency and economy of labour went hand in hand; each officer, warrant officer, non-commissioned officer and man was enabled to pull his full weight, and a redundant hand would have been merely a clog in the machine.