A battalion commander would be asked to furnish, say, 100 men. In order to give his men as much rest as possible, he would furnish a different hundred each night. The fact that these working parties were changed daily, coupled with the many difficulties of getting together at the right time and the right place the transport, tools, material, supervision and labor required for the execution of any job, had this result: Only about 25% of the work required was executed, although the men themselves had probably expended the energy required for a full day's work; the fighting efficiency of the infantry was being impaired; their training was being interfered with.

Engineering Difficulties Gradually Increased

We were forced to ask a man to fight a battle to-day and build a road to-morrow. That was unfair. We had little enough time to train an infantry soldier to be an expert rifleman, bomber, Lewis-gunner, etc., and yet we had to ask him to become a road-builder, water-works constructor and all the other things which an engineer must be.

We felt that it would be much better if we could leave it to the infantryman to do the actual fighting, the work for which he was trained, and create an engineer organization sufficiently large and self-contained to carry out all engineer services. For a while we tried a compromise, viz., the attachment of a permanent working party to field companies, to which system there were sound objections raised by infantry commanders. It increased the discrepancy between war establishments and trench strength and interfered with the organization and development of the platoon, which is the fighting unit of the infantry. It dislocated infantry training and prevented non-commissioned officers and men in these permanent working parties from gaining promotion in their own units. They quickly forgot their infantry training and became "engineers."

The introduction of new weapons and new methods of attack and defence was rapid and progressive and constantly rendered more difficult the engineering problems to be solved. The depth of the battle zone had to be increased enormously, owing to the increase of range of trench mortars and heavy artillery. In the beginning of the war, most of the guns were low trajectory weapons, but the high-angle gun forced us to go underground to gain protection. The bomb-dropping devices in connection with aeroplanes made of the latter a long range weapon with direct observation, and in consequence steps had to be taken to provide protection for troops even in rear areas, where normally no such work was necessary at the beginning of the war. Furthermore, the enormous increase in the number of guns created the necessity of providing means by which the very large tonnage of ammunition could be delivered at these guns. This meant railroads, tramways, sidings, and much greater wear and tear on roads; all of which were under the care of the engineers.

Self-Contained Engineering Organization

The advent of the tank with the 37-ton axle load required that, during an advance, engineer works of the most substantial nature should be executed with the greatest rapidity; and these results, it was considered, could only be accomplished if the personnel permanently allotted for the execution of engineer services were greatly increased, and if the technical supervision, skilled labor, unskilled labor, material and transport were merged into one organization under one control.

We had in France, in addition to these engineer companies and pioneer battalions, three tunnelling companies, concerning whose work I shall make a reference later on. Within a division the personnel of the three field companies and pioneer battalions was reorganized by utilizing each field company as a nucleus, absorbing the pioneer battalion; and by the addition of a proportion of a tunnelling company and other personnel, there were created three engineer battalions and a bridging transport section, the whole constituting an "engineer brigade." In forming the engineer battalions, care was taken to provide for the dilution of the highly skilled sapper personnel by including in due proportions men semi-skilled and unskilled Class A labor, who had completed their infantry training.

The transport, both horse and mechanical, was increased so as to provide the amount it had been found, after several years' experience, was necessary to ensure the delivery of engineer stores during active oprations; and we find that the three engineer companies, which at the beginning of the war formed part of the division, developed into three engineer battalions to a division at the close of the war.

This reorganization was carried out in the field under a great handicap, but it was completed the last week in July, 1918. During the first week in August, in preparation for the battle of Amiens, the new organization was subjected to its first trial, a very severe one, which more than justified the change.

During the final hundred days, to ensure the rapid advance of the Canadian corps, the "Canadian Engineers" provided from themselves all necessary facilities in the way of cable and signal services, communication trenches, infantry tracks, mule tracks, plank roads, metal roads, pushed tramlines, mechanically propelled tramways, bridges, water supplies, demolitions, investigation parties, camouflage, etc., without calling upon any other troops for a working party. The fighting efficiency of the other arms was therefore not impaired in any way, and they were enabled to conserve their entire energy and devote it to the task of overcoming and wearing down the enemy opposition. The value of this was seen in the rapid and unprecedented advances made and sustained by the corps. I am not saying too much when I say that to the reorganization of our engineer services was due in large measure the success of the Canadian Corps during the final hundred days.

Division of Engineer Services

With the Canadian Corps, the corps was the fighting unit. This was due to the fact that the Canadian Corps was composed of four permanent divisions, whereas, in other corps, the divisions were constantly changing. The work of the corps naturally fell into four main departments: General staff (which dealt with training, intelligence, operations, defence schemes, etc.); artillery; "A" and "Q"; and engineers. The work of each department was closely involved with that of every other department; and it is due to the co-ordination and co-operation of all these departments that good results were obtained.

The chief engineer was the technical adviser of the corps commander on all engineer services; and in addition, he administered the "Canadian Engineer" personnel in France. He was given a sufficient staff and had under him four field engineers, one each for defences, water supply, tramways and roads.

The engineer services within the corps were divided, roughly, into divisional areas and corps area. A line of demarcation was settled upon, in front of which divisions were responsible for carrying out their work. In the rear of this line was the corps area, in which all necessary work was carried out by the corps engineer troops, working directly under the chief engineer. These corps troops often varied from 20,000 to 50,000 men, and were served by five engineer companies. With each division we had an engineer brigade consisting of three battalions and one bridging transport section. Each battalion, roughly 1,000 strong, was divided into headquarters and four companies, three of which were organized for general engineering work and the fourth for tunnelling and mining work. The bridging transport section carried sufficient pontoon and other bridging equipment to enable 225 ft. of medium bridging to be constructed. A medium bridge is one which will carry field artillery, cavalry in sections or infantry in fours.

Responsibilities of Chief Engineer

When the corps undertook an operation involving more than one division, the engineer units were pooled and came under the executive control of the chief engineer for the operation.

Under the chief engineer were placed defences, roads, tramways, water supply, offensive and defensive mining,