To make a traffic diversion off the main road took time, owing to the nature of road required to carry heavy traffic. The British Army had adopted a new bridge called the "Inglis portable military bridge, rectangular type," and this proved invaluable. It was composed of a number of identical bays, 12 ft. long, 12 ft. high and 12 ft. wide, and was designed to carry a dead load of 84 tons distributed over a clear span of 84 ft. The bridge was of the Warren girder type, the tension and compression members being mild steel, lap-welded tubes, thickened at the ends and pin-connected in steel junction boxes. The transoms and transverse stiffeners were I-beams, the web being cut out in places by oxyacetylene plant to reduce the weight for handling to a minimum. Each part of the bridge could be manhandled, the weight of one 12-ft. bay in skeleton form (that is, ready for launching) being 1.735 tons, and one bay of the finished structure, complete with decking, 3.16 tons.

## Inglis Portable Bridge

The first bay of the bridge is built on a two-wheeled trolley, and a long arm, sufficient for the gap to be bridged, is built out as a cantilever on one side, and a shorter counterbalance is constructed simultaneously on the other side of the trolley. When the skeleton bridge is completed, the end bay of the counterbalance is loaded with road bearers till balance is obtained. The bridge is pushed forward by hand power over the gap on a prepared track, and the far side lowered onto its abutment. The counterbalance is removed, then the trolley, and the near side lowered onto its abutment, and the decking laid.

During the advance of the Canadian Corps over the Canal-du-Nord in September, 1918, a bridge of this type, 108-ft. clear span, was erected under heavy shell-fire and opened for traffic in 12½ hours, a work party of approximately 200 sappers being employed on the construction of the bridge, abutments and approaches.

The bridge at this span was good for a distributed load of 51 tons, and on the following day, after the erection of a trestle as a centre support, it took all classes of transport. The bridge can be built of any span in multiples of 12 ft., but is limited to 120 ft., with distributed load of 41 tons. Immediately these bridges were erected, construction was started on a bridge of a more permanent type, and the Inglis removed in preparation for use in another attack.

The Germans had very large dumps of good squared bridging timber; with these, and I-beams, many bridges were constructed. The Canadian engineer was very much in his element with a cross-cut saw, squared timber and some spikes,—a welecome change from the old trench warfare days of pick and shovel work.

## Tramways

Another interesting feature of the work of the Canadian engineers in France was the corps tramway system. The Canadian is a very practical fellow and believes greatly in labor-saving devices.

Very early in the war the thought came to me, as it did to many others, that railways could, with profit, be much more extensively used, and that even in the forward areas light railway lines could be laid down, over which cars of some sort could be operated, either pushed by hand, drawn by mules, or pulled by engines. As early as March, 1916, the chief engineer organized an unofficial unit called the "Canadian Corps Tramways Company." He did this by borrowing suitable men from all sources for the construction of light railways in the forward area. This organization soon demonstrated the practicability of the operation of light railway lines in the forward area, and the value of them in facilitiating the delivery of trench munitions, supplies and ammunition, and in the saving in transport and man power thereby effected.

At a later date when the practicability and the usefulness of these light railways had been thoroughly demonstrated, their construction was undertaken under G.H.Q. organization on a large scale. In fact, G.H.Q. wished to take over the construction and the operation of all light railways, a policy to which the Canadian corps persistently refused to agree. We contended that the G.H.Q. organization could construct and operate effectively on to a point where deliveries in bulk could be made in daylight by steam. We preferred that the distribution of supplies in our forward areas should be under our own control.

After two years' work, the organization of the Canadian Corps Tramways Company was approved, although the sections had been operating for many months unofficially. One section we called the operating section, and the other the construction section. They constructed, maintained and operated all tramways in the forward area, taking over the cars at the transfer sidings and making deliveries as required. In the Lens area these sections operated and maintained about 75 miles of line in the forward area. All supplis, trench munitions, rations, etc., were sent forward over these lines. The wounded came out by the same means. Every pound of ammunition was sent up by the light railways, and in the end this system became so perfect that in making a relief, units were sent up by this method of transportation and the relieved units brought back to their billets.

It is hard to appreciate the part played by this service in maintaining the morale, strength, and fighting efficiency of the corps. In the Lens area we were operating nearly 150 small trains a day, and over 2,000 tons of freight was transported daily by this means. But for the tramways all this would have bad to be taken forward by horse transport or pack animals, or carried in by hand. The tramway organization developed a wonderful "esprit de corps"; its members sought to increase their freight returns. It is even said that their manager would halt lorries on the road to find out what they were carrying, and what their destination was. He would then go to the consigner and ask for the business. Our system was a miniature C.P.R. system, employing up-to-date railway methods. Going to the railway yard at Lens Junction, one would find a yardmaster, train despatcher, switchman, block signals, etc.

## Gas Attacks

We used these tramways in connection with our gas attacks with great success. The old way of making a gas attack was to instal cylinders in our front line, awaiting a favorable wind before they could be discharged. This involved a great deal of work; and if the wind was unfavorable, as it often was for days together, it gave us a good deal of worry for fear the Boche might in a raid discover that we had cylinders installed, and, as a results of this information, subject our trenches to heavy bombardment. possibly breaking the cylinders and gassing our own men. Personally, I did not like this method of gas attack, and never installed a cylinder in a trench under my control. We fitted up cars capable of taking three tiers of cylinders. These cars would be held in the back area ready to go forward. When a favorable time came, they would be run up as quickly as possible to the front area, our front line trenches cleared, the gas from the cylinders released, and the train would be on its way back, almost, before the hostile artillery opened up.

One cannot leave the question of tramways without mentioning the name of the tramway officer, Col. Rogers, one of the most enthusiastic and capable officers ever serving in the Canadian corps. There will be many who remember Col. Rogers' observation car, in which he used to show interested visitors over his lines, also his private car, christened "Coniagas."

## Search-Light Section

The search-light section of the corps, operated by the engineers, also deserves special reference. During the campaign of 1917-18, night bombing was much more extensively indulged in than formerly. The result was that it was interfering very much with the men's sleep even in the rest areas. We were anxious to do something to counteract the success of those raids, which were affecting the morale of troops. Aeroplanes did not prefer an area where searchlights were operating. They disliked being caught in the beams, because such predicament made them a better target for the anti-aircraft guns and also for our planes, which