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Engineering Battalions: Their Work in the War

Review of Engineer Services in Regard to Defences, Roads, Tramways, Water Supply, Mining and Tunnelling, Bridging, Searchlights, Etc.—Tribute to the Energy and Initiative of the "Canadian Engineers"—Address to the Dominion Land Surveyors' Association

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ALTHOUGH I wish that someone more technically qualified—someone with sufficient technical knowledge to present the subject more interestingly and intelligently than my ignorance will permit—had been chosen to review the work of the Canadian Engineers in the great war, yet I welcome the opportunity of saying something of the work of that splendid corps—the engineers—whom, on account of their modesty and the perfectly natural popular tendency to remember chiefly the role of the infantry, the general public has often failed to appreciate.

Let me begin by defining the mission of the engineers in France: It was to apply engineering science to the emergencies of modern warfare in order to protect and assist the troops, to ameliorate the conditions under which they were serving and to facilitate locomotion and communications.

Perhaps I should pause here to point out one essential difference between the engineer of everyday life and the engineer of the army. In civil life, he is purely a technical adviser. In the army, he is not only a technical adviser but he is also the contractor. In civil life, he advises; he prepares the plans; he supervises the construction of the work. In the army, in addition to giving advice, preparing plans and supervising construction, he performed the actual work of construction in many instances for the first few years of the war, and in all instances in the Canadian Corps during the last months of the war.

Until May 24th, 1918, the organization of engineer units within the Canadian Corps was exactly the same as that of similar units in the Imperial service. Upon the conclusion of the offensive operations which culminated in the capture of Passchendaele in November, 1917, the chief engineer of our corps, Maj.-Gen. W. B. Lindsay, C.B., C.M.G., D.S.O., again urged the reorganization of the units and the personnel required for engineer services, upon the ground that the Imperial establishments and organizations were entirely unsuitable for coping with

the situation and the conditions developed during the war. It was a matter which we had often discussed, and I was in full accord with his views. A proposal for the reorganization was put forward, receiving the endorsement of G.H.Q. and the Overseas Minister, and was brought into effect on the date above mentioned, May 24th, 1918. The reasons which led to the change being carried into effect were briefly as follows:—

When the war began each division had available for carrying out engineer services three field companies, each administratively a complete unit of a strength of 215, making 645 engineers in the division. These field companies were composed of highly-trained men, almost wholly intended for supervision and able to accomplish little work by themselves. The need for an increase in the personnel of the engineers was soon realized, and there was added to each division a pioneer battalion, which was placed under the C.R.E. of the division for work only, but not for administration. These pioneer battalions were very useful units, and more so if officered by engineer officers, which was not always the case, though I do not wish to intimate that all officers who were not engineer officers were unsatisfactory.

Under the old system they were frittered away on all sorts of jobs throughout the division, and were subject to all the evils which arise from dual control. It was the practice in the earlier days, and a necessary one, to detail daily working parties from the infantry to execute the work under the supervision of en-

gineers. This proved to be a very unsatisfactory and costly method. The engineers laid out the work and were responsible for its supervision and for getting on the ground all the necessary tools, material and transport; but the actual execution of the work was left to these infantry working parties; that is, the engineers were held responsible for the quality of the work and the infantry for the quantity executed.



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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 operations; 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,

tunneling, bridging, demolition, the supply and manufacture of the necessary engineer stores, and the construction of accommodation for troops and horses. Let us examine these in greater detail:—

As to defences, the general policy governing them—their nature and siting—was laid down by the general staff. They were constructed under the supervision of the engineers—in divisional areas under the officer commanding the engineer brigade, and in the corps area under the chief engineer.

Defences include wiring. In the early days the wire was strung along wooden posts driven into the ground by a mallet. Often one could hear the enemy pounding their sticks in. The question immediately arose as to whether it was advisable to shoot up their wiring party with machine guns, or to get out and get busy ourselves. We usually adopted the latter plan until we got out a fair amount of wire in front of our immediate front line. The wooden posts were soon replaced by wire screw-stakes, which had the advantage that it was possible to put them in place without the enemy hearing what was going on. In addition to the wire stakes, we made up "knife-rests," so called because the framework resembled a knife-rest. They were made up in the rear, brought up at night and thrown over the parapet.

Wiring

In the beginning, the wiring was done by the engineers and special wiring parties, known as the "Suicide Club"; yet, strange to say, although these men often worked in "No Man's Land," their casualties were few. In latter years every man was trained in the art of wiring—trained in squads of ten. We knew exactly how much wiring a squad of ten men could put up in so many hours, working either by day or by night. I have seen remarkable demonstrations of rapid wiring. I think a squad of ten men can put up 50 yds. of double-apron wire in some eight or nine minutes, and battalions did not take long to wire themselves securely.

In the Lens area, where the corps was for many months, we erected hundreds and hundreds of miles of wiring. In front of our second line there were seven belts of this double-apron wire, and in front of our main line another seven belts. The wire was not put up in haphazard fashion, but was erected in relation to the machine guns which covered it. If you saw a long belt of wire stretched out in one direction, you knew that there were machine guns sited so as to sweep that wire. There is nothing which holds up troops as quickly as barbed wire; and during the war many unnecessary casualties were caused by troops being ordered to attack when the wire had not been sufficiently cut. This cutting of wire was a difficult operation until the advent of the .106 fuse. One of the great advantages of tanks was that they were able to cross uncut wire, crushing it so that the infantry could follow at once. The tanks were fitted with grappling-irons which pulled the wire completely aside.

Trenches

After barbed wire comes trenches. The first thing a soldier cares about after reaching a position is digging himself in, and for this purpose he is provided with what is known as an "entrenching tool"; yet it was often the custom to send in with troops about to make an attack a certain proportion of spades and picks. If not sent in with the troops, they were got up as soon after dark as possible. In many parts of Flanders it was impossible to dig trenches, the water lying so close to the surface. Trenches were constructed in those areas by filling sand bags and piling them up, one on top of the other—a very unsatisfactory method. They were soon pounded to pieces by shell fire, and the bags rotted after being exposed to wet. The piling of sandbags is an art, and many troops suffered much discomfort from the imperfect way in which the work was often done. All who have served in France know what is meant by sandbags "slithering in."

When we were in an area where trenches could be made we dug down, at first making our trenches deep and narrow; but the winter of 1915-6 cured us of that folly. We then

made them much wider and took care that they had a proper berm. Although the narrow, deep trench gave greater protection from shell fire, the wide trench permitted much more rapid movement.

In connection with the building of trenches a proper system of drainage had to be put in, and "bath-mats" had to be laid. The trenches were revetted,—chicken wire, corrugated iron and hurdles being used, the last being the most satisfactory. When trench was revetted with corrugated iron, after a severe shelling it required a great deal of work to get it into any sort of decent shape again.

Dugouts

Leading from these trenches were the dugouts for the garrison. The Germans taught us all we knew about the construction of dugouts. Until the battle of the Somme was fought, ours were principally of the "Old Bill" type, viz., a square excavation in the side of the trench, covered with corrugated iron and a layer of sandbags. When we overran the German trenches at the Somme we found dugouts quite 30 or 40 ft. below the surface, and often leading down to a second tier of dugouts. These were often lighted by electricity and could be made very comfortable. You can readily understand the technical training the engineers were required to have in order to construct these dugouts. We aimed at providing sufficient protection for the troops in the trenches and dugouts, and all our outposts, headquarters, signal stations and report centres were similarly protected.

These dugouts often became, in a battle, death-traps for their inhabitants. A severe shelling previous to an attack forced the garrison into the dugouts, and we aimed at our infantry arriving in the hostile trenches before the defenders could emerge from them. If the interned garrison did not immediately surrender, bombs were thrown down and mobile charges exploded, blocking the entrance. In an attack special parties were told off to deal with any of the enemy who might be hiding in the dugouts. These parties were called "mopping-up parties."

Subways and Gun Emplacements

With the dugouts go the subways (underground passages from support lines to the front lines), which we constructed when we had time so as to avoid having to come out of the trenches. Before the battle of Vimy we had been able to construct a great many of these subways. One division, I remember, had a light railway installed, and was thus enabled to get all its bombs, trench mortars and other ammunition, supplies, etc., up to the front line without exposing the carrying party to the dangers they would be subjected to if forced to go above ground. In our defence of Hill 70 we were making the subway the backbone of the defence. This subway, besides providing safe passage to the front, also gave safe living quarters to the garrison, and from it stairways led to machine-gun emplacements, carefully camouflaged along its entire length. It was compartmented in order that access to one part of the tunnel would not mean that the whole thing was permanently lost.

Following wiring, trenches, dugouts, etc., come machine-gun emplacements. During the war there was a great advance in the tactical employment of the machine-gun. At first, the emplacements were simply open emplacements with no other protection than what the ordinary trench afforded; then we sought to give them head-cover protection from shrapnel. This was simply a rude structure covered by sand bags. With the increase in the employment of high-angle guns came the necessity for further protection; and by the use of I-beams, heavy timbers, sand bags, etc., we were able to provide it to a certain extent. Naturally, a demand for cement arose in the making of these emplacements. But the British army did not make many cement machine-gun emplacements owing to the lack of cement. Much of the product of our factories went to Holland, where it eventually found its way into the German front areas.

The enemy employed this type of structure to a large degree; along the Hindenburg line from Neuville Vitasse you could count cement machine-gun emplacements every

hundred yards. They also used it in the construction of pill boxes, which formed the framework of their defence system in the Flanders area, where it was not possible to make a dugout. These pill boxes were a very hard nut for us to crack in the third battle of Ypres, 1917.

We favored the Champagne type of emplacement. This consisted of a tunnel, often running one hundred yards or so out from a living trench, and coming up to the ground in a six-foot opening, carefully camouflaged. The crew would live in the tunnel with their guns and ammunition supply; and when the hostile attack developed they would take up their position in the opening, a place entirely unsuspected by the enemy. Some hundreds of these machine-gun emplacements formed a large part of our defences in the Lens area. In the latter part of the war, when the fighting became more open, the main defence consisted of a loose pattern of machine-gun strong points. These were simply circular pits, dug into the ground, camouflaged whenever possible, and of a sufficient size to hold the crew and ammunition.

Mining and Tunnelling

I have made reference to a mining and tunnelling detachment with the engineers. Defensive mining was carried out to protect our lines from attack underground by the enemy, and to ascertain his whereabouts underground, and his intentions. This form of warfare began in 1915; was very popular in 1916; and ceased in 1917, when we got the upper hand along practically the entire front.

The tunnellers would dig down into the ground and burrow along until they heard the hostile miner working. Listening sets were installed and incessant watch was kept. When we concluded the enemy was in a position to blow his mine we would endeavor to anticipate him. In such close proximity have the miners worked, that our listeners could frequently hear the Boches talking; and on several occasions we quietly broke into their tunnels, killed their miners, carried away anything that was valuable and destroyed the workings.

Offensive mining is carried out to attack the enemy's workings; to destroy enemy strong points; to defilade the fire from machine-gun nests which cannot be reached; to break a hole through the enemy's first defensive system; to blow communication trenches intended to connect our system with his; and to provide for our own troops a passage covered from view.

An attack of ours in which mining played a great part was at the battle of Messines, on June 7th, 1917, when we blew up, on the Messines and Wytchaete front, some twenty miles, practically destroying the enemy front-line system and so shocking the defenders that rapid progress on our part was possible. So completely did we demonstrate our superiority in mining in that battle that thereafter the enemy practically ceased this form of warfare. The decision was greatly welcomed by ourselves, because we believed that insufficient results were obtained from the enormous amount of work entailed. It was a form of warfare forced upon us by the enemy, and one which we most gladly gave up. The Canadian Corps had a good deal of experience with mining activity on the Vimy front, Hill 60, Hooge and Mont St. Eloi front.

Mining at the "Bluff"

Up to June, 1917, the day on which the battle of Messines was fought, the largest mine blown by either the Germans or the allies on the Western Front was blown at the "Bluff" during the latter part of July, 1916. The events in connection with this form an interesting story.

In February, 1916, the Germans had blown a mine under that portion of the Bluff nearest to their lines. It might be well to explain that the Bluff is the spoil bank from the Ypres-Comines canal. Immediately upon blowing the mine in February they attacked and seized the Bluff; were counter-attacked several times in the following few days, but unsuccessfully. They remained in possession of the Bluff until the next month—March—when they were driven off. The casualties on the British side, resulting from the operations in

February and March at this particular point, were about 4,400.

The Canadians took over these lines about the first of April, the 2nd Division extending their line northward, including Mount St. Eloi and up to the canal; the 1st Division, from the canal, including the Bluff, up to Mount Sorrel; and the 3rd Division, from Mount Sorrel to Hooge.

Towards the latter part of May the 1st Division turned over Mount Sorrel defences to the 3rd Division, and it was in this area the Germans made their very violent attack on June 2nd.

To enable the 1st Division to make the counter-attack, their troops were withdrawn from the Bluff sector, which was turned over to the 2nd Division, the 1st Division not getting back to that area until the latter part of July.

On resuming responsibility for the Bluff area, I sent for the mining officer and asked him the mining situation on the front. He informed me that we were almost sure to be blown underneath the Bluff, and that we might be blown under the Bean and Pollock. Upon this information, instructions were immediately issued to the brigade concerned, to hold the Bluff as lightly as possible, to prepare a crater-jumping party, to place additional machine-guns in position to cover the area in front of the Bluff, while the artillery were asked to lay their S.O.S. night lines to cover the Bluff. The brigade reported at 8 o'clock one evening that the instructions given had been carried out, when, strange to say, the Germans blew their mine that same night at 10 o'clock, making a crater 450 ft. long by 160 ft. wide.

A Canadian Victory

Before the earth had fallen, the crater-jumping party were on their way to consolidate the crater, the machine-guns immediately opened up, while all the artillery in the division came down with a crash on "No-Man's Land." The Germans, no doubt anticipating the same measure of success which accompanied their former effort in February, left their trenches in large numbers once more to seize the Bluff. They were caught in the machine-gun fire and barrage, and suffered very heavy casualties. This annoyed them very much, and they opened a heavy bombardment on our lines which they kept up practically all night. We were fortunate in getting off with only 42 killed and wounded during that night's operations, a very small number when compared with the number it had cost to hold our lines intact in the previous February and March.

There is another curious co-incidence in connection with this event: Shortly before 10 o'clock on the night in question, a young engineer officer, accompanied by a wiring party of about fifteen, was on his way to put out additional wire entanglements east of the Bluff. The sentry on duty told him that he ought to be careful as the Germans were going to blow a mine. The engineer officer asked him when, and strange to say the sentry answered: "About 10 o'clock to-night."

The engineer officer wrote a note to his company commander setting forth what he had just been told, asked for instructions, and despatched it to his company commander. While waiting for the reply, the mine went up, and the orderly who was delivering the message was the only one of the party not a casualty. The message sent by the engineer officer in question to his company commander is on file.

The Germans were so disappointed in their intentions that they delayed re-opening their mining operations in that vicinity. Our miners, anticipating such a thing, went out to "No Man's Land," which was here some hundreds of yards wide, sunk a shaft and were fortunate enough to break into the German mine gallery, so that the works there definitely passed into our possession. Some may say that this was luck, but it was the luck that usually accompanies foresight, energy and initiative.

Accommodation

Leaving the question of engineer services in the active work of defence, we come to accommodation; and to appreciate this we must remember that the Canadian Corps

was practically a moving city, with a population varying from 105,000 to 160,000 men and from 25,000 to 60,000 horses, the whole or part of which often moved on short notice. The provision of the necessary facilities for the existence of this moving city constituted an important problem. It involved the provision and erection of the necessary hutting for quarters for officers and men, and in winter for shelter for horses; the necessary sanitary arrangements, such as latrines, baths, laundries, etc.; the provision of water for man and beast; and the one hundred and one things which are required for the maintenance of such a population in the field.

Arrangements had also to be made for the reception of the necessary supplies, rations and forage, ammunition, etc. This involved arrangements for railway sidings; development and maintenance of well-defined traffic routes to enable the heavy traffic to move without interruption; transport of supplies and ammunition to dumps and refilling points, from which they were distributed; and at these dumps and refilling points, facilities had to be provided for means of access, suitable covering for winter, and protection from damage by bombs and shell-fire.

Arrangements required by the medical department for the handling of sick and wounded involved the provision of roads or tramways for their evacuation; also the construction of regimental aid posts, advance dressing stations, main dressing stations and casualty clearing stations.

Water Supply

Reference has been made to water supply. This involved the provision of water supply necessary for drinking, cooking and washing for the men, and water for the horses; while, in addition, arrangements had also to be made in case of having to move suddenly into a new area a large number of men and horses; an area in which, probably, little was known of the facilities for water supply. In passing, I may mention that an important feature of the question of water supply for horses was that they must all be watered three times a day; and the strain on the available supply came at approximately the same hour. Furthermore, as it was very uncertain what engines and pumps were available, methods had frequently to be improvised.

I remember that at Ecoivres we developed a very large water supply, installing our own pumps and laying hundreds of miles of pipe to distribute the water. These pipes were laid on top of the ground at the start, but as labor became available, they were buried. In some of our areas we had water laid to the front line trenches. At Fosse 6, near Vimy, our engineers developed a water supply capable of providing 3,000 gallons an hour; and at Fosse 3, near Hill 65, we were developing a water supply of 4,000 gallons an hour. One interesting thing which occurs to my mind in connection with the water supply was our system of baths. We aimed to give every man a bath once in eight days.

Roads

The construction and maintenance of roads was also another very important feature. There were many good roads in the country where we served; but during the war the traffic on them was much greater than what had been contemplated when the roads were built, with the result that in bad weather many of the roads broke up. They required the most constant care and supervision. Many of them were altogether re-built. In the forward areas, the difficulties were enormously increased; many of the roads were under enemy observation, and so no work could be done in the day time. As there was no traffic on them in the day time, it followed that we had to repair them when the traffic was most busy.

It was often found that additional roads had to be made. To do this quickly we advocated the construction of corduroy roads, or plank roads,—a suggestion which was not at all enthusiastically received. In fact it was pooh-poohed until we had demonstrated the worth of a plank road, after which many such roads appeared. I remember our application for planks to build such a road was refused. We then asked whether, if we could not get planks, we could be furnished

with a saw mill. This was given to us, and in Bois de Alleux we cut down the trees and made our own planks,—an example of resource and initiative for which our Canadians became famous. Many infantry tracks and mule tracks had to be constructed and well marked. The proper way to mark a road was something we learned from the Boche; many will well remember such signs as "O.U. Denain," etc.

Bridges

Closely associated with roads are bridges. Apparently, the only bridge which it was contemplated the engineers would be called upon to put in position, was one made of pontoons; and most faithfully the sappers hauled their pontoons for many months, during which time it looked as though no need for them would ever arise. The only use to which I saw the pontoons put in the early days of the war was to furnish a grandstand at a sports meeting, or a platform for a boxing-bout. During the last hundred days, however, the pontoons well repaid the care they had been given and the practice of putting them into position. In the last hundred days the bridging problems confronting the engineers were very numerous and varied; while the difficulties were much increased by the thorough demolition of the original structures.

When the Germans were driven back they succeeded, in most instances, in destroying their bridges; not only were the girder sections cut by explosives and dropped into the river or canal, but the abutments were completely destroyed, and large craters blown in the approach roads. These craters had all to be filled or bridged before the heavy bridging material could be rushed forward. The reconstruction of these bridges was necessary to the development of our communications, and they were a tempting target for the enemy. As a general rule, they had to be erected on the original site, as otherwise a traffic diversion and road had to be made, and this involved loss of time. The bridging operations may be divided into three phases, viz: (1) Crossings for infantry; (2) crossings for first line transport, i.e., field guns, horse transport, etc.; (3) heavy bridges to take tanks, 6-in. guns, lorries, etc.

Infantry Crossings

These consisted of improvised crossings, or cork pier foot bridges, over the damaged structure. Sufficient slabs of cork to give the requisite buoyancy were baled together with wire netting and nailed across the stringers, and the bridge so formed took infantry across in single file. The German foot bridge was similar in many respects, with the exception that instead of cork they used hollow wrought-iron cylinders. These were more easily handled, but they were very easily punctured and the bridge put out of commission.

The pontoons and trestle equipment of the army proved itself invaluable for crossing the canal system; and a bridge of 90-ft. span could be erected in 1 to 1½ hrs. under adverse conditions. As an example of what can be done in speedy pontoon bridge construction by trained sappers, the following may prove interesting: The 12th Field Company, Canadian Engineers, erected 10 bays and one shore bay, total length 155 ft., of medium pontoon bridge, in 9 mins. and 48 secs. This was in England, and all the pontoons and equipment were unloaded and sorted out on the beach, but none were in the water prior to construction. Over the rivers various expedients were used; but, in general, trestle bridges were constructed with any material available.

Heavy Bridges

The construction of heavy bridges over the canals presented many problems; the latest type of tank had a live load of 37 tons, and the new 6-in. gun an axle load of 17 tons. The canals were approximately 90 ft. wide, and the clear span necessary about 108 ft. Clear span bridges were often required when it was impossible to remove the damaged structure and its presence in the bottom of the canal prevented the use of trestles and cribbing, at least for speedy construction.

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 oxy-acetylene 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 welcome 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 facilitating 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. organiza-

tion 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 supplies, 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 had 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 result 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 search-lights 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

often went up at night seeking just such a target. G.H.Q. gave us the search-lights and we trained personnel to operate them, using for that purpose P. B. engineers. During the month of September, 1918, I saw five hostile aeroplanes brought down at night by our planes; they were first located and blinded by the search-lights operated by the Canadian engineers.

Another thing we asked the engineers to supply and supervise was the camouflaging of gun positions, new defensive works, headquarters, etc. Material was manufactured at the Corps Camouflage Park in order to supplement the supply from the base, and also to insure a more perfect simulation to local conditions. The manufacture of camouflage and its erection was all done under the supervision of the Corps Engineer Camouflage Officer. It gave scope for great ingenuity, and many interesting results were obtained.

Stores and Workshops

Frequently reference has been made to engineer stores. It was impossible to purchase any stores or material locally, as the country had been stripped early in the war, and the French authorities reserved to themselves everything that was left. In consequence the requirements of the corps as regards engineer stores had to be foreseen, estimated, demanded many weeks ahead, and obtained through regular army channels from outside sources. These engineer stores included cement, corrugated iron, felt roofing, steel joists and rails, posts and wire for entanglements, wire netting, hurdles, canvas and frames for revetting, trench boards, bricks, baths, stoves, ironmongery, timbers of all sizes, electrical stores, mining and tunnelling stores, water pipes and fittings, pumps and, as the auctioneer says, "other articles too numerous to mention."

These stores and materials were received in bulk at corps engineer parks established at broad-gauge railheads. From there they were allotted to corps or divisional engineer services and transported by light railways, corps tramways, lorry or wagon transport to advanced corps engineer parks, divisional parks, advance divisional, brigade and battalion dumps.

At an engineer park a workshop was established wherein, as far as possible, timber was resawn to sizes required, made up into standard designs for mining frames, revetting frames, trench boards, notice boards, gun emplacements, sectional huts, targets, trench bridges, infantry bridges, artillery bridges, etc. In addition to saw mills, tinsmith and plumber shops, blacksmith shops, machine shops and paint shops were in operation, producing articles which could be obtained in no other way, and were produced here in order to save divisions as much work as possible. At first, these shops were operated entirely by "A" category men, but latterly we formed a unit known as the Artisan Company, or the P.B. Company, made up of men who had become casualties with engineer units and had been placed in a lower category than class A. This unit was utilized in running the corps workshops, thus relieving class A sappers for work in the forward area. In this manner N.C.O.'s and sappers who had previous front-line experience were utilized to the best advantage in the construction of "U" frames and revetting, and in handling all articles of trench stores with the use of which they were familiar. By standardizing designs and concentrating the work in the corps workshops, the output was greatly increased and a big load taken off the division. The unit performed a good deal of useful work and completely justified its existence.

Maps

Another interesting section was the mapping section. Each brigade and each division had a small map section, but the most of the work was done by the mapping section of the corps. In the Canadian Corps we had a large, thoroughly organized intelligence section, seeking to get information from the enemy by every possible means: By aeroplane photographs, by reconnaissance in aeroplanes, from infantry and artillery observation posts, from special observation posts, by raids, by questioning former residents of the country, and

by every means which the human mind could suggest. This information was put on maps. Each division employed the same method, so that one division relieving the other would find itself in complete possession of all the information available regarding the hostile country opposite.

In the early part of the war we had very few maps. I well remember the very rough sketches turned over to us in 1915 when we entered the Hill 63 and Ploegstreet area. If a battalion commander were lucky, he might be given a rough map of his front line. His unfortunate adjutant, whether an artist or not, had to make copies for the company commanders. In the latter months of the war every officer and every N.C.O., and sometimes every man, was given a map or plan of the area over which he would attack.

There were two other exceedingly important sections of the engineer services, and they were by no means the least interesting: The corps survey section and the signallers. However, I will make no further reference here to either, as the work of each would require extensive detailed description.

Battle of Bourlon Wood

Before closing I wish to set forth in some detail the part played by the engineers in the battle of Bourlon Wood. The engineer preparations for the Bourlon Wood operations were undertaken on five days' notice, and were exceedingly difficult, owing to the nature of the ground. On the front over which the Canadians attacked, the way was barred by the Canal-du-Nord, 100 ft. wide, with banks up to 15 ft. in height, the water in many places being over 8 ft. deep. The ground sloped from the south to the north, and about half of the front over which the Canadian Corps attacked was covered with a difficult marsh, 1,000 ft. wide in places. The ground on both sides sloped towards the canal, and the bare, glacier-like slopes were almost devoid of cover of any sort. The famous feature, Bourlon Wood, dominated the whole situation, and gave observation over all movement, by day, for miles inside the Canadian lines. The canal and the approaches to it were strongly defended by every artifice of barbed wire and machine-gun nests cunningly placed. Rows of trenches with splendid gun positions were on the enemy's side. In his retirement to the line of the Canal-du-Nord the enemy had destroyed all bridges over the canal, and on the main roads had blown huge mine craters, showing up clearly in all aeroplane photographs. The front line of the Canadians was, roughly, parallel to the canal and about 500 yds. from it. This was only an outpost line, as the whole situation was dominated from the eastern bank of the canal, and the slightest movement brought heavy shell-fire and machine-gun fire from the Boche.

Preparations for the Attack

The problem confronting the engineers in preparing for this attack involved the repair of roads demolished by shell-fire; the pushing forward of cross-country tracks for infantry and horse transport to the front line to facilitate the delivery of ammunition, stores and supplies; the provision of engineer materials of all sorts; and the rapid construction of improvised headquarters for battalions, brigades, divisions, etc., and of dugout accommodation and shelters of all descriptions. A difficult question was the provision of water supply for the large number of horses, approximately 40,000, assembled in a very congested area.

The problem confronting the engineers in the attack was to get the infantry and the guns over the canal in the face of enemy barrage, and to provide sufficient facilities in the way of roads, bridges, tramways, etc., which would ensure the sustained supply of ammunition for the guns, as well as of stores, munitions and rations for the large number of troops engaged. Every detail in the preparations was worked out most carefully, and as it was clear that the enemy's barrage would naturally fall on the line of the canal and be retained there, the following were provided for: Seven infantry footbridges of an unsinkable type, and ten crossings for guns and horse transport (five of which had to be developed at once for heavy traffic, even while the continuous

stream of guns and ammunition wagons were pouring over them).

Tramways had to be pushed forward; and water supply had to be developed in the forward area for the hosts of men and horses moving forward on captured ground.

Provision had to be made for a rapid examination of roads along which the guns would proceed to their new positions, and a rapid reconnaissance had to be made for concealed mines and bomb traps in dugouts, cellars and in all places which would be of value as cover for men, and for land mines on the roads demolished by shell-fire.

Arrangements had to be made for getting forward the necessary screw-stakes, barbed wire, picks and shovels to enable our men to consolidate the position they had gained, and assistance had to be given them in this consolidation.

Entire Operation Very Successful

Before zero hour 16 miles of roads had been repaired up to the front line and seven miles of tramways constructed. On these tramways over 3,000 tons of ammunition per day were being delivered to advanced dumps and gun positions; the requisite water supply was provided for the huge concentration of horses, and all necessary arrangements were completed.

After zero hour all crossings were put through successfully in spite of the heavy rifle and machine-gun fire. The attack kicked off at 5.20 a.m., and the first gun crossed the canal at 8.40 a.m. The other crossings were completed at various times during the day, depending upon the fluctuations in the fight and the extent to which the work was exposed to heavy and concentrated shell-fire. Owing to the nature of the ground and the heavy traffic which would immediately be thrown upon these crossings, it was practically impossible to consider crossings at any place except where good roads existed. These crossings were well known to the enemy and were naturally subjected to heavy shell-fire. Progress was slower in the northern half of the front, as it took a much longer time to clean up machine-gun nests in the extensive marsh, and the town of Marquion held out for a long time. The gun positions north of the Sensea canal were all able to enfilade the canal for three-quarters of the front attacked.

The engineers went over with the infantry to get their footbridges across; and the engineer wagons, with their six-horse teams, were pushed forward so rapidly in several cases that all the horses were killed by machine-guns, and the men got their materials down to the bridge sites by manhandling the wagons along after the horses had been killed. In one case a party of Boche machine gunners, who had evidently been overlooked by the mopping-up parties, emerged from some concealed tunnel or dugout and attacked the engineer party attempting to bridge the canal. The engineer officer in charge took part of his men and beat off the attack, and at the same time kept on with the construction of the bridge without interruption.

Record in Bridge Construction

The bridges constructed were of all types: Pontoon trestle, heavy pontoon, and, lastly, heavy steel bridges for all traffic.

A remarkable record was made in the erection of two heavy steel bridges of 110-ft. span in spite of heavy shell-fire and machine-gun fire. The materials for the two bridges were got on to the site about two o'clock in the afternoon. The approaches were prepared and the bridges erected and open for heavy traffic in 12 hours' actual work. This is considered to be a record. In all, three heavy traffic bridges of approximately 110-ft. span were placed across the Canal-du-Nord, two of them being completed in about 12 hours' actual working time and one in 24 hours' time.

By 2 p.m. three new pumping installations had been installed on captured ground, and sufficient horse-troughs erected to water 5,000 horses an hour. All materials were got forward to the infantry, and the positions gained were consolidated. About three miles of tramways were constructed and brought into operation.

The battle of Bourlon Wood was an engineers' battle. The success of the whole operation depended upon the speed with which the necessary crossings of the Canal-du-Nord were provided, and the way in which they were maintained and improved during the day, so as to enable the guns and infantry to be maintained in the position which they had reached in their advance.

It was in this battle that a sapper won the V.C. I refer to Capt. Mike Mitchell, of the 3rd Battalion of engineers, who hails from Winnipeg. Capt. Mitchell was awarded the V.C. for conspicuous gallantry and devotion to duty on the nights of October 8th and 9th, 1918, at the Canal de L'Escaut, just northeast of Cambrai, when his division (the 2nd Division) got around Cambrai from the north, outflanking it, and by so doing enabled the 3rd Division to push through the town in the early morning of that day.

Capt. Mitchell led a small party at the head of the first wave of infantry in order to examine the advance bridges on the line of approach, and, if possible, to prevent the enemy from destroying them. On reaching the canal he found the first bridge already blown up. Under a heavy barrage he crossed to the next bridge, where he cut a number of lead wires. Then, in total darkness and unaware of the position or strength of the enemy at the bridge-head, he dashed across the main bridge over the canal. This bridge was found to be heavily charged for demolition; and while Capt. Mitchell, assisted by his N.C.O., were cutting the wires, the enemy attempted to rush the bridge in order to blow up the charges. He at once dashed to the assistance of his sentry, who was wounded, killed three of the enemy, captured twelve, and removed the charges which he knew might have been fired at any moment by the enemy.

Reorganization of "Canadian Engineers"

The war is over; and, in the light of experience gained during the past five years, the "Canadian Engineers" of the active (non-permanent) militia are about to be reorganized. There are financial limitations, and no drastic changes are contemplated. It is hoped, however, that it may be possible to build up a strong reserve composed of technically qualified engineers who have seen service in the field, and who in time of need would at once be available for the performance of military duty.

In Canada works of construction are ever in progress; engineers with practical experience are readily obtained; and in no country in the world is it easier to mobilize at short notice units required for engineer services. For these and other reasons it is proposed to limit training, in time of peace, to field companies, field troops and fortress companies, and, for the present at any rate, not to proceed with the organization of the more highly technical units.

On the other hand, I make the suggestion that to the corps of the Royal Canadian Engineers there might be assigned, in addition to its military functions, duties not dissimilar to those performed by the engineers of the United States army. The corps might be charged with the execution of national works; that is to say, the carrying out of river and harbor improvements, the erection of public buildings, the construction of roads, railways and canals; and it might also undertake all coast and interior surveys required for government purposes.

In conclusion, a nation at war must be prepared to make the fullest use of its engineering resources; it must be ready to avail itself of all modern developments in engineering science. "It is, therefore, of the first importance" (I quote from a recent report on the organization of the Royal Engineers) "that a careful study of the manner in which engineering resources can be utilized in war should form one of the paramount duties of the higher direction of the army, both in war and in peace; and that there should exist an organization by which such matters can be definitely brought to the notice of the responsible authorities, together with a machinery by which the whole resources of the engineering profession of civil life can be brought to bear on the solution of military problems and made available in war for the service of the army."

Joint Commission to Study St. Lawrence Schemes

United States and Canadian Governments Refer Questions of Power Development and Canalization to International Joint Commission in Nine Questions—Instructions to Engineers in Charge—Detailed Text of Reference—Letter from Mr. Rowell to Mr. Magrath

UNDER the provisions of Article 9 of the treaty of January 11th, 1909, the governments of Great Britain and the United States have agreed to submit to the International Joint Commission certain questions relating to the proposed canalization of the St. Lawrence river and the international development of the water power resources of that river.

The questions submitted and the terms of the reference are set forth in a letter addressed to the chairman of the Canadian section of the Commission by Hon. N. W. Rowell, acting secretary of state for external affairs. An identically worded note has been transmitted to the chairman of the United States section of the Commission by Mr. Lansing, the secretary of state of the United States.

The letter from Mr. Rowell to Mr. Magrath is as follows:—

DEPARTMENT OF EXTERNAL AFFAIRS, CANADA
Ottawa, January 21, 1920.

C. A. Magrath, Esq.,
Chairman, Canadian Section,
International Joint Commission,
Ottawa.

Sir:—

I have the honor to inform you that the governments of the United States of America and of the Dominion of Canada, under the provisions of Article IX. of the Treaty of the 11th of January, 1909, between the governments of the United States and Great Britain, herewith refer certain questions, as set forth below 'involving the beneficial use of the waters of the St. Lawrence river, between Montreal and Lake Ontario, in the interests of both countries, and, in general, the rights, obligations, or interests of either in relation to the other, or to the inhabitants of the other along their common frontier.'

It is desired that the said questions be made the basis of an investigation to be carried out by the International Joint Commission, to the end that the said Commission may submit a report to the two countries covering the subject matter of this reference, together with such conclusions and recommendations as may be considered pertinent in the premises.

Question 1.—What further improvement in the St. Lawrence river, between Montreal and Lake Ontario, is necessary to make the same navigable for deep draught vessels of either the lake or ocean-going type; what draught of water is recommended; and what is the estimated cost?

In answering this question the Commission is requested to consider:—

(a) Navigation interests alone, whether by the construction of locks and dams in the river; by side canals with the necessary locks; or by a combination of the two.

(b) The combination of navigation and power interests to obtain the greatest beneficial use of the waters of the river.

Question 2.—Which of the schemes submitted by the government or other engineers is preferred, and why?

Question 3.—Under what general method of procedure and in what general order shall the various physical and administrative features of the improvement be carried out?

Question 4.—Upon what basis shall the capital cost of the completed improvement be apportioned to each country?

Question 5.—Upon what basis shall the costs of operation and maintenance be apportioned to each country?

Question 6.—What method of control is recommended for the operation of the improved waterway to secure its most beneficial use?

Question 7.—Will regulating Lake Ontario increase the low water flow in the St. Lawrence Ship Channel below Montreal? And if so, to what extent and at what additional cost?

Question 8.—To what extent will the improvement develop the resources, commerce and industry of each country?

Question 9.—What traffic, both incoming and outgoing, in kind and quantity, is likely to be carried upon the proposed route both at its inception and in the future? Consideration to be given not only to present conditions, but to probable changes therein resulting from the development of industrial activities due to availability of large quantities of hydraulic power?

Pending the receipt of plans, estimates and other engineering data necessary for the final consideration of this reference, the Commission is requested to hold such public hearings as may be considered necessary or advisable in order to obtain all information bearing, directly or indirectly, on the physical, commercial and economic feasibility of the project as a whole.

To facilitate the preparation of the desired report each government will, from its official engineering personnel, appoint an engineer with full authority to confer with a similar officer of the other government for the purpose: First, of acquiring, each in his own country, such data as may be found necessary to supplement the existing engineering data and surveys; and second, of preparing complete outline plans for the estimates of the cost of the proposed improvement, including the value of all property, easements, damages and rights connected therewith. These plans and estimates are to be submitted to the Commission as soon as practicable but not later than one year from the date of appointment and the Commission is requested to forward to the two governments its final report with recommendation not later than three months thereafter. A copy of the instructions furnished these engineers is attached hereto.

I have the honor to be,
Sir,
Your obedient servant,
N. W. ROWELL,
Acting Secretary of State
for External Affairs.

Instructions to Engineers in Charge

St. Lawrence River, Montreal to Lake Ontario Navigation Project.

You are hereby designated to take charge of the survey of the St. Lawrence river, Montreal to Lake Ontario, for the purpose of preparing plans and estimates for its further improvement to make the same navigable for deep-draught vessels of either the lake or ocean-going type, and to obtain the greatest beneficial use from these waters.

The surveys, plans and estimates are to be submitted to the International Joint Commission within twelve months and are to assist the Commission in answering the questions of a reference to the matter under the provisions of Article IX. of the treaty of the 11th January, 1909, between the United States and Great Britain. (A copy of the letter of reference is enclosed for your information.)

It is desired to expedite the completion of the duty confided to you, by utilizing all available surveys and other reliable information, whether derived from public or from private sources. That a proper basis of procedure may be agreed upon in the first instance, and the field work and the preparation of plans and estimates promptly and efficiently carried on thereafter, you are requested to confer fully

and freely with (*name of individual to be inserted*), who has been designated to take charge of corresponding duties on behalf of the (*name of country to be inserted*), to arrange for the division of the field work and for co-operation in the preparation of the desired plans and estimates. While it is clear that the field work necessary to complete existing information may properly and advantageously be divided, co-operation and unity in the preparation of plans and estimates seem preferable.

It will be noted that the reference to the Joint Commission contemplate four different general schemes or methods of improvement as follows:

- (a) By means of locks and navigation dams in the river.
- (b) By means of locks and side canals.
- (c) By a combination of the two preceding methods.
- (d) By means of locks and power dams.

The plans and estimates should definitely cover these four general schemes or methods of improvement, but other variations of them may be considered and, if deemed desirable, also presented to the Commission.

The channels to be considered are to be of 25 and 30 feet depth at low water, and the plans and estimates should be prepared correspondingly. A choice between them will, under the terms of the reference, be made by the Commission.

As detailed plans cannot be prepared within the time limit of one year fixed for this work, it is desired that merely outline plans and lump sum estimates, based upon experience from similar work—such as the enlargement of the Welland Canal, and power development at Niagara Falls, should be submitted.

The general schemes should be furnished to the Commission, showing—first, the best for navigation alone and, second, for the most efficient utilization of the waters of the St. Lawrence for navigation and power, together with the approximate costs thereof.

As the handling and disposal of ice is a fundamental difficulty on the St. Lawrence river, the arrangements regarded as being necessary for this purpose should be discussed as well as those recommended for ice disposal during the construction period and thereafter.

Regulation of the levels of Lake Ontario so as to equalize the discharge of the St. Lawrence may be desirable in the interest of navigation, of ice disposal, and of power development. If the plans include any provisions for such regulation, an explanation should be furnished to make clear just what is proposed.

Finally, you are requested to keep the International Joint Commission fully advised of your progress and to maintain close and sympathetic touch with it so as to insure complete co-ordination.

Construction Industries Conference at Ottawa

Constitution Adopted and Permanent Form of Organization Effected—Reports on Labor, Standard Practices and Business Relations — New National Association of General Contractors Formed with J. B. Carswell as President

FORMAL organization of the Association of Canadian Building and Construction Industries was perfected at a conference of general contractors, sub-contractors and supply dealers, held Monday, Tuesday and Wednesday of last week at Chateau Laurier, Ottawa. A comprehensive constitution and by-laws were adopted and a new executive elected as follows:—

President, J. P. Anglin, of Anglin, Norcross, Ltd., general contractors, Montreal; first vice-president, J. B. Carswell, of the Carswell Construction Co., general contractors, Toronto; second vice-president, James Mackie, of the James Mackie Co., Ltd., Winnipeg; secretary, James Phinnemore, painting contractor, Toronto; treasurer, G. A. Crain, general contractor, Ottawa.

The attendance at the conference last week was not so large as at the first conference, which was held in November, 1917, at Ottawa, nor was there quite the same enthusiasm that characterized the first conference, but on the other hand there was an expressed determination to carry out the organization of the association upon business-like lines.

The attendance totalled 86. Of these, 34 were from Ottawa; of the other 52, some came from as far west as Calgary and some as far east as St. John, N.B. There were 39 general contractors at the meeting, of whom 11 were from Ottawa and 28 from outside points. Of the 14 sub-contractors in attendance, 8 were Ottawa men; and of the 27 supply dealers, 13 were from outside of Ottawa.

Following is a list of general contractors who attended the conference: J. S. C. Adamson, Ottawa; J. P. Anglin, Anglin-Norcross, Ltd., Montreal; J. B. Carswell, Carswell Construction Co., Toronto; A. W. Cassidy, A. W. Cassidy & Co., Saskatoon; W. Stewart Christie, Alex. Christie & Son, Ottawa; K. D. Church, Church, Ross & Co., Montreal; G. A. Crain, Ottawa; W. Milne Crockett, Eastern Townships Construction Co., Sherbrooke; A. H. Dancy, H. N. Dancy & Son, Ltd., Toronto; A. Sidney Davies, Atlas Construction Co., Ltd., Montreal; F. H. Dickenson, Inland Construction Co., Toronto; John Flood, John Flood & Sons, St. John, N.B.;

John Foley, Ottawa Construction Co., Ottawa; R. J. Fuller, John V. Gray Construction Co., Toronto; Jos. Gosselin, Jr., Jos. Gosselin, Ltd., Quebec; Hugh Graham, Alex. I. Garvock, Ottawa; H. T. Hazleton, Hazleton and Walin, Ltd., Winnipeg; J. F. Heaney, Lockwood, Greene & Co., of Canada, Ltd., Montreal; F. E. Healy, Pigott-Healy Construction Co., Hamilton; P. E. James, P. H. Secord & Sons Construction Co., Ltd., Brantford; Robt. J. Lecky, Regina; Sir F. O. W. Loomis, D. G. Loomis & Son, Montreal; D. H. Lunam, Poole Construction Co., Ltd., Regina; E. A. Markham, Poole Construction Co., Ltd., Regina; Jos. F. Meagher, Ross, Meagher Co., Ottawa; D. McArthur, McArthur Bros., Ottawa; R. McArthur, McArthur Bros., Ottawa; Thos. McLaughlin, Ottawa; Norman McLeod, Norman McLeod, Ltd., Toronto; Joseph M. Pigott, Pigott-Healy Construction Co., Hamilton; J. E. Poirier, Ottawa; S. Pritchard, Moose Jaw; Jno. Rutherford, London; S. F. Smith, Ottawa; J. A. Strumbert, D. G. Loomis & Son, Montreal; J. C. K. Stuart, Stuart & Sinclair, Hamilton; J. K. Thomas, Thomas-Jamieson-McKenzie, Ltd., Calgary; Wm. Wilson, Wilson & Wilson, Ltd., Regina; and W. H. Yates, W. H. Yates Construction Co., Ltd., Hamilton.

The "sub," or trade contractors, who were at the conference were: P. Ackroyd, electrician, Ottawa; H. L. Allen, electrician, Ottawa; W. E. Dillon, W. E. Dillon Co., Ltd., Toronto; R. Hooper, Hooper Bros., Ottawa; J. W. A. Kirk, Ottawa Cut Stone Co., Ottawa; W. A. Mattice, Dominion Bridge Co., Ottawa; James Mackie, James Mackie Co., Ltd., Winnipeg; Wm. McInenly, Mac Electrical Co., Ottawa; W. J. Nicholson, National Fireproofing Co. of Can., Ltd., Toronto; R. K. Palmer, Hamilton Bridge Works Co., Ltd., Hamilton; Jas. Phinnemore, painter, Toronto; James Ritchie, cut stone contractor, Ottawa; E. D. Spence, trade contractor, Ottawa; and W. N. Talbot, W. N. Talbot Co., Ltd., Regina.

Following are the representatives of manufacturing firms or supply dealers who were at the conference: J. C. Adams, Canada Cement Co., Toronto; Fred Armstrong, Port Hope Sanitary Mfg. Co., Toronto; Ernest M. Barrett, Barrett Bros., Ottawa; W. P. Baxter, James Robertson Co., Ltd.,

Montreal; W. W. Cuzner, Cuzner Hardware Co., Ottawa; A. J. Dickey, C. A. Dunham Co., Ltd., Toronto; A. A. Dion, Ottawa Electric Co., Ottawa; C. W. Marshall, Canadian Agency & Supply Co., Ottawa; O. Forest, Ottawa Fireproof Supply Co., Ottawa; P. A. Galarneau, Citadel Brick Co., Ltd., Quebec; G. B. Greene, General Supply Co. of Can., Ltd., Ottawa; T. S. Kirby, T. S. Kirby Co., Ltd., Ottawa; J. M. G. Crockerby, Alex. McArthur & Co., Ltd., Montreal; W. C. Massiah, Sherwin-Williams Co., Ltd., Montreal; W. A. Mattice, Dominion Bridge Co., Ltd., Ottawa; W. H. McIntyre, Ottawa Gas Co., Ottawa; W. J. Nicholson, National Fireproofing Co., Ltd., Toronto; R. K. Palmer, Hamilton Bridge Works Co., Ltd., Hamilton; Hugh Peel, Pedlar People, Ltd., Ottawa; Ernest Ramus, Builders' Sales, Ltd., Ottawa; W. A. Rankin, hardware dealer, Ottawa; C. G. Secord, Brantford Roofing Co., Ltd., Brantford; J. H. Shaver, C. A. Dunham Co., Ltd., Toronto; Chas. Smallpiece, Taylor, Forbes Co., Ltd., Montreal; and J. C. G. Stuart, Pedlar People, Ltd., Oshawa.

First Session

President J. P. Anglin opened the first session at 10.45 a.m., Monday, February 2nd, and announced that the main work of the conference would be accomplished by four committees, as follows: (1) Constitution and by-laws; (2) labor; (3) business relations; and (4) standard practices. It was moved by Mr. Phinnemore, seconded by Mr. Armstrong, that the national council should appoint three members on each of these committees and that not less than two and not more than five additional members should be appointed by each of the three different sections of the association, namely, general contractors, trade contractors and supply dealers. This was carried, but at a later meeting Mr. Armstrong moved that each committee be limited to seven in number. His motion was carried after considerable argument. The committees as finally reported were as follows:—

Committee on constitution and by-laws: H. T. Hazelton (chairman), K. D. Church, J. A. Pigott, W. N. Talbot, N. McLeod, E. A. Markham and W. R. Carr.

Committee on labor: Jos. Gosselin, Jr. (chairman), Wm. Wilson, A. H. Dancy, G. A. Crain, James Mackie, S. Pritchard and R. J. Fuller.

Committee on business relations: R. J. Lecky (chairman), W. H. Yates, W. A. Mattice, C. F. Smallpiece, D. H. Lunam, Chas. Secord, J. M. G. Lockerby.

Committee on standard practices: J. Phinnemore (chairman), J. K. Thomas, J. A. Stuart, W. E. Dillon, A. W. Cassidy, P. E. Galarneau and J. B. Carswell.

W. A. Mattice, of Ottawa, was elected chairman of the committee on local arrangements, with power to select his own committee. G. A. Crain, of Ottawa, was appointed chairman of the committee on conference finances, with power to select his own committee. At 11.30 a.m. the session adjourned for a meeting of the national council, to which all of the other delegates present were invited.

Meeting of National Council

In opening the meeting of the council, Mr. Anglin said that although everyone in the building and construction industries had been notified of the conference, the attendance was somewhat disappointing; that there did not appear to be the same need, or feeling toward the conference as there was in the fall of 1917, when the first conference had been called practically at the request of the government. Reconstruction was then on everyone's tongue, and the enthusiasm was greater than the association could ever hope to obtain again. At that time the contractors and supply men were not busy, but now business is looking for them. It had been intended to hold this second conference last fall, but various developments had interfered, among which was the trouble at Winnipeg. Mr. Anglin announced that the association now has a charter.

No business was transacted at this meeting of the national council other than the appointment of three members for each of the four main committees, but it gave the members present a chance to exchange ideas and to state the conditions of the building industry in various parts of the country. The meeting adjourned about 1 p.m. for a luncheon,

which was attended by a number of Ottawa engineers, contractors and business men.

Hon. N. W. Rowell, president of the Privy Council and acting secretary of state for external affairs, addressed the delegates after luncheon, reviewing the work of the recent international labor conference at Washington, D.C. Mr. Rowell touched briefly upon each of the main points brought before that conference, and told what stand the Canadian delegates had taken on each point, and why. He reviewed the effect of the decisions of the conference on labor conditions throughout the world.

Second Business Session

At 3 o'clock Monday afternoon the business session was resumed with the vice-president, Fred Armstrong, of Toronto, in the chair. Mr. Anglin delivered his presidential address, which will be published in next week's issue. The constitution was then considered clause by clause, and there was a very lengthy discussion on many of the proposed clauses, with the result that no other business was transacted that afternoon. After all the members present had thoroughly expressed their views, the final revision of the constitution was left to the committee.

The general contractors held a meeting Monday evening, the minutes of which were confidential and not for publication. Conditions throughout the industry were discussed in detail. H. T. Hazelton, of Hazelton & Walin, Ltd., Winnipeg, presided.

At 10 o'clock Tuesday morning Mr. Anglin called the conference to order again, and the secretary presented various letters and telegrams explaining the unavoidable absence of some of the members of the national council. The four major committees were completed by the selection of the members above mentioned, and the conference adjourned to allow these committees time to prepare their reports. A conference of the sub-contractors was held at 12 o'clock noon, the minutes of which were not for publication. At the luncheon the principal speaker was John C. Frazee, secretary of the National Federation of Construction Industries of the United States. An abstract of Mr. Frazee's speech will be published in next week's issue.

Senator Gideon Robertson, Minister of Labor, expressed his appreciation of Mr. Frazee's remarks and said that the future was indeed bright and hopeful if a Canadian association can be formed to do all of the things in Canada that the National Federation of Construction Industries has done in the United States. The minister outlined what his department has done during the past year to remedy unemployment, referring especially to the chain of employment offices that the government has opened throughout Canada. These offices have found positions for 226,000 men and women, of whom 37% have been returned soldiers. He said that the dislocation of business after the war had not been as serious as expected, and that the government is now very confident of the future for Canadian business firms.

At 8 p.m. the conference was resumed with President Anglin in the chair. Upon motion by R. J. Leckie, a telegram was sent to J. C. Frazee, expressing the association's appreciation of his address. Mr. Crain announced that his conference finance committee consisted of Messrs. Smallpiece, Dillon, Mackie and Thomas.

Report on Constitution

Mr. Hazelton, chairman of committee on constitution and by-laws, presented the preliminary report of that committee. It had been proposed by the conference that the name of the association be changed to the Association of Canadian Construction Industries, but Mr. Hazelton's committee recommended that if any change be made that the name "Federation of Canadian Construction Industries" be adopted, but in view of the expense of amending the charter, it was recommended that the name be left as it is for the time being.

The committee recommended that the membership be divided into two classes: (a) Individual, and (b) collective; and that the fee for each class be \$25 per annum. Individual membership may be obtained by any firm or cor-

poration engaged in the construction industry. Collective membership may be obtained by any group or association of individuals, firms or corporations, whether local, provincial or national. Plural memberships may be obtained by any individual or collective member who wishes to support the association to the extent of more than \$25 per annum. Each membership is entitled to one vote in the affairs of the association, provided that it is represented individually at the annual meeting.

The committee recommended that the local groups in the association get together and form provincial groups, and that each province nominate three representatives to the national council, which council is to be made up entirely of these members so nominated, together with the elected executive officers. The nominating committee is to consist of one member from each province represented at the annual meeting. The committee recommended the elimination of the arrangements which had been originally proposed for arbitration between members, to decide disputes relating to any commercial matter or practice, as it was thought that such arrangements were not necessary or in the best interests of the association at present.

Report on Business Relations

The labor committee reported progress. The business relations committee, of which Mr. Yates was chairman and Mr. Leckie secretary, presented the following report:—

"After considerable amount of discussion as to the lines on which the association could benefit the members as a whole, the following recommendation is respectfully made:—

"That a standing committee be formed to take up the whole subject of business relations (1) between the general contractors, architects and owners; (2) between the general contractors, sub-trades and supply houses; (3) between the sub-trades, supply houses, architects and owners.

"That this committee get in touch with all branches and exchanges throughout Canada and obtain their opinions on this subject, also to state their special requirements along these lines.

"That this committee then report its findings with suggestions to the national council of this association, who shall in turn take whatever action they may see fit to improve business relations along the lines as set forth above.

"It is suggested for the guidance of this committee, that the following may be considered:—

"1.—That all members of this association, whether through branches or directly, shall bind themselves to as far as possible deal only within the association.

"2.—That some system may be worked out whereby the general contractor shall be protected in return for his undertaking to deal only within the association.

"3.—That the uniform contracts, which it is hoped will become universal when they are drawn up, shall include a contract form between the sub-contractor, the supply house and the general contractor along the lines of the uniform contract now in use in Winnipeg, to especially protect the sub-contractor and supply houses as to their payments being made promptly."

Report on Standard Practices

J. B. Carswell, chairman of the committee on standard practices, presented the following report:—

"Forms of Tenders and Bids and Question of Unit Prices.—The committee recommends: (a) That no subdivision of tenders or unit prices be given to architects or engineers before the contract is closed or before written assurance has been received that a contract will be entered into.

"(b) That architects and engineers be notified that general contractors will not submit bulk competitive tenders where the said architect or engineer is at the same time taking bids on his work by trades.

"(c) That the practice of giving certified cheques with bids, both on private and public work be strongly discouraged, and it is suggested that in view of the large deposits which have to be made by bonding companies with the provincial and Dominion governments, that bid bonds be substituted.

"Standard Forms of Contract.—It is recommended that a committee be immediately formed, consisting of three responsible architects, appointed by the Royal Architectural Institute of Canada, and three members of this association, and that legal advice be obtained by the architects on the one hand, and this association on the other hand, to cooperate in drawing up a standard form of contract and general conditions which can be used throughout the Dominion.

"Further, that a standard form of sub-contract be prepared, which form should bind the sub-contractor to the same conditions of contract as the general contractor, and assure the sub-contractor of the same privileges and conditions as accrue to the general contractor.

"Penalties and Bonuses.—Inasmuch as architects and engineers invariably reserve the right to dismiss any contractor for incompetency, it is recommended that penalty and bonus clauses should be eliminated entirely from construction contracts.

"Straight Contract and Cost-Plus Work.—It is recommended that lump-sum contracts be strongly discouraged until existing conditions become more normal, and that the 'cost plus a percentage' or 'cost plus a fixed or sliding fee' form of contract be advocated as the only fair and reasonable basis from the viewpoint both of the contractor and owner, and that a resolution to this effect be immediately forwarded to the Dominion and provincial governments and municipal bodies, and to all architectural and engineering bodies interested."

Will Invite Engineers' Co-operation

It was moved by A. E. Jennings and seconded by R. J. Lecky that the above report on standard practices be amended to provide for the appointment of two members of the Engineering Institute of Canada, two members of the Royal Architectural Institute and four contractors, as the committee to consider standard forms of contract, instead of three architects and three contractors as suggested by the above report. The report was carried with this amendment, and the Engineering Institute will be invited to cooperate in the work.

Mr. Mattice presented a resolution adopted by the Ottawa branch of the Association of Canadian Building and Construction Industries, demanding that all public tenders be opened immediately in public at the hour for which they are called; and that the contracts be awarded immediately wherever possible; and that the certified cheques accompanying bids be returned within a week or otherwise bear interest. The conference endorsed this resolution and also the principal of a general contractor letting a sub-contractor know whether he had used the latter's figure, so that the sub-contractor will know whether he stands any possible chance of obtaining the work.

Fred Armstrong, vice-president of the association, addressed the meeting, urging the conference to adopt all possible ideas which would make the association more attractive to the supply men. He urged them to deal with such matters as the "made-in-Canada" campaign, freight rates, development of Canadian resources, etc. Canada must become accustomed to thinking nationally, said Mr. Armstrong. There is no reason why Canadian raw materials should go to the United States to be refined or prepared, and then come back to this country, subject to custom duties. He threatened that Canadian manufacturers would take no part in the work of the association unless the latter supports the use of Canadian materials.

The president, Mr. Anglin, appointed the following as the nominating committee: J. K. Thomas, of Alberta; W. Wilson, of Saskatchewan; H. T. Hazelton, of Manitoba; J. M. Pigott, of Ontario; H. E. Smallpiece, of Quebec; and John Flood, of New Brunswick.

Report of Labor Committee

Wednesday, February 4th, was the last day of the conference, and the meeting was called to order by Mr. Anglin, who introduced several members who had just registered. The following report was presented by R. J. Fuller, chairman of the labor committee:—

"Your committee on labor have considered at length the agenda submitted. It will be readily understood that the problems arising out of the consideration of the relations between employers and employees are too numerous and comprehensive to be covered even superficially in the limited time at our disposal. We beg, however, to report the following recommendations:—

"1.—Admitting, as we do, the right of labor to organize, we submit that this association should urge that all labor organizations become incorporated in Canada or otherwise be made responsible so that all contracts entered into between organized labor on the one hand, and individual or corporate employers or incorporated associations of employers on the other hand, shall be made binding upon each of the contracting parties.

"2.—That legislation be sought making compulsory the reference to a board of conciliation of all disputes which cannot be settled by the parties directly interested therein, before the employer be permitted to close down his business or the employees be permitted to call a strike.

"3.—That this association adopt a policy of having such agreements as are entered into with the labor organizations expire on the 31st day of March, and that a clause be inserted in all such agreements requiring that any new agreements or modifications of existing agreements be executed at least three months prior to the date on which they become effective. Further, that the period covered by such agreements should be determined by the local bodies until the present abnormal conditions be over.

"4.—That this association take up with the Dominion and provincial governments and the reputable labor organizations of Canada the matter of apprenticeship and trade tests along the following lines: (a) The institution of an apprenticeship system in the various trades, whereby the apprentice would obtain a practical training under the supervision of practical employers and at the same time a technical training at a government technical school; (b) the institution of an examining board consisting of an employer, a labor representative and a government representative to examine the apprentice as to his mastery of his trade before giving him the rank of journeyman; (c) the conclusion of an arrangement whereby the union would not admit new members to their organization until the qualifications of such new members had been passed on by the examining board mentioned above.

"5.—That when recommendation No. 4 as above shall have been carried out successfully, this association will make every effort to have the unions grade and classify their men, using the machinery there set up to determine such grading or classification, to the end that the incentive of its logical reward should be placed before the mechanics to encourage their increased efficiency.

"6.—That a standing committee or a paid official be designated by this association to get action on these items as rapidly as possible, to the end that some of the objects here laid down may be reported to our next meeting as having been attained.

"7.—That the matter of immigration of desirable building mechanics be left with the incoming executive, to whom this committee is prepared to present a confidential report."

Discussion on Labor Report

President Anglin inquired as to whether the committee would recommend suing the unions after they had been incorporated, in case of broken agreements, and he wanted to know what they would collect, and also what the results would be after they had collected. His own opinion was that incorporation would not be of benefit to the employers. The history of organized labor, he said, is the history of international labor, and international labor had taken a stand that all agreements must be carried out by the unions. Despite this, however, agreements had been broken in all parts of America during the past year. How can men be prevented from leaving their work and going to other localities where wages are higher? What contractors need is some sort of central machinery to control themselves to some

extent and to eliminate, so far as possible, the bidding for labor.

Mr. Fuller replied that there was no intention of suing the unions, but that the committee did desire to restrict sympathetic strikes.

Mr. Church, of Montreal, thought it was waste of time to talk about asking the unions to grade and classify their men, claiming that this idea is utterly opposed to the principles of trade unionism, but this view was not concurred in by the other members, who felt that, although the unions had made many demands upon the employers, the employers had not made enough demands upon the unions. The labor committee's report was adopted.

Winnipeg Invites Next Conference

Mr. Mackie and Mr. Hazelton presented an invitation from W. H. Carter, president of the Winnipeg Board of Trade, for the association to hold the next conference at Winnipeg. This invitation was acknowledged with thanks and referred to the incoming executive.

Mr. Phinnimore presented a resolution that the conference should petition the government to reimburse contractors for loss on war work owing to the unusual conditions under which this work was done. After considerable discussion, this resolution was adopted. Many members stated that they were opposed to a resolution such as this on general principles, but they agreed with Mr. Phinnimore that conditions under which the war work had been done were very exceptional and that the government might well take a broad view under these special circumstances.

The conference adjourned for luncheon, and at the head table, with Mr. Anglin, were a number of presidents of building and contracting associations from various parts of Canada, including: H. D. Hazelton, president of the Winnipeg Builders' Exchange; Wm. Wilson, president of the Saskatchewan Provincial Association of Contractors; F. W. Dakin, president of the Sherbrooke branch of the association; G. B. Greene, president of the Ottawa branch of the association; J. B. Carswell, president of the General Contractors' Section of the Toronto Builders' Exchange; K. D. Church, chairman of the General Contractors' Section of the Montreal branch of the association; W. H. Yates, chairman of the Hamilton branch of the association; and J. K. Thomas, chairman of the Calgary branch of the association.

Financial Statement

After lunch Mr. Anglin spoke on the future of the association, and called upon Mr. Crain, the treasurer, to outline its financial needs. Mr. Crain stated that the expenses of the last conference had been about \$1,000, which had been collected at the conference, and it was estimated that the expense of this year's conference would be about \$900. To January 1st, 1920, \$3,886 had been collected, all of which had been expended excepting \$104. Since January 1st, \$390 additional has been received, but the expenses have been \$336, so the balance on hand was \$163. The Ottawa branch had voted \$100 towards the expense of the conference, so the total balance available was \$263. At least \$2,200 was required, however, to pay the association's bills to date. This includes \$900 expenses of the conference and \$1,300 legal fees, office rental, secretary's salary and travelling expenses, etc.

The association, therefore, at present has a deficit of \$2,000. The general contractors of Toronto had promised to help in wiping out this deficit, and J. B. Carswell said he thought the association could count upon \$1,000 from that source. Of the contributions to date, Montreal has subscribed \$2,975; Toronto, \$800; and Regina, Moose Jaw, London, Ottawa and other cities, various sums ranging from \$50 to \$130.

Subscriptions Solicited

Two subscription sheets were circulated, one on which members could promise individual or plural memberships, and the other for receiving subscriptions towards wiping out the present deficit.

Contractors, manufacturers and supply dealers throughout the country are requested to subscribe toward the deficit,

and also to become members of the association at the rate of \$25 per annum, and it is hoped by the executive that enough members will be obtained to make the association self-supporting this year and to enable it to open a permanent office in Ottawa.

After the luncheon the general contractors met and decided to incorporate a Canadian General Contractors' Association. J. B. Carswell, of Toronto, was elected president; W. H. Yates, of Hamilton, vice-president; and Hugh Graham, of Ottawa, secretary. The term "general contractor" was defined, and it was held that in order to obtain membership in the association a contractor must be responsible for all of the trades in carrying out the contract for an entire structure, and that he must perform with his own organization the work of at least two of the trades.

At 3 p.m. the conference assembled for the last session and received the final report of the committee on constitution and by-laws. The newly-formed Canadian General Contractors' Association announced their organization and applied for a collective membership in the Association of Canadian Building and Construction Industries. Upon motion of Mr. Smallpiece, the conference recommended that the incoming executive consider the advisability of addressing the government in regard to readjustments in the business profits tax. Mr. Thomas, of Calgary, urged that more publicity for the conference be obtained, especially in the daily press, and this was referred to the incoming executive. On motion of Mr. Pigott, it was decided that forms should be prepared and circulated during the coming year to obtain new members for the association.

ENGINEERING INSTITUTE ELECTIONS

AT a meeting of the council of Engineering Institute of Canada held January 26th in Montreal, the following elections and transfers were announced:—

Members.—N. C. Mills, Montreal; A. I. Payne, Calgary; W. A. Winfield, Halifax; A. E. Wright, Copper Mountain, B.C.

Associate members.—Lieut. C. H. Biddell, Regina; J. A. Coombs, Toronto; C. McG. Crooks, Bedford, N.S.; W. O. Cudworth, North Bay; W. A. Gilmour, Montreal; Kenneth Gordon, Moncton; Major W. A. Grafftey, Westmount; P. S. Gregory, Montreal; H. W. Harkness, Tsinanfu, China; H. F. Hebert, Toronto; C. E. Herd, Montreal; Maj. H. B. Hicks, Cranbrook, B.C.; Lieut. E. H. Jupp, Orillia; Capt. R. E. MacAfee, Montreal; Capt. C. K. S. Macdonell, Barrie; Capt. L. B. McCurdy, Truro; Maj. W. G. McGhie, St. Catharines; J. S. Mills, New Glasgow; G. C. Perkins, Lachine; E. L. Pettingill, Copper Cliff; W. B. Redfern, Toronto; Arthur Sande, Hamilton; J. J. Traill, Toronto; L. S. Tuck, Kenogami, Que.; Lieut. J. E. A. Warner, Cape Madeleine, Que.; E. S. Winslow, Westmount; S. C. Wolfe, Montreal.

Juniors.—C. F. Camber, Minto, N.B.; Capt. G. V. Douglas, Montreal; Lieut. B. H. Johnston, Toronto; M. F. Ker, Niagara Falls; Ewen MacEwen, Montreal; Capt. D. H. Macfarlane, M.C., Montreal; J. H. McKinney, St. John; Robert Melrose, St. John; Edgar Penney, Montreal; Lieut. W. D. Proctor, Toronto; Capt. G. H. Rochester, Montreal; G. H. Thurber, Chatham, N.B.

Transferred, associate members to members.—J. A. G. Goulet, Peterboro; G. G. Hare, St. John; C. C. Kirby, St. John; Col. F. F. Longley, D.S.M., O.B.E., New York; Lieut.-Col. W. L. Malcolm, Kingston.

Transferred, juniors to associate members.—Capt. T. D. Ruggles, Kenora, Ont.; Harold Sprenger, Winnipeg.

Transferred, student to associate member.—Capt. J. A. Knight, M.C., Toronto.

Transferred, students to juniors.—F. D. Austin, Sault Ste. Marie; Lieut. W. E. Longworthy, M.C., Regina; Capt. D. S. McPhail, Montreal; H. M. Roscoe, Anyox, B.C.; E. L. Schellens, Montreal.

ANNUAL CONFERENCE ON ROAD CONSTRUCTION

THE sixth annual Conference on Road Construction for County Road Superintendents and Engineers will be held at Parliament Buildings, Toronto, March 1st, 2nd and 3rd, 1920. This yearly conference is held under the auspices of the Ontario Department of Public Highways. The program follows:—

Monday, March 1st.—Morning Session—10 a.m., "Drainage," G. R. Marston, County Engineer of Norfolk. Discussion introduced by Chas. Talbot, County Engineer of Middlesex; J. G. Cameron, County Engineer of Stormont, Dundas and Glengarry. "Quarrying and Crushing," T. V. Anderson, County Road Superintendent of Lennox and Addington. Discussion introduced by R. H. Fair, County Road Superintendent of Frontenac; J. R. McQuigge, County Engineer of Renfrew.

Afternoon Session—2 p.m., address, Hon. F. S. Biggs, Minister of Public Works and Highways. "Mechanical Handling of Stone and Gravel," A. M. Jackson, County Engineer of Brant. Discussion introduced by J. F. Pineo, County Road Superintendent of Elgin; T. R. Allison, County Road Superintendent of Wentworth.

Tuesday, March 2nd.—Morning Session—9.30 a.m., "Bituminous Penetration Surfaces," A. B. Manson, City Engineer of Stratford. Discussion introduced by Peter Robertson, County Road Superintendent of Lincoln; F. A. Senecal, County Road Superintendent of Prescott and Russell. "Street Paving in Towns and Villages," E. A. James, Engineer to the Toronto and York Roads Commission. Discussion introduced by J. G. Mill, City Engineer of Belleville.

Afternoon Session—2 p.m., "Highway Laws." Open discussion, introduced by W. A. McLean, Deputy Minister of Highways of Ontario.

Wednesday, March 3rd.—Morning Session—9.30 a.m., "Time and Cost Keeping on County Roads," K. W. McKay, County Clerk of Elgin. Discussion introduced by D. W. McBurney, County Road Superintendent of Haldimand; D. J. Kean, County Engineer of Ontario. "Concrete Road Construction," H. E. Davis, Assistant Engineer, Department of Public Highways. Discussion introduced by W. G. McGeorge, County Engineer of Kent; J. F. Millen, Sandwich.

Afternoon Session—2 p.m., "Concrete Bridges and Culverts," Arthur Sedgwick, Assistant Engineer, Ontario Department of Public Highways. Discussion introduced by T. R. Patterson, County Engineer of Huron; J. M. Young, County Road Superintendent of Wellington. "Maintenance of Stone and Gravel Roads," William Watters, County Road Superintendent of Lanark. Discussion introduced by W. W. Brookfield, County Road Superintendent of Welland; H. G. Bleecker, County Road Superintendent of Hastings.

CANADIAN GOOD ROADS CONVENTION

ANNOUNCEMENT has been made that the seventh annual Canadian Good Roads Convention will be held at the Royal Alexandra Hotel, Winnipeg, on June 1st, 2nd and 3rd next. The decision to hold the convention in the west for the first time was made at a meeting of the executive of the Canadian Good Roads Association under the chairmanship of President S. L. Squire. The invitation was sent by the Winnipeg city council, with the hearty support of the Manitoba provincial government, board of trade and motor organizations. Special cars will go from Montreal, Toronto, Port Arthur, Ottawa and other big centres for the convenience of the delegates and their wives.

The Engineers' Club of Toronto has just closed the twentieth and most successful year in its history. The board of directors, at a meeting held last Tuesday evening, decided (as the limit of accommodation in the present quarters has almost been reached) to double the amount of the entrance fee. The following officers were elected for 1920: President, Melville P. White; 1st vice-pres., Tracy D. leMay; 2nd vice-pres., J. B. Carswell; 3rd vice-pres., W. R. McRae.

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SERVICE TO THE PUBLIC

DURING the strike of the employees of the Montreal water works, the members of the Montreal branch of the Engineering Institute of Canada have again demonstrated the service that such a body of engineers can render to the public in times of emergency.

With the exception of the men at the filtration plant, every employee of the Montreal water works, to the number of several hundred, quit work without warning at midnight, December 31st, 1919. They had made demands upon the civic administrative commission for higher wages and had been informed that the commission would like to receive evidence that wages such as they demanded were being paid by private firms. The men submitted a certain amount of evidence which was not entirely satisfactory to the commission, and the latter asked for more evidence and understood that the men intended to obtain same and that they would return for another appointment.

Instead of making any further effort to satisfy the commission as to the reasonableness of their demands, the men went on strike, leaving the city of Montreal without water on New Year's Day. The situation was critical,—so critical that fires had to be drawn in one of the largest hospitals in the city. Not only did heating systems suffer, but there was a great shortage of water for all domestic purposes, and had there been a conflagration, the city would have been at its mercy.

But the Montreal branch of the Engineering Institute of Canada came to the rescue of the citizens without delay. Invitations were telephoned on New Year's Day to 54 members of the branch to attend a meeting to discuss the situation, and 50 of them assembled within a few hours. It is understood that at least two of the other four were out of town. These 50 men went to the pumping plant, took off their coats

and started work. It is rumored that they found the plant in very bad condition, that the boilers had not been cleaned for a considerable period, that the pumps had been allowed to run for some time without lubricant, and that the whole plant was in a very difficult condition to start.

The following day these engineers returned to the plant and brought with them approximately 150 skilled mechanics, pump-runners, firemen, draftsmen and engineering and mechanical assistants of all kinds, selected from their own staffs of employees. By noon some of the pumps were running, and within two days the water supply was normal. With a few exceptions it was not necessary for the 50 members of the branch to remain at work any longer, but the men whom they loaned are still running the water works, as the strike is not yet settled.

At the request of R. A. Ross, who is a member of the administrative commission of the city, and who has just been elected president of the Engineering Institute for the coming twelve months, a few of the members of the branch who are particularly skilled in water works pumping problems, have devoted a great deal of attention during the past six weeks to the operation of the plant, and it is said that under Mr. Ross' able leadership, they have brought it to a state of efficiency far excelling anything previously attained.

The Montreal engineers have been very modest regarding their performance, and the public of Montreal do not realize to what extent the city was indebted to them in this emergency, but when the history of that strike has been finally written, the fine public spirit and unselfish desire to serve which characterizes the entire body of Montreal engineers, will be the outstanding feature of the story.

ENGINEERING INSTITUTE OF CANADA

THAT the announced "rejuvenation" of the Engineering Institute of Canada has been entirely successful, was quite evident at the thirty-third annual meeting held a fortnight ago in Montreal. The attendance broke all previous records; fully 500 members and guests from Montreal and vicinity registered, and the out-of-town attendance was quite equal to that of previous years, bringing the total registration to over 650.

The meeting was well worthy of the large attendance. The technical papers were of high order of merit and covered a multitude of interests. The discussion on engineering education was especially brilliant; those who took part in it are among the leaders in technical education in Canada.

The report of the council, reviewing the past year's activities, met with general approbation and the members evinced a lively interest in the prospects for the future growth of the institute, both in numbers and prestige. The only item in the annual report that met with any adverse criticism, was the fact that there was a deficit of \$6,440. Unfortunately, there was also a deficit (\$2,085) for the year 1918. Prior to 1918, however, there had not been a deficit for more than a decade, excepting in 1914, in which year the Montreal printing prices became so high that the work of producing the transactions was transferred to Toronto for the following two years, with the result that 1915 showed a surplus of \$2,304 and 1916 a surplus of \$3,642, despite war conditions and remitted fees.

The chief causes of the 1919 deficit were: (a) An unusual expenditure of \$1,727 in connection with the work of the legislation committee; (b) a net loss of \$5,022 on the publication of the institute's journal, of which \$2,003 was made up, however, by voluntary subscriptions from members; (c) an increase of about \$7,000 in salaries and wages, as compared with 1917, of which increase the council attributes about \$4,000 to the publication of the journal; and (d) an increase of about \$2,500 in general expenses of administration, as compared with 1917. On the other hand, the expenditure for "printing and stationery" was only \$1,700 more than in 1917 and was \$4,000 less than in 1918, despite the increasing costs of printing, this being due to the transfer to "journal expenditure" of some expenses that would other-

wise have appeared as "printing and stationery." Due to the increasing cost of supplies of all kinds, it is only natural that the expenses of the institute should show some increase. The losses on the journal will be largely overcome during the next year by increasing the annual dues by \$2.

It is possible—or at least it is to be hoped—that in regard to the general policy of the institute's journal, the members will make some change in the near future. This adventure into the publishing business has apparently not improved the finances of the institute, and it holds grave danger of tinging the conduct of the institute's affairs with a commercialism that might seriously impair the institute's

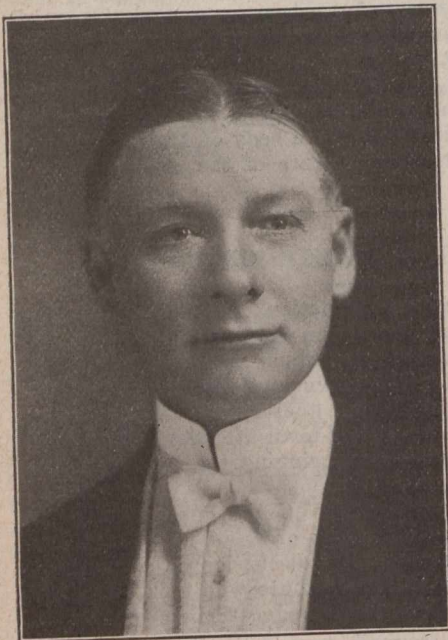
prestige, and this would be truly a calamity, for the greatest asset the institute has is its high prestige; its freedom from commercialism has been its great strength and the bed-rock of its professionalism.

Every engineer in Canada should join the Engineering Institute and help to maintain its influence and prestige. The greater its membership and the more active the interest of that membership, the surer will the institute be governed in a wise manner and in the best interests of engineering in Canada. In all of the institute's activities excepting the present policy of its journal, *The Canadian Engineer* is a staunch supporter of the Engineering Institute of Canada.

PERSONALS

G. F. W. PRICE has been appointed city architect of Toronto, succeeding W. W. Pearse, who recently resigned in order to become business administrator of the Board of Education, Toronto. Mr. Price has been assistant city architect for several years. He joined the department about fifteen years ago in the capacity of an assistant engineer

under the late Robert McCallum, the first city architect of Toronto. Mr. Price later became inspector of the department and assistant to Mr. McCallum, and he was also chief assistant to Mr. Pearse, who succeeded Mr. McCallum. Mr. Price has had personal charge of the inspection of over \$200,000,000 worth of building construction in Toronto. During the time that he has been with the department, he has also personally conducted the legal end of its affairs. He has devoted special attention to



fire prevention, and has attended practically all the conferences on this subject in the United States and Canada. Mr. Price was born 52 years ago in Belfast, Ireland, but his parents moved to Toronto when he was a youth, and he was educated in the Toronto public and high schools, later returning to Ireland to complete his education at the Methodist College, Belfast, and the Belfast Technical School. After graduation Mr. Price returned to Canada and entered an apprenticeship with E. J. Lennox, of Toronto, and was subsequently employed as draftsman in the offices of the following firms: Edwards & Webster, Toronto; Darling & Curry, Toronto; and LeHommedeau & Son, New York. He later became chief draftsman successively for the following: W. G. Storm, Toronto; Darling & Pearson, Toronto; S. G. Curry, Toronto; Geo. Miller & Co., Toronto; and James Balfour, Hamilton. He spent 2½ years in the office of W. J. Gilleland, civil engineer, and for 4½ years was engaged as assistant engineer in the construction of the city hall, Toronto.

THOMAS E. MCCAULAY, of Calgary, has been appointed general manager of the New Brunswick Power Co., St. John, N.B.

W. J. MOORE, of Pembroke, Ont., has been appointed road superintendent of Renfrew county, succeeding J. R. McQuigge, resigned.

MAJ. A. J. MCPHERSON, of Regina, has been appointed chairman of the commission which will investigate the pro-

posed scheme for supplying Regina and Moose Jaw with water from the South Saskatchewan river.

A. W. BALDWIN, manager of the street railway at Guelph, Ont., has tendered his resignation to the city clerk, to take effect at the end of this month. Mr. Baldwin has accepted a position with a manufacturing concern.

R. MCDOWELL has been appointed engineer of Grey county, Ont. Mr. McDowell has been consulting engineer on all of the county's work for more than a year, and at the request of the roads committee of the county council, the appointment has been made permanent.

THOMAS ADAMS, town planning adviser to the Commission of Conservation and to the Housing Committee of the Dominion Cabinet, has been given permission to devote a portion of his time to private practice, and he has been retained by the Niagara Falls Park Commission and by several municipalities in California.

GILBERT H. PRATT, who was formerly chief chemist of the New York Continental Jewell Filtration Co., prior to which he was chief of the Rhode Island State Department of Health, has been appointed acting district sales representative for New York, New England and northern New Jersey for Wallace & Tiernan Co., Inc., during the absence in Europe of A. M. E. Johnstone.

HENRY A. TERREAULT, formerly connected with the government shipyards at Sorel, Que., has been appointed water works superintendent of the city of Montreal, succeeding T. W. LESAGE. Mr. Lesage will remain in the city's employ as consulting engineer upon aqueduct matters. Mr. Lesage has been connected with the water works department of Montreal for nearly 40 years, having succeeded his father in the position of superintendent.

OBITUARIES

CAPT. DAVID KYLE, M.C., vice-president and director of the Algoma Steel Corporation, died last Saturday from pneumonia following an attack of influenza. Capt. Kyle was born in Scotland and came to Canada in 1910 as engineer in charge of the construction of the merchant mill of the Algoma Corporation, and was later in charge of maintenance. In 1912 he was appointed general superintendent, but in the fall of 1914 he went overseas. In 1917, by special arrangement with the military authorities, he was allowed to return to Canada to resume his place in the executive office of the steel company. He was 36 years of age.

JAMES ROGERS, a veteran railway contractor, died last week at his home in Montreal. Mr. Rogers was born at River Beaudette, Que. He began his career with the Grand Trunk Railway. The first contract he undertook was on the Lake Superior section of the C.P.R. as a "sub" to R. G. Reid. Later he built other sections of the C.P.R. and of the Intercolonial Railway, and double-tracked the Grand Trunk from Hamilton to Niagara Falls, and from St. Lambert to St. John's, Que. Other contracts undertaken by Mr. Rogers included a section of the Soulages canal and the Atwater bridge over the Lachine canal. For a time he was bridge inspector for the Intercolonial Railway, and was inspector for the government on the construction of the North Shore Railroad between Montreal and Quebec.