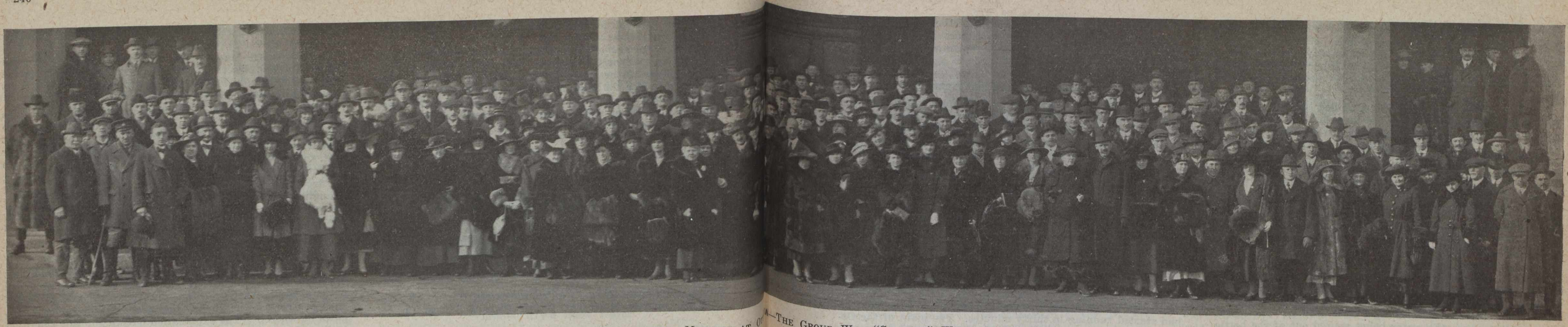

PHOTO TAKEN LAST WEEK AT THE GENERAL PROFESSIONAL MEETING AT O—THE GROUP WAS "SNAPPED" WHEN ON THE WAY TO THE NEW PARLIAMENT BUILDINGS

the full number of units are installed. We therefore studied the conditions carefully and have adopted the method of removing approximately half the surface ice the whole length of the canal, operating with open water all winter.

By this method of operation, the sluices originally installed with 16 ft. openings for handling ice, were considerably troublesome, as they would not handle the large sheets of shore ice, 36 to 40 ins. thick, which are likely to enter the canal while it is kept open; so last summer we rebuilt our west end sluiceway, erecting two openings, each of 44 ft., with 5 to 6 ft. of water flowing over the crest. It is our intention to rebuild next summer the sluiceway next to the power house, installing two openings each 60 ft. wide.

To close these openings after the ice season, a stop-log dam has been designed, with openings for logs 15½ ft. long. The steelwork is lowered into place and the logs then inserted.

Always Open Water in Canal

Experimental work was carried out before we found that the only way to operate the plant was to keep open water in the canal all the year round. It was thought possible that floating ice could be diverted from the canal by means of a suitable boom, stretched at the proper angle from the most westerly sluiceway to the north shore of the canal, but this was found to be not the case, as the ice entered the canal in such large volumes that lighter ice went under the boom and large sheet ice ultimately broke the boom.

Next we experimented with a timber ice deflector at a point 1,500 to 1,800 ft. above the entrance to the canal, the idea being to deflect the large surface ice which breaks from the shores and also the frazil and anchor ice.

This method of protection was not found to be very efficient, when the wind condition was such as to hold all of the ice that was floating in the river above the diversion dam toward the north shore. Also during extreme cold weather the reefs in the channel outside the entrance of the canal would become heavily coated with anchor ice. With these dams and the diversion dam ice coated, only a small part of the required water entered the canal, so that we removed our diversion dam and are taking care of whatever ice enters the power canal. We are still making improvements in our canal entrance, said Mr. Wilson, by increasing the channels of supply, removing some of the reefs that have been a source of trouble during ice season. By the time our remaining units are installed, the canal will be in proper shape at the entrance. We are thoroughly satisfied that with the modifications in the sluices, and the work completed on the intake, that the plant will operate to maximum capacity all year.

In the handling of ice, one of the most important features is proper equipment. When winter sets in, the canal does not freeze over, but becomes coated with a rough surface of ice blown in by wind. The mixture, consisting of frazil, sheet ice and sometimes snow, usually takes four to six hours, with suitable wind conditions, to coat the two miles of canal with ice.

We have two ice breakers that are really reinforced tugs, and it has been found that after the surface of the canal has become coated with the conglomerate mass that it takes several days of extreme cold before it becomes consolidated to such an extent that the tugs have difficulty in breaking it up. With proper ice sluices to avoid jamming when the broken surface ice is carried down, a channel 100 to 150 ft. can be made from the power house to the entrance in a day and a half by using the two ice breakers.

At times we have resorted to the use of explosives in breaking up the jams. We have experimented with various kinds of explosives to find out which would be the most efficient in ice. We have used 60%, 40% and 30% nitro-glycerine dynamite in sticks 1½ ins. diameter, 8 ins. long, and in charges of seven to eight sticks, but they were all too fast and only pot-holed the ice.

With the aid of the Canadian Explosives Co., we obtained an explosive made from ammonium nitrate, having strength equal to 30% nitro-glycerine dynamite in sticks 3 ins. in diameter and 8 ins. long. This gives a large volume of gas, slow in action and very satisfactory. It has the advantage of not freezing unless 5° or more below zero, and if left in the water an hour or longer, it dissolves and is no longer dangerous.

In reply to a question, Mr. Wilson stated that the present installation consists of 12 units, each about 10,000 h.p., and that the ultimate installation will be 18 units.

Mr. Thornton's Discussion

K. B. Thornton, manager of the Public Service Corporation, Montreal, opened the discussion on Mr. Wilson's paper, saying that in the old days, extremely cold weather meant strenuous days and sleepless nights for the operators of hydro-electric plants, while to the man on the street it meant the stopping of street cars and the closing of works, and to the shareholders in power companies it meant a decrease in net earnings.

Mr. Wilson's paper, said Mr. Thornton, is another assurance that a power plant can be operated successfully throughout the winter. It is particularly suitable that this paper should be read in Ottawa, where experiments for the prevention of ice troubles have been carried on for twenty years by John Murphy, as duly recorded in the transactions of scientific societies and technical journals. Mr. Murphy and Dr. H. T. Barnes, of McGill University, have greatly improved the methods of combatting ice troubles, and in the future those troubles will be reduced still further and more active steps taken to prevent the formation of the ice.

The handling of ice is a problem peculiar to each plant, and any general formula is uncertain. The methods of handling ice at Cedars may be absolutely different than those required elsewhere. They have a plant of large capacity drawing water from a large intake canal.

Sluiceways Nearly Always Too Small

Mr. Thornton referred to the suggested remedial improvements, particularly in the size of the sluiceway openings. These are almost always too small as perpetrated by many designing engineers, he said. As regards protection at the intake, his idea would be to place overlapping, parallel, protecting dams at the entrance to the forebay. But the quantities of water and the size of the openings are so enormous, that he is content to let Mr. Wilson go ahead with his scheme of handling the problem.

With reference to the underhung dam shown by Mr. Wilson, where 60 per cent. of the cross section had been taken up with ice, Mr. Thornton stated that he had found that where the entrance to the forebay is adjacent to rapid running water, and where there is a canal with a forebay at the end of it, one always get an underhung dam immediately where the velocity decreases at the end of the canal and beginning of the forebay. In the plant with which Mr. Thornton is connected, this is their one and only source of ice trouble; that is, where the canal joins the forebay. They have to cut a channel across the forebay to the dam and take it out, and then their trouble is over.

Power Sites Fixed by Nature

Regarding the careful selection of power site mentioned by Mr. Wilson, Mr. Thornton thought that this is usually predetermined by nature, and that not much latitude is allowed by nature in selecting a river power-house site. The problem is generally a financial one; that is, as to whether any certain small change is warranted by the expense and by the loss or gain in head, etc. Any operating engineer always finds that there are improvements that he could make if he could design his plant all over again.

In 1906, Mr. Wilson in a paper discussing the influence of ice on operation, had said that where possible dams should be installed and the water taken out through sluices from the bottom of the dam.

In 1908, Mr. Murphy said that ice troubles could only be remedied by building dams by which an equitable flow could be secured all the year round. Before the Royal Society, Mr. Murphy said that dams would reduce frazil.

The ideal situation, said Mr. Thornton, is a completely canalized river or canal, as opposed to a partially canalized river.

The Quebec Streams Commission, the Commission of Conservation and the Dominion Power Board are all investigating storage on rivers with the idea of conserving the water, preventing floods in the spring and drought in the fall. If realized, the installation of these dams would also greatly reduce trouble due to the blocking of ice. The prevention of ice-forming conditions should be given more consideration. This is a field that up to now has been completely ignored, all efforts having been to eliminate ice troubles as found in individual plants.

Regarding the ice being thicker at the edges of the forebay than in the centre, this always happens, said Mr. Thornton, whether the elevation is varied or not. In one plant with which he is familiar, the elevation was not varied a foot, and yet the ice was two or three times as thick on the shore as in the centre, due, he believed, to difference in the velocity of the water.

Mr. Murphy's Discussion

John Murphy said that Mr. Wilson had been kind enough to submit a copy of his paper to him some days previously so that he (Mr. Murphy) would be able to discuss it, and that he noticed that in the original copy of the paper, Mr. Wilson had ascribed the ease with which the ice goes through the wheels without sticking, to the fact that the pressure on the ice generated mechanical heat sufficient to keep the ice from sticking. Mr. Murphy observed that Mr. Wilson had since deleted this sentence and had credited the non-sticking of the ice to the fact that the metal parts of the wheels were kept at a higher temperature by the heat from the generator room.

He was very glad to see that Mr. Wilson had changed that sentence, because he felt that it was very important, and that in his second explanation Mr. Wilson had arrived at the true explanation. If the metal parts of the wheels were exposed to the outer air and not kept slightly warm, the ice certainly would stick and the wheels would be frozen up. "This is a little point, but an important one, and one which should be taken up by the bodies concerned with water development, because if we dam a river like the St. Lawrence and don't take care of the ice, I don't know where we will be at," said Mr. Murphy.

Mr. Murphy declared that agitation plays an important part in the formation of ice crystals, and that where the surface is agitated by the wind or where the water forms