HIGH TENSION TRANSFORMERS,

(Concluded from last issue).

In the construction of large high tension transformers many serious problems are encountered. In addition to the difficulties incident to the winding and assembling of large coils, and the care which must be exercised in handling the quantity of insulation required, the question of keeping the insulation in good condition during manufacture, shipment and installation is perhaps one of the most important problems. The presence of moisture is fatal to the insulating properties of the best material which can be obtained. Even with the utmost care during manufacture, a certain amount of moisture invariably finds its way into the insulation. Some method must be devised then to thoroughly remove this before the transformers can be in the proper condition for operation. Inasmuch as it is inadvisable and impracticable to ship large units in their cases and under oil, the plans for removing this moisture must comprehend the drying out of the transformers at the point of installation and immediately before the oil is placed in the cases. A striking example of this was presented by several of the transformers shipped to Montreal and to Shawinigan Falls. These transformers left the States in December, arriving in Canada at one of the coldest periods of the winter. Before they arrived at their destination the weather suddenly moderated and the atmosphere was heavily impregnated with moisture. The transformers were, however, at a temperature many degrees below freezing point, and on being unpacked, were found to be entirely covered with a white frost to a thickness of from ⅜ to ¾ inches. The weather continuing warm, this frost gradually melted, leaving a considerable amount of water throughout the transformers. The manner in which these transformers were successfully dried out will, no doubt, prove interesting at the time. As soon as possible, the transformers were placed in their cases without oil and the tops put in position. The low tension windings were short circuited through the high tension windings. Thermometers were placed at those points which might be expected to develop the highest temperature under these conditions of heating. These thermometers were very carefully watched and the current was so regulated that the actual maximum temperature remained in the vicinity of 100 degrees C. At this temperature both oil and water vapors were thrown off in great quantities. Energy at 500 volts direct current was available, and electric heaters, accommodated to this voltage, were designed and made. These heaters were enclosed in sheet iron boxes and connection was made between them and an opening at the bottom of the transformer case by means of ordinary stove pipe. The heaters delivered to the transformers a great volume of air heated to a temperature of almost 200 degrees C. Baffle plates were placed inside the transformer cases so that the hot blast might not blow directly against either the coils or the insulation. The hot air rose from the bottom of the case to the top, pouring out of an opening left in the cover. This circulation of hot dry air tended to remove from the inside of the case the vapors expelled from the interior of the transformer by the heat generated there. This process was continued for several days. Measurements of the insulation resistance were taken from time to time until the results showed that the transformers were in even better condition than they had been when they successfully underwent the puncture and over-potential tests of 100,000 volts. While the transformers were still hot the oil was placed in the cases and an increased current circulated through their windings. The quantity of this current was such that the heat generated in the windings was sufficient to maintain a fairly vigorous circulation of oil through the interior of the transformer. No trouble was encountered in bringing the transformers up to full voltage for the first time and nothing has since arisen which indicates that the insulation is in any other than first-class condition.

This paper would not be complete without at least a reference to another important Canadian power transmission. The Montreal Light, Heat, and Power Company transmits power from its generating plant on the Richelieu River to Montreal, eighteen miles distant, at 25,000 volts. These transformers have the greatest capacity of any transformers ever built, namely, 2,750 K.W. The step-down station of this line is in the heart of the city of Montreal, and owing to city ordinances prohibiting the storage of quantities of oil within the city limits, the air-blast type was chosen. These transformers are of the same general construction as the Shawinigan, except, of course, that they are not placed in cases, but are provided with a neat cast iron housing. The air is forced through ducts placed between the coils and between the iron laminations in a manner analagous to the natural circulation of oil through the ventilating ducts of an oil-insulated transformer. The amount of insulating material used is, of course, greater than in transformers of the oil type designed for the same voltage. Up to the time of the unfortunate accident to the dam at Chambly, these transformers and the transmission line gave a service highly satisfactory in all respects.

In bringing this paper to a close it may perhaps be no more than fair to say that the special emphasis laid upon the transformers of the Shawinigan Water & Power Company is due to the fact, not generally realized, that the Shawinigan transmission system stands as chief of the three most prominent long distance, high voltage systems in the world, exceeding one of them in voltage and one in length of line; and to the fact that these transformers present the latest and best features, electrical and mechanical, of good transformer design.

RUTS.

With gravel roads there is a pronounced tendency to rut, and when ruts begin to appear on the surface, great care should be used in selecting new materials with which they should be immediately filled. Every hole or rut in the roadway, if not tamped full of some good material, like that of which the road is constructed, will become filled with water and will be made deeper and wider by each passing vehicle. A hole which could have been filled with a shovelful of material will soon need a cartful. The rut or hole to be repaired should be cleared of dust, mud, or water, and just sufficient good, fresh gravel placed in it to be even with the surrounding surface after having been thoroughly consolidated with a pounder. Sod should not be placed on the surface, neither should the surface be ruined by throwing upon it the worn-out material from the gutters alongside. Ruts and holes in earth roads should not be filled with stone nor gravel unless a considerable section is to be so treated; for if such material is dumped into the holes or ruts, it does not wear uniformly with the rest of the road, but produces lumps and ridges and in many cases results in making two holes for every one repaired.

Reversible road machines are often used in drawing the material out of ditches to the centre of the roadway, which is left there to be washed again into the ditches by the first heavy rain. A far more satisfactory method, when the roadway is sufficiently high, and where a heavy roller cannot be had, is to trim the shoulders and ridges off and smooth the surface with the machine. This work should begin in the centre of the road, and the loose dirt should be gradually pushed to the ditches and finally shoved off the roadway or deposited where it will not be washed back into the ditches by rain. Where this method is followed, a smooth, firm surface is immediately secured, and such a surface will resist the action of rain, frost and narrow tires much longer than one composed of loose and worn-out material thrown up from the ditches.

In making extensive repairs, plows or scoops should never be used, for such implements break up the compact surface which age and traffic have made tolerable. Earth roads can be rapidly repaired by a judicious use of road machines and road rollers. The road machine places the material where it is most needed and the roller compacts and keeps it there. These two labor-saving machines are just as effectual and necessary in modern road work as the mower, self-binder, and thresher are in modern farm work. Road machines and