CANADA'S PROJECTS OF WATERWAY IMPROVEMENT.

The Hon. J. D. Hazen, Minister of Marine and Fisheries, addressed the tenth annual convention of the National Rivers and Harbor Congress, held recently at Washington, D.C., on the great projects of waterway improvement under contract or in contemplation in the Dominion of Canada.

It was pointed out by Mr. Hazen that Montreal, the chief port of Canada, affords the best example of modern harbor works and equipment and has special advantages over any port on the North American continent from its inland situation in regard to discharging of cargo and affording communication by water via the Great Lakes to a point 1900 miles farther inland at the head of Lake Superior. Mr. Hazen referred briefly to the great growth in trade at Montreal which has made necessary the deepening of the channel in the St. Lawrence River at a cost up to the present of $16,000,000; and which will be greatly augmented by the work now in progress.

Mr. Hazen pointed out also improvements under way or to be undertaken at other ports: at Quebec harbor, the lock and dam on the St. Charles River to cost $3,000,000; at St. John, improvements to cost millions, one contract alone amounting to $7,500,000; at Halifax, the reconstruction of deep-water terminals to cost over $8,200,000; the new breakwater 5,500 feet in length under construction at the twin ports of Fort William and Port Arthur; the many new drydocks, etc., at numerous smaller intervening ports, and at Vancouver and Victoria the government wharf and breakwater respectively, totalling a general cost of $5,500,000.

In connection with Canada's canal question, Mr. Hazen said: "Canada and the United States jointly operate one of the largest systems of Inland waterways in the world, a most valuable heritage for purposes of transportation. This whole system of canals on both sides of the line is free of tolls, and open to the vessels of both countries. The Canadian canal system represents a capital cost of $104,000,000. If to this, however, is added the capital cost of harbors, the dredging of channels, lighthouses, buoys, etc., it will be found that Canada has contributed upwards of $365,000,000 all told for the establishment of means of transportation by water."

He mentioned that the whole scheme for the Trent Canal is now being carried out; that the new Welland Canal is already under construction, and is to aggregate a cost in the neighborhood of fifty million dollars; and that the construction of the Georgian Bay Canal is one of the schemes contemplated for the near future.

Mr. Hazen closed his address by remarking that the Canadian Government has entered actively upon "the project of affording facilities at all our great national ports which will enable them to compete on at least even terms with any other ports on this continent."

German capitalists headed by Capt. Von Der Osten, of Berlin, have secured from the provincial government a concession of forty square miles near Sussex, N.B., and will prospect for salt, gypsum ore, potassium and petroleum. The project is capitalized at three million dollars, and in particular the promoters expect to develop a big industry in potassium, which is known to exist in large quantities, and for which the United States offers an almost unlimited market.

THE CORROSION OF WATER MAINS.*

By William Ransom, A.M.I.C.E.

THE subject of the corrosion of iron mains is one of great importance to waterworks engineers, who naturally desire to obtain as long a life as possible for their water mains, and also are anxious to use such materials as will not impart any impurity or deleterious property to the water in the course of its distribution. The need for investigation and conference on the subject can be realized and its practical importance better understood when the recent case of a town in South Africa is mentioned, where a new steel water main has become so pitted with rust that it has become necessary to partly replace it with a cast-iron main. It was found that the damage was due to the sulphuric acid in the soil resulting from the oxidation of pyrites in the soil. Other portions of the main have been protected by covering with two thicknesses of bituminized Hessian cloth, and afterwards coated with a bituminous composition.

The writer had his special attention drawn to this subject in connection with some investigations he made with regard to a town water supply which not only corroded the mains but deposited a brown percipitant upon exposure, and caused an objectionable discoloration to domestic utensils, etc., while at times an unpleasant smell was noticed when the water was drawn from the mains.

We are all familiar with the ordinary formation of rust, but there are many factors at work to complicate the corrosion of water mains, and in this short paper the writer can only hope to refer to one or two phases of the subject in which he has been especially interested.

Dry oxygen has no effect upon iron at normal temperature, but if the iron be heated oxidation takes place and a black scale or oxide forms on the surface, which, when the metal is heated to white heat, is represented by the formula Fe_3O_4. This is the scale which, being non-adherent, is brushed off the hot plates after they have passed through the rolling mills.

It is when moisture is present together with carbonic dioxide that oxygen is able to act most readily upon iron at the ordinary temperature and a brown hydrate of ferric oxide if formed. Water, which contains free CO_2, and is therefore a weak acid solution, will very quickly corrode the iron mains through which it is being distributed. The rust that is formed is not a protective coat, for it is hygroscopic, and fresh water is brought into contact with the iron to continue the process of oxidation. The chemical action produces a certain amount of heat, which also helps in the work of oxidation. The various impurities in the water and the different qualities of iron modify or complicate the corrosive effect on the mains and the discoloration caused to the water. The ordinary action of corrosion is prevented by giving the iron a protective coat of some bitumastic material, but there is great difficulty in ensuring perfect protection, for pinholes, etc., may soon form centres for the formation of rust.

There have been many investigators who have made a special study of the formation of rust. Wehner, of Munich, in 1907 summarized the various forms of rust under three headings: Firstly, coarse blotches or blisters of rust which are formed on the interior of water mains and on the exterior of pipes laid in damp or salt soil. Pro-

*A paper read at the meeting of the Institution of Civil Engineers, held at Birmingham on Nov. 20, 1913.