On very high voltage transmission lines, where the corona limits determine the size of conductors, the steel conductors have an opening, for use on branch lines supplying a few thousand kv.-a. on networks of 100,000 volts and higher.

In conclusion, it has been shown that large steel cable, if properly manufactured, can be used for carrying alternating current. It appears that the chief opportunity for the use of steel conductors is on branch lines where the size of copper required merely for the electrical loads would be too small to use. However, in all cases steel conductors will be nearly as cheap as copper ones, if not cheaper, and the use of steel will always increase the reliability of the transmission system.

## HYDRO-ELECTRIC RADIAL RAILWAYS FOR THE NIAGARA PENINSULA.

A MEETING of delegates of the Ontario Hydro-Electric Railway Association was held at Hamilton recently, when plans of the proposed railway to be built by the Ontario Hydro-Electric Power Commission, between Toronto and Niagara Falls were explained and discussed. The portion of this line between Toronto and Port Credit has already been dealt with by the various municipalities concerned, the second section, that between Port Credit and St. Catharines, being one chiefly under discussion.

F. A. Gaby, chief engineer of the Commission, in explaining, stated that the route it was proposed to follow through Hamilton was that adopted by the Canadian Northern Railway, and it was probable that the C.N.R. right-of-way would be taken over and the Hamilton station located on James Street, near Murray Street. The line, when completed, would be available for other railway companies on terms being arranged. It was estimated that the right-of-way would cost \$2,000,000 and the construction, so far as Hamilton was concerned, \$2,250,000, and stations and terminals about \$500,000. The line would run from Port Credit, where a junction would be made with the proposed Toronto-London line, thence to Clarkson, through the centre of Oakville, then south of the G.T.R. and parallel with the Hamilton Radial Railway, through Burlington. From the lastmentioned point two surveys had been made, one on the north and one on the south of the Plains Road. The line would cross the G.T.R. overhead and proceed along the proposed Canadian Northern Railway route, and thence to Stoney Creek, Winona, Vineland, Grimsby, Beamsville and St. Catharines. It was intended to use 80-lb. steel, and the whole equipment would be of the highest class, with rolling stock similar to that used on the London and Port Stanley Railway. Mr. Gaby also stated that four lines had been surveyed from St. Catharines to Niagara Falls, and the Commission was of opinion that two lines would be required, one to go via Port Robinson and one by a more direct route.

The Venezuelan Government has decided to build a highway across the republic that will be 683 miles long.

A new type of ship has arrived at Christiana, Norway, from the shipyards of Christianiafjord. The ship, which resembles a huge barge, is constructed entirely of concrete, except for the ribs, which are steel, and is the first stone vessel ever floated. It is said the hull will resist damage better than steel or wood, and that the ship is therefore safer.

## REPORT ON WATER SUPPLY FOR HAMILTON.

A T the joint request of the Board of Control and sub-committee of the works committee, Mr. James Milne, mechanical and electrical engineer, City Hall, Toronto, has prepared a report covering sug-

gested extensions of the waterworks of Hamilton. The following extracts are taken from his interim report:-

The water supply for a large city is unlike any other public undertaking. It must be of ample quantity and continuous. When the power for street railway purposes fails, the public are inconvenienced, but can resort to walking. When the electric lighting fails, the public can resort to gas, coal oil lamps and candles. When the water fails, however, there is nothing they can resort to; and besides endangering the public health by putting all sanitary arrangements out of action, such a failure, should a serious fire arise, would become nothing short of a calamity.

Pumping stations for waterworks should be selfcontained; that is to say, power for operating the pumps should be absolutely under the city's control and independent of any outside source. Experience has shown that where a waterworks pumping plant is dependent upon an outside source for power, and the plant and accessories are not under the absolute and immediate control of the owners, continuity of service cannot be guaranteed. It may also be noted that electric power for pumping purposes in first-class plants has not been shown to be less costly than steam. The only point, therefore, in favor of electrically operated pumps is their low initial cost.

Turning to the consideration of the proposal made to you by the Dominion Power & Transmission Company, in their letter of the 3rd of August, 1916, the adoption of this proposal would mean that, after going to a considerable expense for plant and transmission lines, you would still be purchasing power at a high cost from an outside source. Bearing in mind the indispensable condition of continuity of service, together with the consequent necessity of having the power plant under your own control, and the further important fact, that electric power for pumping purposes is not cheaper than steam, I do not consider it would be to your advantage to accept the proposal of the Dominion Power & Transmission Company. If the company had the necessary power available, and, without involving the city in a large expenditure for generator, transmission lines, etc., would agree to furnish an auxiliary service (to be used in case of the failure of Hydro power) at a reasonable cost, in a manner similar to which the Toronto Power Company furnish an auxiliary service to the Toronto waterworks, such an arrangement might be of advantage to you, until such time as you have a plant of your own, capable of furnishing the city's full requirements.

Coming now to the consideration of the extensions required to your pumping station, I may first remark that your reservoirs are of such small capacity that they have little or no bearing on the required capacity of the pumping station; and to increase the capacity of the reservoirs is at present out of the question. For practical purposes, therefore, and leaving out all academic discussion on reservoirs, which, while useful, are not absolutely essential; the pumping station should be so designed as to furnish, without interruption, the maximum demand and have, in addition, at least one spare pumping unit. Your average daily pumpage for last July was 14,500,000 Imperial gallons, which is an increase of 40 per cent. over the average daily consumption for the year 1915, and the