tion has run successfully for many years, the cost of maintenance being a mere trifle.

The Government is now substituting diaphones for all the types of instruments previously used for fog alarms. These instruments are claimed to give a very penetrating sound. They have the advantage over the syren that they can be kept at a constant pitch, and if the Canadian patentees succeed in producing perfect resonation they will doubtless prove superior in sound-carrying capacity to any signal yet invented. They are run by compressed air, and we are installing oil engines to operate them, because it is frequently difficult to obtain sufficient fresh water for steam engines at our fog alarm stations. The sound is produced by the free vibration in a slotted cylinder of a very light slotted piston, the air being admitted in rear of the piston, and escaping through the slots, which are alternately opened and closed sufficiently fast to produce a pure musical note.

A survey of the tides and currents of the Dominion is being conducted under the charge of Dr. W. Bell Dawson, one of the society's members. This survey, although having marine information for its more immediate object, yet requires to be based on engineering methods for its successful accomplishment. Its problems include construction and mechanical appliances, and questions in astronomy, physics and hydraulics require consideration to make the work effective. Tide tables, based upon very complete gauge records, are now issued for the whole Dominion. The velocity and direction of currents have been determined in the St. Lawrence as well as upon the most dangerous parts of the Atlantic coast, and the results placed in the hands of mariners.

The tidal results have already proved valuable in connection with harbor construction, docks and dredging. Mean sea level, which the modern method of reducing tidal observations determines so accurately, affords the only trustworthy plane of reference for geodetic surveys. The Tidal Survey, by maintaining a uniform datum for the observations from year to year, has already referred mean sea level to bench marks established at Quebec, Halifax, and St. John, N.B. There are now also bench marks and sufficient tidal record for this purpose at a number of widely separated points in the area extending from the St. Lawrence to Newfoundland, and from Labrador to Nova Scotia. These isolated bench marks ought to be connected by continuous levels. Some admirable work has already been accomplished in this direction by R. Steckel, of our society, and it is unfortunate that the pressure of more urgent duties has prevented the prosecution to completion of this scientifically important connecting link. The same data are also being determined on the Pacific coast at Victoria, Vancouver, and Port Simpson.

For hydrographic charts, Canada was for a long time dependent upon the surveys made in the early part of the last century by that well-known hydrographer, the late Admiral Bayfield. The immense quantity of work accomplished by that distinguished naval officer, and the wonderful accuracy of his charts, considering the rapidity with which he must have worked, and the clumsy vessels at his disposal in those early days, are beyond praise, but naturally these early charts became more or less unreliable with the introduction of deeper draught vessels and steam navigation. In 1887 this department borrowed from the Admiralty the services of a hydrographic surveyor, Staff-Commander Boulton, who organized a re-survey of the Great Lakes, which has since been continuously carried on. We now have modern charts of the Canadian shores of all the Great Lakes, except Ontario, and portions of Lake Superior unfinished. On Captain Boulton's retirement he was succeeded by W. J. Stewart, his pupil, and a graduate of the Royal Military College, and also one of our members who has lately been put in charge of all our hydrographic surveying. Last year this department took over from the Department of Railways and Canals a hydrographic survey of Lake St. Louis, and also took over from the Public Works Department the staff engaged on the re-survey, nearly completed, of the ship channel between Montreal and Quebec. There is no lack of work in this branch ready for attention when such can be given to it. The Maritime Province shore of the Gulf of St.

Lawrence requires re-surveying, and a great deal of detail work is also required on our Pacific coast. If the advocated railway to Hudson Bay for the shipment of North-West grain by that route ever becomes an accomplished fact, the Marine Department will also be called on for extensive work both in surveying and establishing aids to navigation in that remote Canadian sea, for existing charts of its coast lines are merely the roughest kind of sketches.

Several small hydrographic surveys have been made by the department, the most extensive of these being a survey of the whole of Lake Winnipeg, which has occupied Mr. Stewart or one of his assistants for the past three years. We have not yet undertaken the publication of charts, these being engraved and published by the Imperial Admiralty without cost to us, but there is a staff for the collecting, editing and publication of descriptions of aids to navigation, sailing directions, hydrographical notes and other information of value to mariners, that is doing very creditable work.

The experience of this department with ice-breaking steamers is worthy of a word of reference, but most of the facts were brought out in papers and discussions before this society some years ago, and need not be enlarged upon here. We have had charge, since the inception of the enterprise, of the winter ferry between Prince Edward Island and the mainland. The first boat used for the service was built from the plans of Edmund Sewell, of Quebec, and embodied the results of his experience in the winter ferry service at that The Northern Light was a wooden steamer and perplace. formed the service with a fair degree of success. It was replaced by a Scotch built steel boat, the Stanley, which was, I believe, the first boat built of steel used as an ice-breaker. The Stanley in turn has been replaced by a larger, more strongly protected and more powerful steamer, the Minto, which has done the best work of the three, but all have at times been caught in the heavy fields for periods varying from a few days to a few weeks.

The great quantity of grain now grown in our North-West has made shippers anxious to extend inland navigation to as late a date in the autumn as it may be possible to force a passage through the making ice, and the department has been strongly urged to assist the movement by extending the limit of time for removing buoys and all other floating aids to navigation, and by breaking ice where necessary. This autumn the lights in Lake Superior were kept open a fortnight later than usual, necessitating special arrangements for the removal of the isolated keepers, and Fort William and Port Arthur harbors were kept open by employing ice-breaking tugs. This allowed shippers to get out by the cheap water route a considerable portion of this autumn's crop.

Two ice-breaking steamers, built in Scotland for the department have been put in commission this winter, the one to maintain a ferry between Pointe aux Originaux and Murray Bay, the other to keep the river open, if possible, between Quebec and Montreal. This last proposition is rather in the nature of an experiment, as no one is quite sure how much can be accomplished or what the effect would be of preventing the ice bridge from forming.

The maintenance and improvement of the ship channel between Quebec and Montreal, begun by the Montreal Harbor Commissioners, and later assumed by the Department of Public Works, was last year transferred to the Marine Department, for the sake of consolidating control of the work. This channel is now 30 feet deep at low water, except over St. Augustine bar, where the least depth is 23 feet, but where there is a rise of the tide of 16 feet. The immediate aim of the department is to complete the depth to 30 feet throughout, to make the least width 500 feet, and to light the whole extent for night navigation. The only serious work remaining to accomplish this is the widening from 300 to 500 feet of Cap à la Roche cut, an excavation in limestone. Judging by past experience, this work will no sooner be accomplished than a further widening and deepening will be asked for, to accommodate the ever-enlarging steamers seeking the St. Lawrence trade.

The address concluded with a reference to the improvements in the harbor of Montreal.

The address was enthusiastically received, and Colonel Anderson was complimented on his choice of subject.