

The Elsinore was built to act as ferry and ice breaker, her dimensions being: Length 179 ft., beam 43 ft., draught 10 ft., single track capacity 7 cars, single screw at each end.

Four car ferries were built later to accommodate the traffic, two by the Danish government, and two by the German government, two screw boats and two paddle boats, the paddle boats for use in summer only. Length 280 ft., beam 60 ft., draught 13½ ft., i.h.p. 2,600, speed 14 knots.

The car ferry system has also been adopted at the following points: Across the Straits of Messina, the Nordser canal in Holland, also from the Rugen island to Stralsund in Pomerania, and at other points given in this report.

The Ontario no. 1, car ferry and ice breaker on Lake Ontario, cost \$370,000, cars 24, staterooms 100 passengers, length 320 ft., beam 56 ft., draught 15 ft., speed 15 miles, screws twin aft, owner Grand Trunk Ry., built 1906.

The Ermack, ice breaker, not a car ferry. Length 305 ft., beam 71 ft., draught 23 ft. Three stern propellers and one bow propeller, i.h.p. 2,500 each set of engines, with 8,000 h.p., speed 15¼ knots. All engines running 16½ knots forward propeller 13 ft. diameter. All propellers, nickel steel blades (tensile strength 80,000 lbs. per sq. in.). Has steamed through field ice 18 to 24 ins. thick with 6 ins. of snow on top at speed of 8 knots. Went through 1-3 of a mile of rafted ice 20 to 25 ft. thick in two hours. On her trip to Spitzbergen she encountered Polar ice 12 to 14 ft. thick, through which she forced her way at 2½ knots an hour.

The Urimack is a sister ship to the Ermack and has engines of i.h.p. 10,000, triple screws, two at the stern and one at the bow. She is used to keep open navigation through 45 miles of ice to Vladivostok harbor.

The Neva is another Russian boat of the same dimensions and power as the Ermack.

The Finnish ice breaker Sampo. Length 232 ft., beam 45 ft., draught 18 ft., i.h.p. 2,500.

Experience with the Ermack, Urimack, Neva and Sampo has shown that pack ice of practically any thickness can be negotiated. The Ermack on one occasion encountered pack ice 34 ft. thick, 9 ft. being above the level of the field through which she successfully forced her way.

The Baikal, an ice breaker and car ferry on Lake Baikal, Russia. Length 290 ft., beam 53½ ft., draught 18½ ft., 2 screws aft and one forward.

The Delaware, an ice breaker. Length 232 ft., beam 45 ft., draught 13 ft., speed 15 miles, aft engines 2,400 i.h.p., forward engines 400 i.h.p. Two screws aft and one forward, has also a water line deck without camber or sheer, to give additional stiffness, and prevent her being crushed in by moving ice packs.

The St. Ignace, built in 1889. Length 235 ft., beam 52 ft., bow and stern propellers, capacity 10 freight cars, speed 15 miles. This was the first boat built with a bow propeller.

The Sainte Marie, built in 1893. Length 305 ft., beam 53 ft., bow and stern propellers, capacity 18 freight cars, speed 16 miles an hour.

The St. Ignace and the Sainte Marie were designed by Frank Kirby, and built at Detroit, Mich., for summer and winter navigation in the Straits of Mackinac, for the Duluth, South Shore and Atlantic, the Michigan Central and Grand Rapids and Indiana railroads, to make the connecting link between the upper and lower peninsulas of Michigan, the run between Mackinaw city and St. Ignace being 8 miles. Pere

Marquette no. 2, no. 15, no. 19 and no. 20, are all similar and were designed by R. Lagan.

The Pere Marquette no. 20. Length 350 ft., beam 56 ft., draught 14 ft., i.h.p. 2,500 each, twin screws aft, speed 14 miles, 4 tracks, 30 steel coal cars.

The photograph of the Marquette and Bessemer no. 2 forcing her way through piled ice on Lake Erie gives some idea of the class of steam boat used on the Great Lakes for car ferry service. Two of these vessels were lost about 18 months ago, one on Lake Erie, and the other on Lake Michigan. The cause for the one on Lake Erie has never been determined as she has not been found and all hands perished. The loss of the one on Lake Michigan was attributed to leaving the bow port hole lights open when leaving the harbor, and not being discovered until too late to close against the inrush of water, and not being provided with collision bulkhead she filled and foundered.

No. 1 for carrying coal in bulk loaded from tracks on her decks. Length 255 ft., beam 43 ft.

No. 14 has three tracks and is an open deck, and used for transferring cars across the Detroit river. Length 351¼ ft., beam 52 ft.

No. 1 and no. 14 were designed by Frank Kirby, all for the Pere Marquette Steamship Co.

THE TYPE OF VESSEL that would be best adapted for the Northumberland straits would be one between the design of the Delaware and the Bessemer and Pere Marquette types. It should have an ice crushing bow, with bow propeller of special nickel steel, and engines of 200 i.h.p., twin screws aft, with engines of 2,500 i.h.p. each, sea cocks as designed for encountering lolley ice, heavy ice, belt plating, stiffening deck without camber or sheer at water level, to protect hull against pinching by moving ice flows, two railway tracks to accommodate 5 freight cars each, and to load and unload over the stern, and accommodation for passengers as well as crew. This would necessitate a boat about 280 ft. long, 50 ft. beam, 16 ft. draught light and about 18 ft. draught under full load, which would be able to negotiate any of the ice conditions to be found in the straits. Approximate mathematical calculations as to the proper shape of forefoot of ice breaking steamer, and the thickness of ice a given steamer is capable of breaking, were worked out by R. Runenburg, and may be found in Proceedings of the Institute of Civil Engineers, paper 2371, 1891.

CONFIRMATION. Might I suggest that this report be confirmed in its various details as follows: By E. Tiffin, General Traffic Manager, I.R.C., as to the traffic; by F. P. Brady, General Superintendent, I.R.C., as to maintenance and operations; by W. B. Mackenzie, Chief Engineer, I.R.C., who has made a study of this question for some years, and has some valuable information collected, as to the construction, etc.; also by some independent master mariner who is conversant with the navigation of the straits.

I believe that their confirmation of this report would materially strengthen it, and help to allay the feeling of discontent and disappointment that is sure to arise in the places which have been looking forward to having the terminus of the car ferry established at their port.

The foregoing report was made to the Minister of Railways and Canals, who commissioned Prof. Kirkpatrick to investigate the question.

An Ottawa dispatch of Sept. 4, stated that the Railways Department had received several tenders for the construction of the car ferry, from British and U.S. firms.

## Lake Vessels and Pilotage Dues in Montreal Harbor.

It is probable that, during the next session of Parliament, amendments will be made to the Canada Shipping Act, regarding pilotage dues in Montreal harbor, in so far as vessels trading from the great lakes are concerned. It is contended that the present regulations constitute a discrimination against vessels from the lakes entering Montreal harbor, as they are compelled to take on a pilot at the mouth of the Lachine canal, or pay the pilotage dues, and also pay a moving charge when changing from one point of the harbor to another, while vessels trading from Quebec are not compelled to take on a pilot, nor pay pilotage dues.

In this connection representatives of the Dominion Marine Association, the Shipping Federation of Canada, and the Pilotage Association, recently met the acting Premier and the Deputy Minister of Marine, to discuss the fulfilment of an arrangement made earlier in the year, whereby assent would be given to the abolition of the pilotage moving charge in any part of Montreal harbor, if the owners of lake vessels would support a scheme for the arrangement and enforcement of regulations governing the traffic in the harbor. The regulations were prepared, revised and sanctioned by both the Dominion Marine Association and the Shipping Federation, and the interview was arranged chiefly to settle the limits within which exemption should be given from the moving charge which lake vessel owners contend is simply a tax on the vessel. The Dominion Marine Association asked that the agreement arrived at be carried out if the regulations now proposed were put in force. The Shipping Federation and the Pilotage Association however contend that exemption from the moving charge should be confined within the limits covered by the regulations. Ultimately it was decided that the approved regulations should be put in force, and that the moving charge be abolished, only within the same limits, which include that part of Montreal harbor extending from its western limit as far east as the eastern limit of the section which includes the Sutherland pier, just east of the Tarte pier. The Dominion Marine Association remains opposed to the imposition of the charge within any part of the harbor, and stays on record as in favor of its complete abolition.

## Internal Combustion Engines for Dredges.

—A somewhat new line of development in the application of internal combustion engines is the operation of dredges, and two dipper dredges operated in this manner are now at work on drainage ditch excavation in Iowa. The dredges are in general standard designs of the Marion Steam Shovel Co., which supplied the machinery, the special feature being the application of oil engines instead of steam engines for the hoists. The engines were supplied by Fairbanks-Morse & Co. The dredges were built for D. C. Stephens, contractor, of Buffalo, N.Y., and the design of the hull was modified to suit the engine equipment. Compressed air is used in raising steam in the auxiliary boiler.

The Dominion Government has approved the Montreal Harbor Commissioners' by-law prescribing a system of signals, consisting of semaphores by day and lights at night, for use in the Montreal harbor from the Tarte pier to the Lachine canal. Hitherto small vessels have passed from point to point without any system, causing a number of minor accidents, and endangering shipping.