INSTITUTE OF MARINE ENGINEERS
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President—SIR JOHN GUNN.

VOLUME XV.

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ON
ICEBREAKERS AND THEIR SERVICES.

BY

MR. A. GULSTON.

DELIVERED AT THE

LONDON INSTITUTION, FINSBURY CIRCUS, E.C.

ON

MONDAY, DECEMBER 7th, 1903.

CHAIRMAN:

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A MEETING of the Institute of Marine Engineers was held on Monday evening at the London Institution, Finsbury Circus, E.C., when an extremely interesting lecture on "Icebreakers and their Services" was delivered by Mr. A. Gulston. The chair was occupied by Mr. T. F. Aukland (Companion).

Mr. GULSTON opened his lecture by observing that icebreakers were of many forms and dimensions,

varying from a steam launch 40 feet long to the enormous *Ermack*, of 8,000 tons displacement and 10,000 horse-power. The first recognised icebreaker was a tug called the *Pilot*, of Cronstadt. A new bow was built on that vessel, and in 1870 she was set to work. That early icebreaker was superseded in 1889 by two small icebreakers, the *Zarja* and the *Luna*, which acted as ordinary tugs during the open season. Those two vessels were of 150 i.h.p. each. The ports of Hamburg and Copenhagen followed the lead of Cronstadt, and at Hamburg there were now several icebreakers. Although those vessels were not large, they were well designed and suitably arranged for the work they had to perform amongst the drift ice in the Elbe. The first icebreaker at Copenhagen was the *Staerkodder*, of 800 i.h.p.; but the fine icebreaker *Sleipner*, belonging to the harbour authorities, now controlled the winter traffic at Copenhagen. That vessel was of 2,000 i.h.p. and 1,450 tons displacement. She was fitted with compound machinery, on the assumption that less damage was likely to occur to low-pressure boilers than would be the case with higher pressure, owing to the constantly changing steam pressures consequent in an icebreaker when at work. Icebreaking as an assistance to commerce was brought to a high state of perfection at the ports of Hango and Helsingfors, in Finland, although the latter port was not kept open all the winter, the whole power of the Finnish icebreakers *Murtaja* and *Sampo* being, about January, concentrated entirely on Hango. The actual performance of the *Sampo* in the Gulf of Finland showed that she had a very efficient form for icebreaking. She passed through field ice of 12 in. to 16 in. in thickness at 8 knots an hour, and the thickness of the drift ice she had generally been at work in, was some 8 ft. to 10 ft., through which she could pass at from two to three knots an hour. At Christiania there was a fine icebreaker, the *Isbjern*, built at that port, and she kept a channel free under all the conditions of ice at that place.

Ordinary merchant steamers trading during the winter in icebound seas should have the plating at the bows doubled, and the side plating for some width above the water-line should be of a much heavier scantling than usual. The propeller blades should be of very strong design, and so fitted to the boss as to facilitate repairs. When that was done steamers could, to a large extent, take care of themselves. Without strengthening of that nature vessels dared not "charge" the ice, or the plating would be holed, and it was impossible to drive the engines, or the blades of the propeller would be knocked off. At Reval there were four icebreakers of varying dimensions, and the efforts of those vessels were supplemented by a well-arranged system of telegraphing all ships approaching the coast. There were also icebreakers at Odessa, Kiel, Riga, Stockholm, Rostoff, Stettin, Libau, Amsterdam, Calmar, and Nicolaisk, Vladivostock, &c. The lecturer then proceeded to deal with the design of icebreakers and vessels suitable for working amongst ice. Those vessels, he said, should have the bow angles and lines so arranged that when they had mounted the ice, and the ice was giving way under the vessel's weight, they must not jamb when returning to be water-borne forward, always remembering that they were advancing and should remount the ice. When the ice was broken down it should pass along below the vessel or under the field ice; otherwise, it lay on the water and had a tendency to jamb the vessel sideways, which resulted in the icebreaker having to smash a larger proportion of ice than was necessary, to give side clearance, thus absorbing more power, coal and time, and probably resulting in having to back and charge the ice. An icebreaker should also be able to turn easily out of the channel she had cut, and the form of the bow lines had much effect on that manœuvre. The designs of icebreakers varied so much that there was no certain data to guide builders, but practice had shown that the full forward form, or spoon-

shaped bow, was not successful in hard and packed ice, as the vessel pushed the ice in front of herself, instead of cutting and dispersing it. It should be borne in mind that icebreakers, when "charging" in heavy ice, were in collision, so to speak, during the whole time that they were at work, and that entailed much more strengthening of the bows and sides as the ice to be dealt with became more formidable. The shell-plating must be considerably increased in small boats, and still more so as the vessels increased in size. Additional stringers, stronger decks, and a liberal addition to the number of bulkheads, transverse and longitudinal, as well as many pillars, became a necessity to prevent the constant recurrence of repairs. All piping should be kept under the deck, and the fire pipes should be fitted with hydrants below and above that deck. The boiler-rooms must be well closed up, and consideration had to be given to the disposal of the ashes. The rudder should be arranged for easy unshipment afloat, and should be of large area and immensely strong. The moving parts of the machinery and the shafts must be extra strong and largely in excess of ordinary practice. On the engines it was preferable to have direct steam reversing gear, as the "all-round" type was a very heavy tax on the engineers when the ship was ice-breaking. The vessel should be so designed that, if possible, she could be tipped to replace a propeller blade whilst afloat. The captain or icemaster had to exercise considerable care when cutting out vessels fast in the ice, and the procedure was to pass across the bow and then the stern of the fastened ship. Endeavours should be made to crack the ice in some direction towards the ends of the vessel before passing her in a parallel direction, so as to obviate, as far as possible, all chances of crushing the steamer's sides. The lecturer then proceeded to describe the icebreaking passenger and mail steamers. There were, he said, not many of those vessels at work, and they were not able to force the packs so readily

as an icebreaker could. Three vessels of that type, the *Express* and the *Abo*, running between Stockholm and Hango, and the *Bore*, running between Stockholm and Abo, kept up a steady time table throughout the winter. After referring to various vessels of that type, the lecturer described the *Stanley*, an ice-breaking mail-boat belonging to the Canadian Government, and engaged in running between Prince Edward's Island and Newfoundland. The *Britannia* —the first steamer of the Cunard Company—was next dealt with. That vessel, Mr. Gulston observed, became imprisoned in the ice at Boston, U.S.A., in 1844, and the people of the town arranged to help to cut her out. That project was carried through by sawing and breaking the ice, and by the aid of her paddle-wheels she reached the open water. The distance that the *Britannia* had to be cut out was seven miles, and at that date that was a remarkable undertaking. The old-time whalers of Dundee and other ports, some of which were now engaged in Polar work, were essentially icebreakers of a type. They were built entirely of wood, the bows sheathed with iron, and many daring deeds had been done with some of those vessels in Polar seas. From that class of vessel they must not exclude Dr. Nansen's *Fram*. That ship was well designed to withstand shocks and ice pressures, and that she had proved in her long endurance in Polar ice on two expeditions. Nor must they overlook the *Discovery*, of the National Antarctic Expedition, now at work in the immense ice of the Southern Polar Ocean, and the *Scotia*, of the Scottish National Expedition. Another type of vessel for use in winter was the railway ferry ice-breaking steamer. That useful type of vessel represented many problems, and was by far the most difficult to design and arrange. Some of those vessels were of great size, and those best known to them were used on the Danish State railways, between the islands of the Great Belt and the mainlands. There were also the famous railway ferry icebreakers at Saratoff, on the River Volga, which

were used for keeping up the services of the Riazan Ouralask Railway across that mighty river, which was icebound for several months during the winter. The fleet consisted of two steamers, one being an icebreaker and the other a railway ferry icebreaker. Those vessels were fired by oil fuel, which had given entire satisfaction. As those two steamers had to pass through the system of locks on the Marinsky Canal from Lake Ladoga to the River Sweir, and so to the Volga, it had been necessary to build them so that they could be parted to enter the locks—the icebreaker in halves and the railway ferry into four portions. That gave rise to considerable ingenuity of design and a large amount of work, as each half of the icebreaker had to be placed in a barge to pass through the canal system; and, of course, all the work had to be gone through again in joining them up. Those two vessels were sent away from the Walker Shipyard bolted together at the division bulkheads, and all in readiness for parting, which operation took place on the River Neva some distance above St. Petersburg. All disconnecting and coupling-up had to be done afloat, which rendered the task all the more complex. The next vessel he would describe was the *Scotia*, also built at Walker-on-Tyne. She had been constructed to the order of the Inter-Colonial Railway of Canada for service across the Strait of Canso, between Cape Breton Island and Nova Scotia. She was a typical icebreaker. Either end of the vessel was intended to be bow or stern at will, so that in working it was not necessary for her to turn round when entering or leaving her landings. On her deck she had three sets of rails, and was designed to carry nine Pullman or corridor bogie sleeping cars 80 feet long, each weighing 52 tons unloaded. The ship was entirely controlled from the bridge, as the centre of the deck had to be kept clear for the railway coaches. The lecturer then described the railway ferry ice-breaking steamers *St. Marie* and *St. Ignace*, which plied across the Straits of Mackinaw, between Lake

Huron and Michigan, a distance of seven miles. Both those boats were built of oak, sheathed with iron in way of the water-line. After describing yet other vessels of the same type for use in American waters, Mr. Gulston proceeded to give a detailed account of the building and working of the famous icebreaker *Baikal*, running on Lake Baikal, in the centre of Siberia. That vessel was built to connect the eastern and western ends of the Siberian Railway, which, as they knew, made a continuous railway from Ostend to Vladivostock in Eastern Siberia and Port Arthur in Manchuria. The distance of the ferry across the lake was fifty-two miles. The *Baikal* was built on the Tyne. The hull was completely erected, marked, taken down, and shipped inside of six months, and 2,700 tons weight in 6,900 packages had to be transhipped for some 1,500 miles across Siberia by boat to the place of re-erection. The boilers, of which there were fifteen, had to be kept under 20 tons in weight for transhipment purposes, and even those great pieces were moved in sledges by the aid of hand and pony power from the railway trucks to the ship. During the winter that that enormous steamer had been at work she had proved herself to be most successful in keeping the service open under difficulties of ice navigation that were unknown, and therefore even unthought of, during her construction. There was, of course, no knowledge of the ice, as regards navigating purposes, on Lake Baikal until that vessel went to work. The next vessel to be considered was the *Ermack*, which had been built for Polar enterprise, as well as for icebreaking in the Baltic. The speed of the *Ermack* through 24 inches of solid ice, with 6 in. to 12 in. of snow on it, was 9 knots an hour, and she could charge and demolish packs of ice 20 to 35 feet thick. In Polar ice the speed had to be kept at about from $2\frac{1}{2}$ to $3\frac{1}{2}$ knots per hour, as one was apt to lose control of the vessel in that enormous ice, and the local shocks became very severe when she was charging about at

her own " sweet will " amongst the Palæocristic ices. She had proved herself to be of enormous use on her station on the Baltic coast of Russia, where she could negotiate any ice and could safely bring out of danger all steamers that she went to assist. Indeed, in one season she rescued and assisted shipping of over £2,000,000 value, and in another winter she salved the Russian battleship *Grand Admiral Apraxine*, of £750,000 value. With the *Ermack* in the Baltic there was no difficulty in Russia putting her fleet to sea, which usually wintered at Cronstadt, as the *Ermack* could easily guide them to open water should necessity arise, and there was nothing to prevent that vessel herself being made into an armed cruiser.

The lecture, which was of great interest throughout, was illustrated by a collection of lantern slides —over a hundred in number—that can only be described as unique. These pictures gave an excellent idea of the many types of icebreaker described by Mr. Gulston, and a grand idea of the lonely Northern regions and icebound ports where those vessels carry on their useful work.

Mr. C. W. MURRAY proposed a very hearty vote of thanks to Mr. Gulston for his excellent lecture, and the vote, having been seconded by Mr. W. MCLAREN, was most cordially agreed to.

It was intimated that on Monday, December 14, an adjourned discussion on " Grinding Machinery," introduced in the paper read by Mr. Bales, would be held at 58 Romford Road, Stratford, at 8 p.m.

A vote of thanks to the chairman for presiding brought the meeting to a close.