of cargo being carried in addition to the coals, water and stores required for the passage across the Atlantic.

In 1908 the "Laurentic ” and “ Megantic ” were built by Messrs Harland & Wolff for the White Star Canadian Service; they are 55o ft. long, 67 ft. 4 in. beam, 41 ft. 2 in. depth moulded and 14,890 tons gross; they can carry 1660 passengers and a very large cargo. The “ Laurentic ” is provided with reciprocating engines of 6500 LH.P. in combination with Parsons turbines of 3500 H.P., while the “ Megantic ” is fitted with reciprocating engines only. On trial the “ Laurentic ” developed 12,000 H.P. with a speed of 17½ knots, and on service her coal consumption is 12 to 15% less than that of the “ Megantic.” A service from Bristol to Quebec and Montreal was opened in 1910 by the “ Royal George ” and the “ Royal Edward,” which ran for some time in a fast mail service from Marseilles to Alex­andria under the names of “ Heliopolis ” and “ Cairo ” respectively. They were built in 1908 and are 545 ft. long, breadth 60 ft., depth 38 ft., tonnage 11,150 tons gross, displacement 15,000 tons at 22 ft. 6in. draught. Parsons turbines of 18,000 H.P. are fitted, driving three screws at 370 revolutions per minute and giving a maximum speed of 20¾ knots, while 19∙1 knots has been maintained by the “ Royal Edward ” from Bristol to Quebec. Accommodation is provided for over 1000 passengers. Still larger and faster vessels were being arranged for in 1910.

*Emigrant Vessels.*—Many vessels on the Atlantic Service are fitted up for carrying emigrants either with or without other passengers; they are always arranged to carry as much cargo as possible. Ships built for such services include the “ Gerania,” built by the Northumberland Shipbuilding Company in 1909 for Austrian owners. Her dimensions are: length 402 ft., beam 52 ft. 6 in., moulded depth 27 ft. 1 in., 4900 tons gross. She can carry 8000 tons dead-weight on 24 ft. draught at a speed of 11 knots, but her ’tween decks are arranged so that they can be used to carry cattle, troops or emigrants as required. The "Tortona,” built in 1909 by Messrs Swan & Hunter for the Italian emigrant trade to Canada, is 464 ft. long over all, beam 54 ft., depth 29 ft., she is 7900 tons gross and can carry 8600 tons dead-weight as well as over 1000 emigrants. The “Ancona,” built in 1908 by Messrs Workman, Clark & Co. for the Italian emigrant trade to the United States, is 500 ft. long, 8188 tons gross, 7500 l.H.P. ; she can carry 2500 emigrants and a large cargo, and in addition 60 first-class passengers in spacious cabins on a promenade deck amid­ships. Some of the finest vessels carrying emigrants are the ships of the “ Cleveland ” type belonging to the Hamburg-American Company. The “ Cleveland ” is 587 ft. long, 65 ft. breadth moulded, 46∙7 ft. depth, 27,000 tons displacement on a draught of 32 ft. 8 in., 13,000 tons dead-weight capacity, about 17,000 tons gross and 10,000 tons net, with machinery of 9300 I.H.P. and 16 knots speed. She can carry 250 first-class, 392 second-class, 494 third-class and 2064 fourth- class or emigrant passengers, making with a crew of 360 a total of 3560 persons, and has cold storage spaces of 10,000 cub. ft. for provisions, and 30.000 cub. ft. for cargo.

*Liners on other Routes.*—Only a few typical vessels engaged on other routes can be mentioned here. The Royal Mail Company's “ Avon ” (fig. 33, Plate VIII.), trading to the West Indies and round South America to the Pacific coasts, is 520 ft. long, 62 ft. 4 in. beam, 31 ft. 9 in. depth moulded and 11,073 tons gross tonnage. The “ Kenilworth Castle ” (fig. 34, Plate VIII.), in 1910 one of the latest additions to the Union-CastleLine Fleet trading to South Africa, is 570 ft. long, 64 ft. 8 in. beam, 38 ft. 8 in. moulded depth, 12,975 tons gross tonnage, 12,500 I.H.P. and 17½ knots speed. The “Osterley” (fig. 35, Plate VIII.) is typical of the splendid ships running via the Suez Canal to the Eastern ports, Australia and New Zealand; she was built in 1909 by the London & Glasgow Shipbuilding Company for the new fleet of the Orient Line. She is 535 ft. long, 63 ft. beam, 38 ft. depth to upper deck, 18,360 tons displacement at 28 ft. draught, 12,129 tons gross, and obtained 18∙76 knots on trial with 13,790 I.H.P.; 1150 passengers can be carried as well as some 7000 tons of cargo. The “ Maloja,” which in 1910 was being built for the P. & O. Company, is a little larger than the “ Osterley,” being 550 ft. long, 62½ ft. broad, 12,500 tons gross, of 15,000 LH.P. and 19 knots speed.

Many vessels carrying very large cargoes and comparatively few passengers are engaged in the meat and fruit trades, and are fitted up with refrigerating machinery, insulated holds and cooling appliances so as to keep the fruit, vegetables or meat at the required temperature, and at the same time maintain a proper degree of humidity or of dryness of the atmosphere. The number and size of vessels engaged in these trades continue to increase, and the enormous volume of the trade may be indicated by the fact that thirteen million carcases of mutton would be required to fill the holds of the vessels fitted for that particular trade. A typical vessel is the “ Highland Laddie,” built for the Argentine trade in 1909, 420 ft. long, 56 ft. beam, 37 ft. 6 in. moulded depth to shelter deck, 7500 tons gross, 4600 H.P. and speed 15¾ knots on trial. She can carry oyer 500 passengers in well-fitted and comfortable apartments amidslrps, and has insulated cargo-holds of 343,000 cub. ft. capacity. To control the temperature of the chilled beef or frozen mutton in these holds she is fitted with powerful refrigerating machinery, and cooled brine is circulated through tubes lining the sides and ceilings of the holds, some 20 miles of brine pipes being so used. The

“ Ruahine,” built in 1909 for the New Zealand trade, is similarly fitted; she is 480 ft. long, 60 ft. broad, 44 ft. depth moulded, speed on trial 15·9 knots. The “ Port Royal ” of the Elder Dempster Line has insulated holds capable of transporting 3,000,000 bananas, besides pineapples, oranges and other tropical and semi-tropical fruits. The fruit is kept at the desired temperature by means of large volumes of cold dry air circulated through the holds, and the air is cooled by contact with nests of pipes through which brine of a low temperature is circulated. The “ Tortuguero,” a vessel 390 ft. long, 48 ft. beam, 29 ft. 6 in. depth, 4200 tons gross, built for Messrs Elders & Fyffes, has a storage capacity of 2½ times that of the “ Port Royal.”

*Pacific Liners.—*The “ Empress ” vessels of the Canadian Pacific Railway Company were the first liners built specially for the trans- pacific ocean service. The railway reached the Pacific seaboard in 1885, and in 1891 these vessels began running. They reached a maximum speed of 19∙75 knots on trial, and in 1910 could still maintain 17 knots across the Pacific. In 1901 the “ Korea” and “ Siberia ” were built for the service; they were in their day the largest American-built vessels, each being 552 ft. long, 63 ft. beam and 41 ft. depth, of tonnage 11,276 gross, and displacement 18,600 tons when loaded to 27 ft. draught. Quadruple-expansion engines of 18,000 I.H.P. gave them a speed of 20 knots on trial and 18 knots sea-going speed. Two hundred and twenty first-class passengers are carried in cabins and saloons above the upper deck, and provision is made for 60 third-class, and for 1200 Chinese steerage passengers. In 1904 these were joined by the American-built vessels the “ Manchuria" and “ Mongolia,” of 2000 tons greater tonnage. They are 616 ft. long, 65 ft. beam, depth 31 ft. 1 in., 13,639 tons gross, 27,000 tons displacement and 20 knots maximum speed, and can each carry 1920 passengers and a large cargo. These were again outstripped in size by the “ Minnesota ” and “ Dakota,” which arrived shortly afterwards. They were 622 ft. long, of 20,718 tons gross, 33,000 tons displacement, 14 knots speed, and had capacity for 2850 passengers and 20,000 tons of cargo. The “ Dakota ” was lost off the coast of Japan in March 1907, but the “ Minnesota ” was in 1010 still on service, and was the largest merchant vessel yet built in the United States. These American vessels carry on the transpacific service from San Francisco and Seattle, and replace the older vessels with which the American Pacific Mail Company carried on the service for many years. The American and British vessels were all outstripped by the Japanese vessels “ Tenyo Maru ” and “ Chiyo Maru ” of the Toyo Kaisen Kaisha (Japanese Oriental S.S. Co.). They were built in Japan, of the following dimensions : length over all 575 ft., between perpendiculars 558 ft., breadth 63 ft., depth to shelter deck 46 ft. 6 in., to upper deck 38 ft. 6 in., gross tonnage 14,700 tons; displacement 21,500 tons at 31 ft. 8 in. draught. They are driven by three sets of Parsons turbines of a total H.P. of 17,000 at 270 revolutions per minute, and have attained 21·6 knots on trial and 20 knots on ocean service. Steam is supplied by 13 cylindrical boilers, working at 180 lb pressure and fired by oil fuel only. They have accommodation for 275 first-class, 54 second-class and 800 steerage passengers, and over 8000 tons of cargo.

*Special Vessels.—*Many vessels are built for special and exceρ- tional purposes, and cannot be classed with either ordinary cargo or passenger vessels. Amongst these may be included dredgers, train- carrying ferry-boats, ice-breakers, surveying vessels, lightships, fish- ing vessels, coastguard and fishery cruisers, salvage and fire vessels, lifeboats and tugs. To Dredgers a special article is devoted (see Dredge).

*Train Ferries.—*In 1869 Mr Scott Russell described *(Trans. Inst. Nav. Arch.)* a train ferry-boat of special construction in use on the Lake of Constance, having a length of 220 ft., a breadth over the paddle-boxes of 60 ft., and a displacement of 1600 tons; the horse- power of her machinery was 200, divided between two paddle- wheels, each of which was driven by a pair of independent oscillating engines. The object of this steamer was to convey trains between Romanshorn, on the one side of the lake, and Friedrichshafen, on the other ; she was built of iron, and was designed to have great strength combined with light draught.

In 1872 train ferry-boats were introduced into Denmark to carry trains between the mainland and the islands and, later, between Denmark and Sweden. The first was a single track iron paddle vessel, the “ Lille Baelt,” built by Richardson of Newcastle for the service from Fredericia to Strib (2 m.); her dimensions were: length 139 ft., breadth moulded 26 ft., extreme 44 ft. 6 in., draught 8 ft., tonnage 306, I.H.P. 280, and speed 8 knots. A similar boat, the “ Fredericia,” was afterwards built by Schichau of Elbing for the same service; in 1883 this firm built two very similar but longer vessels for ferries of 2-2½ m. across, which proved very successful; and others of various types followed for femes of 16, 18½ and 48 m. across. The Danish government in 1910 employed 22 vessels of a total of about 16,000 tons on eight ferries for railroad cars, as well as separate vessels for other trafic. These services have to be main- tained all the year round, and several of the vessels are specialty strengthened for passage through ice; in addition, four other vessels of 497 to 553 tons gross and 600 to 800 I.H.P. are employed wholly as ice-breakers. The latest of these vessels in 1910 was the “ Christian IX.” employed on the ferry across the Great Belt,