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SEA-BORNE TRAFFIC

PART II (Modern),

BY

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CHAIRMAN:

MR. A. BOYLE (CHAIRMAN OF COUNCIL).

THE wealth and products of India attracted the early attention of England, and the founding and Charter of the East India Company, 31st December, 1600, and re-constitution in 1743, led ultimately to the Government taking over the rights of the Company and the responsibility of the territory, the fruits of the commercial undertaking being gradually extended year by year until now they form our Indian Empire.

It is necessary for our very existence as a nation that we have outlets for our population in the form of emigration, and it is also necessary that we should be on good commercial terms with nations who can supply us with food stuffs in exchange for manu-

factured goods, hence the ships of more recent years have been built with a view to these necessities. The sizes have been increased, and the designs have been modified to suit the special trade for which each ship is intended—whether for carrying passengers and emigrants or cargo. Competition has become an important factor in the arts of shipbuilding and shipowning, and has had a bearing on both, within the last few years especially, and the magnificent steamers now afloat testify to the fact that those who are specially interested in the sea-borne traffic of the nation are quite alive to the situation, and have prepared themselves to meet it.

The emigrant sailing ships with their long, sometimes disastrous, but generally comfortless voyages have given place to the commodious steamer in which emigrants are carried in comparative comfort. It is no longer necessary to rely on salt junk and biscuit for provisions; fresh meat can be kept for years in a refrigerated atmosphere.

The *Great Eastern* was a great advance over the vessels of her day forty to fifty years ago; she was built before the season was ripe for such a ship, and although not a success commercially, she became a mark for progress to work from, and to-day her dimensions have been exceeded, her speed has been exceeded, and at less than half the coal consumption per horse power.

The cost of carriage for goods, whether by land or sea, is a matter of importance to everyone, for everyone is a consumer of goods which have to be transported to the market-place from the manufacturing or growing district. The farmer who can transport his grain, live stock, or dairy produce to the centre of demand for a few pence less per standard weight than a competitor, has a great advantage over him, and, for himself, such may make the margin which tides him over the winter. It has been said that he who can make two grains of corn grow where formerly there grew but one, is a benefactor to his race. We may then say that he who provides the

means of transport for two grains at the cost which formerly only provided for one, also deserves well of his fellows. The cost of transit by rail can be reckoned with greater surety than that by sea. The attachment of one wagon more or less on a goods train can be arranged for without difficulty while the train is being made up, and will not materially affect the running expenses; but in the case of the sea traffic, the large steamer booked for sailing must go entire, whether half loaded or full, and to keep her time dates she must sail even at apparent loss to her owner, and trust to some extent to freights received at ports of call, outward; or better freights homeward to make up what is lacking to cover the outward expenses.

In previous papers and discussions we have had diagrams representing the working expenses of steamers in respect to the machinery; but there are other expenses which bulk largely against the gross earnings of a steamer which require to be included to obtain the cost of our sea-borne traffic. A combination of diagrams, embodying in one the percentages which are required to run a steamer successfully, would be most interesting to have represented, even approximately, combining the following:

1. (*a*) Coals and perishable stores; (*b*) Upkeep, wages, repairs, and renewals.

(*a*) Cost of coals, stores, etc., per mile or per day, fluctuates according to weather, markets and manipulation of skilled or unskilled men.

(*b*) Cost of upkeep, repairs and renewals should be a percentage on the gross value of the machinery, and is really an insurance premium on the full policy covering the valuable machinery and beautiful mechanism encased in the shell of a steamer. A low percentage in allowing for this premium makes a high risk and a doubtful reputation, while a high percentage covers

ordinary risks, and gives good security and a high reputation, enhancing the value of the vessel for all purposes and forming a most important item of expenditure.

2. (*a*) Interest on capital invested—depreciation ; (*b*) Office working expenses ; (*c*) Accident insurance ; (*d*) Brokerage and agencies.

(*a*) The interest on capital can be set down at a fixed amount, after deducting depreciation allowance and adding cost of vital renewals or improvements.

(*b*) Working expenses will vary according to the business done and the number of steamers under management.

(*c*) Accident insurance premiums will vary according to circumstances, and will depend to some extent on the percentage allowed for the policy of upkeep and repair.

(*d*) The expenses connected with brokerage and agency charges will also vary according to the business done and the number of steamers under management.

3. (*a*) Loading and discharging ; (*b*) Harbour dues, pilotage, canal dues, Government charges.

(*a*) The cost of loading and discharging can be rated very nearly, according to the different classes of cargo.

(*b*) The various dues and charges can also be rated approximately near, varying with the special trades on which the steamer is engaged and the class of cargo carried.

Perhaps some members may have an opportunity of working out a diagram showing the different percentages found by experience, which might be reduced without detriment to the ship and machinery.

The exports from Britain are approximately about £248,000,000, and the imports about £450,000,000, or taking the population at 40,000,000, the exports

are about £6·2, and the imports per head of population about £11·2, a state of matters which has caused some to express very strong dissent on patriotic grounds. Referring for a moment to one part of our import trade, that of the frozen meat, it will be seen how enormously this has increased. In 1880, it has been stated, the total number of frozen carcasses of mutton and lamb imported was 400 from Australia; in 1881 these figures were brought up to 17,275, and in 1897 the total number of carcasses imported was 43,277,921 from Australia, New Zealand, Falkland Islands, and the River Plate. In addition to the mutton and lamb imported, the quarters of beef consumed have been increasing year by year until in 1897 it reached a total of 3,044,969 cwt.

The number of ships engaged and fitted for carrying dead meat at the end of 1897 was 123 with a carrying capacity for 4,623,500 carcasses. The cost of carriage for mutton and lamb from New Zealand to London is about $\frac{3}{4}$d. and $\frac{13}{16}$d. per lb., and for beef about $\frac{5}{8}$d. per lb.; the actual cost of the mutton and beef in the Colonies is such that the consumer ought to be able to purchase at prices considerably less now than eight or nine years ago. The expenses in connection with the carriage of dead meat are considerable; expensive machinery and insulated chambers—with consequent reduction of carrying capacity—are necessary. The machinery has to be kept at work in port to preserve a low temperature in the chambers, until all the cargo is discharged; this is a very great disadvantage. The coal consumed, stores and wages, with interest on the capital invested, insurance risks, have all to be considered and accounted for in reckoning the outlay to obtain the $\frac{5}{8}$d. or $\frac{3}{4}$d. per lb. on the frozen meat forming part of the cargo home.

The types of machinery in use for refrigeration are so varied in character that a paper on each system would be of value to the members of the Institute, and I hope that some members experienced in their working will come forward with such.

There is the cold air machine delivering air at a temperature of 40° to 70° below zero, the CO_2 machine, and the anhydrous ammonia machine, with their modifications and combinations, each claiming greater economy, and I see that at present there is a machine in course of construction in which liquid air is to be the medium; the machine is being constructed specially for the transit of fruit, and, as referred to in a recent issue of *British Refrigeration*, "the progress of the experiment will be a matter of considerable interest, etc.," and I may add to the members of the Institute of Marine Engineers.

Turning now to the cost of carriage for a general cargo, this varies greatly according to the circumstances under which the goods are carried; the most important factors bearing on the cost are (1) the route and the facilities for coaling at ports on the way; (2) the cost of coal at the best coaling ports on the route; (3) the class of steamer and the rate of speed.

It will be seen readily that the cost of coal will vary according to the distance it has to be carried, and along with this, the prospects of colliers getting cargo to carry from the ports near which coal is discharged, so that if Welsh coal is used the cost will be greatly enhanced at the further ports; this is somewhat modified by the back cargo freights and by other classes of coal being carried to these ports. The shipowner has, therefore, to consider whether it is cheaper for him to use Welsh coal at a high price per ton, or an inferior coal at a less price per ton, but at a greater rate of consumption.

The line steamer fitted with all the modern appliances to give hotel comforts and luxuries to passengers, naturally costs considerably more to run than the steamer fitted for the bare necessaries of carrying cargo. In the former case the rate of speed is high, as the gain of a day on the voyage is sometimes of great advantage to a traveller, while the gross cost of keeping several hundred passengers for a day is worth considering and comparing with the extra cost of the higher speed in coal.

In the case of the cargo steamer the expenditure of coal is of more importance comparatively, and the rate of speed is therefore kept at the most economical limit. It is a matter of common surprise how greatly the expenditure of coal increases with the higher speeds, approximately in the ratio of the cubes of the speeds.

The cost of running a steamer depends also upon the class of machinery fitted to drive the ship, whether fitted twenty to twenty-five years ago, or quite recently, owing to the difference in the coal consumption during recent years. For argument's sake, take a steamer of about 8,000 to 9,000 tons displacement we may reckon the cost of coal per mile at about 4s.; cost per mile for wages, about 8d.; oil, ¾d.; lighting purposes, 3d.; stores, 2d.; steering and other ship's work, about 5d.; provisions, about 5d.; upkeep and repairs, about 4d.; interest on capital invested, etc., about 10d., say equal to about 7s. 2d. per mile, or on a voyage of 10,000 miles, about £3,600. The total outward freight for such a steamer may be reckoned approximately at £7,000, off which has to be deducted a considerable amount for port charges at the ports of call, Suez Canal dues at 7s. 6d. per ton, about £1,700 to £1,800, loading and discharging expenses, brokerage, insurance, risks of various kinds which swallow up a large portion of the freight, leaving a small margin of profit, and showing that the days of rigid economy are upon us, if we seek to hold our own in the carrying trade of the world. Commerce, without the means of sea-borne traffic would be to us as clay without the art of the potter, and of recent years we have had pressed home to us the fact that while our insular position has given us many advantages and much experience, others have been spurred on to emulate and endeavour to surpass us as traffickers over the face of the deep, the desire of all nations has been towards this end. The advance and the progress which have been witnessed within the past few years have only been made possible by the spirit which has animated the ship-

owner in dealing with the great question of ocean traffic. The necessities of commerce and of competition are met year by year by our merchant princes most nobly.

The following results of a voyage of each are from two different steamers by different builders, belonging to different owners, which were running some ten years ago. It must be noted, however, that they were not steaming over the same course.

Steamer	Total Coal Consumed			Total Mileage		Total Revolutions	Revolutions to	
	Gross	Eng'nes	Sundries	Ship	Screw		1 Ton Coal	1 Mile
M.	1327·7	1263·9	63·8	11,519	13,463	3,903,045	2,940	338
D.	1474·	1347·	127	12,302	14,092	3,894,707	2,891	316
Aver. of 4D.	1556	1418	138	12,212	14,147	3,909,857	2,757	320

Steamer	Coal Consumed		Per Ton Displ. per Mile		Mean Draught Leaving Port			20-ft. Draught
	Per Mile	Per Day	Ship	Screw	Deadweight		Displacmt.	Displ.
	Lb.	Tons			Ft. In.	Tons	Tons	Tons
M.	243	23·6	·0396	·0342	23 0	3,977	6,125	5,152
D.	245	27·9	·0453	·0396	20 10	2,910	5,400	5,140
Aver. of 4D.	259	29·5	·0494	·0426	20 4	2,790	5,265	

	Average Mileage per Day		Average Revolutions			
	Ship	Engines	Per Day	Per Minute	Speed	I.H.P.
	Miles	Miles				
M.	217	252	73,090	50·7	9·04 knots	1,266
D.	255	292	80,863	56·1	10·6 ,,	1,318
Aver. of 4D.	254	295	81,461	56·5	10·6 ,,	1,358

M. was a modern steamer, with triple engines and 150 lb. pressure. D. was about twelve years old, with compound engines and 60 lb. pressure.

The following figures show a comparison between steamers of the type built from 1872 to 1882 with

compound engines, and from 1882 to 1892 with increasing steam pressures.

	Displacement	Draught	Cargo	Miles per Day	Coal per Day	Coal per Ton Displ. per Mile	Weather
	Tons	Ft. In.					
A ..	6,500	21 9	3,321	223·1	25·	·0381	Fair
B ..	6,265	21 0	2,993	208·6	22·6	·0429	Headwinds
C ..	6,100	20 7	3,030	239·4	29·9	·0457	Fair
	Tons	Ft. In.					
D ..	6,100	22 0	2,824	239·	25·86	·0419	Fair
E ..	6,200	22 4¾	—	194·85	28·3	·0497	Bad
F ..	6,380	22 1	2,379	240·3	26·11	·0417	Good

A B and C were built about 1884-1885 and carried 150 lb. steam pressure, D was built about 1882, E about 1883 with 80 lb., F about 1873 with 60 lb. All these steamers show very fair results in regard to coal consumption. The displacement and draught are taken on leaving port for the voyage, the cargo being the actual weight and measurement. They were not all by the same builder but were of a similar type, except F, which had finer lines. The averages are all based on similar voyages, but they were not all at the same period of the year. It will be observed that the weather has had a considerable effect on the speed, and that the larger the carrier, the more economical the results in carriage per mile.

It is interesting to trace the transition from one material to another in the building of boats, ships and steamers. This has not been referred to in the previous notes except incidentally, but the changes that have taken place when necessity brought forth invention to rescue the situation, are like milestones in the path of progress, with noteworthy records around them. I have often been struck with many of the sayings of those who lived several thousand years before us, and like the proportioning of the ark, they came very near facts which succeeding generations verified. The question asked in the days of

Elijah, when the amateur carpenter lost the axehead in the river, "Can iron swim?" lay rolled in the napkin of mystery for 2,700 years until probably a housewife let an iron pot fall into the water with the lid on, and some observant person, spurred on by the child of necessity, set to work. The season was ripe for the reply and the old question was answered by the iron canal barge about 1788.

It is only possible to cope with the sea-borne traffic of to-day by means of iron and steel vessels, which carry more and are lighter than wood. What will the next material be, and when will necessity bring it forth? One is reminded here that—according to an article I have read in one of the technical journals—the lost art of tempering bronze has been recently recovered, or at least it is said that a process has been discovered by which it can be tempered as it was in the days of old, and it may be worthy of record as a re-discovery, although not quite bearing on the subject at present under consideration.

The seamless steel boat to hold forty with dimensions 26 ft. by 8 ft. by 3 ft. 3 in. weighs 13 cwt. without fittings, and a lifeboat with air cases, rudder gear and life lines, weighs 22½ cwt.

The introduction of aluminium of recent years has led to it being considered a possible coming material for ships, as it has been used for smaller vessels; the cost is prohibitive at present, but who shall say what the future holds in the napkin, or what necessity is girding about her loins, to set free when the set time comes? Meantime a paper on the subject of material for ships and boats would be very acceptable as a contribution to the Transactions.

The former portion of these notes does not perhaps admit of debate—it may admit of correction where placed hastily together—but the latter portion may be productive of a valuable and instructive discussion, and I hope such may be the result of placing before you the foregoing thoughts.