[For the Scientific American.]

IRON SHIPBUILDING AND AMERICAN COMMERCE.

BY PROF. HENRY E. COLTON

Whatever force the many reasons assigned for the decline of the American shipping interests may have possessed, there is no doubt that the introduction of iron as a material for the construction of the hulls of vessels has been the great cause Very soon after the discovery of the process of puddling iron and rolling it into plates, we are told that some bold experimenter formed a rude canal boat from those plates; it was not, however, until 1837 that any actual experiment of the new material was made on the ocean. At that time, a vessel of about 270 tuns was built of iron, at Liverpool, and made a trip to Rio de Janeiro, returning with a cargo of coffee dry and safe. Previous to this the possibility of putting together plates of iron into shape for vessels' hulls had been demonstrated on the Thames, on various canals in England, and even for a coasting vessel. The building of the ironsides in 1838 was, however, not the actual commencement of the use of iron, previous operations had been mere experiments. Naturally the innovation met with much opposition. It might do in smooth water but that it would never stand the strain and rough waves of the ocean was the opinion of a large majority. Fairbairn, in 1849, writes that he had up to that time built 100 vessels with iron hulls, which had proven successful, but complains that the British commercial authorities have made no actual recognition of their good qualities and superiority over wooden vessels. It was not until 1854 that the English "Lloyd's" deemed them of sufficient importance and value to merit a rating by rules and regulations. Nowit is but rarely a vessel is built of wood in England, and then only some small craft for river or coast service.

In 1838, we have seen that there was only one shipbuilding firm bold enough to build an iron ship for venture on the ocean. Now there are on the Clyde (Glasgow) alone 37 such firms which in 1808 turned out 26 iron paddle steamers, 77 iron screw do., 1 composite do., do., 44 iron sailing vessels, 9 composite do., and 13 wood do., and 61 iron barges, etc.; on Jan. 1, 1868, they had on hand orders for 57 iron screw steamers, 11 paddle do.; and 26 iron sailing vessels, 12 composite do., and 11 wood do. The same year there were 14 firms operating on the Mersey (Liverpool) which, in 1867, launched 32 iron steam and sailing vessels, and had then on the stocks 18 more, also built a number of iron barges, etc. On the Tyne (Newcastle) there were about 20 firms who built, in 1867, 81 iron ships. There are also at Southampton a number of iron shipyards, but not so briskly employed. The London yards are almost deserted.

The greater proportion of steamers in the above is noteworthy, as also the great excess of screw propellers. Of the English tunnage, more than one third is steam. In 1867 it contained 2,808 steamers of which 1,896 were iron, 877 wood, 28 steel, 4 iron and steel, 3 composite. Of these 1,564 were propelled by paddle-wheels, and 1,244 by screws. Exclusive of inland river, and lake craft, the steam tunnage of the United States does not amount to more than about one third that number, and of them hardly 50 are iron, and many of these are old blockade runners captured during the war, built for that purpose and poorly adapted to ordinary traffic.

Without hulls of iron the introduction of the propeller screw would have been of little moment. No such immense lengths of steamers as now cross the Atlantic, in such rapid time, could have been built of wood and driven by the screw. The great advantages of economy of space and fuel which its use gives would have been lost to the commercial world. Hence we now but seldom see any steamer intended for freight or the general passenger traffic constructed with the side paddle wheels, and even the rather aristocratic French line have had all but one of their side-wheel steamers changed to propeller screws. Such having been the perfection acquired in machinery and model that equally as, or more rapid time, is now gotten with them as ever with side-wheels.

The superiority of English vessels of the present day, therefore, exists in the material of construction, the more general use of steam, and the substitution of the propeller screw for the side-paddle-wheel. With our characteristic energy and enterprise we will soon regain all we have lost in the commercial line, and even ourstrip our neighbors across the water, if we adopt the improvements which they so forcibly present to us. The English "Lloyd's" has rules for rating and insuring iron vessels dependent upon *thickness* not strength of material, and as the average American iron will bear a strain about one third greater than the average English, in building a ship of iron of the same thickness we are using at least one fourth more weight than necessary to make a vessel of equal strength with one constructed in England. Hence to build a ship by their rules we have a greater expense for material. Some modification of this system is evidently necessary for vessels at least in our own trade. They took the models of our fast clippers from us, and we may by energy and perseverance be able to bring them up to a higher standard of material or different rules for construction.

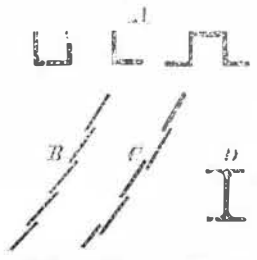
Our registry laws require that all vessels to be capable of registry shall have been built in the United States. These might be modified so that all vessels now owned here be allowed registry, which privilege to end as soon as American ownership ceases; but we are sure no American mechanic, manufacturer, or inventor would be willing that vessels built and owned abroad should be brought in on the same footing and have equal privileges with those the result of our labor and capital.

Another resolution of the N. Y. Chamber of Commerce proposes to admit free of duty all iron and other material used in building ships. We shall not discuss this as it involves the political question of free trade *vs.* protection; but, leaving out of the idea of its injustice to other manufacturers who might claim that they in this dull time were not making as much profit as before the war, we do not believe that in that admission is the radical cure of the diseased commercial interests of our country. The true remedy and that which will enure to the benefit of all Americans is the building of steamers and sailing vessels of iron, on the best models, with the best machinery, of our own material, with our own work men, and our own capital. Learn all we can from abroad and improve that knowledge. It should not be said that the nation of mechanics which has produced the steamboat, the telegraph, the sewing machine, the reaper, the monitor, and hundreds of other new ideas that have astonished the old world, is behind in the construction of an economical marine engine, the arrangement of a boiler or the model of a ship, and it will not be so said a few years hence. In this nation of active thinkers a want is no sooner stated than hundreds of minds are at work to supply it.

The needs of the shipbuilding interests are the adaptation of machinery, still further if possible, to the construction of iron ships; a boiler and engine which will give a fair average speed with a consumption of 10 to 20 tuns of coal per day; these with the conjunctive use of steam and sail will accomplish all we need to manufacture and run vessesls cheaply. Models unsurpassed for beauty or utility we have already. It is evident, however, that in the struggle for economy of construction the future shipyards of the United States will be where there is least freight on coal and iron, and cheapest living expenses. Our observation and experience lead us to believe that outside of Government work, the well paid American laborer does more work, dollar for dollar, than the poorly paid Englishman.

The advantages of an iron vessel are: A greater amount of cargo can be carried on a less draft of water; they will last for 20 years if well made and rate A 1; and so far as any one knows for 50 years, as vessels are now running in good order which were built by Fairbairn in 1840-42. The only deterioration is the oxidation of the metal, and careful painting every six or twelve months will in a measure prevent this. Further, that whether so cheap now the time will come when no wooden vessel can compete with them in any item. Taking into consideration their durability, they are cheaper now. An iron vessel may be beached or sunk and not be materially injured. Two instances of this have lately occurred—the *San Jacinto* beached on Hatteras, and the *Circassian* on Long Island shore. The first is already making her regular trips, the other soon will be. Every reader is acquainted with its advantages as a material for ships of war.

There is a variety of ships now being built in England called composite. The ribs, braces, and all framework are of iron, the sheathing plank of wood. They find great favor with some, as the wood may be sheathed with copper, hence furnishing a bottom better than any paint for a long voyage. They have disadvantages which we shall not here discuss.



The ribs of iron vessels have three shapes, as at A, in the diagram. The standards and braces are usually shaped as at D. The iron planking is put on, as at B, by some builders, but that is more generally abandoned for this style, shown at C. The last is called gutter built, the former clencher built.

At the Atlantic Iron Works, Boston, a number of iron vessels have been built. The Novelty Works, New York, have built several—two of them good sized ocean propellers. Several yards in this city built monitors during the war. One or more have been built in Buffalo. But the chief iron shipyards of the United States and in fact only those employed extensively for that work, are at Chester, Pa., and Wilmington, Del. There is not a month but one or the other of these yards turn out a steamer, and they claim that they can build vessels within five per cent of the cost in England.

These yards are now very active, several river steamers are on the stocks, the Philadelphia, N. Y. & Boston Nav. Co. have fifteen steam colliers contracted for and being built, a large iron steamer for the Old Dominion Steamship Co., to be finished by spring, several propellers for Mr. Lovillard a few side-wheel steamer just finished for Mr. Clyde, and others spoken of. These yards have turned out beautiful models, both for river and ocean service.

The day of wooden ships has passed and the present stock must at least be replaced by iron built crafts. Such a course with proper management will give us eventually the supremacy of the seas and add another triumph to the superiority of our material, skill, and labor.

Two Curious Needles.

The King of Prussia recently visited a needle manufactory in his kingdom in order to see what machinery, combined with the human hand could produce. He was shown a number of superfine needles, thousands of which together did not weigh half an ounce, and marveled how such minute articles could be pierced with an eye. But he was to see that in this respect even something still finer and more perfect could be created. The borer—that is the workman whose business it is to bore the eyes in these needles—asked for a hair from the monarch's head. It was readily given and with a smile. He placed it at once under the boring machine, made a hole in it with the greatest care, furnished it with a thread, and then handed the singular needle to the astonished King.

The second curious needle is in the possession of Queen Victoria. It was made at the celebrated needle manufactory at Redditch, and represents the column Trajan in miniature. This well-known Roman column is adorned with numerous scenes in sculpture, which immortalize Trajan's heroic actions in war. On this diminutive needle, scenes in the life of Queen Victoria are represented in relief, but so finely cut and so small that it requires a magnifying glass to see them. The Victoria needle, moreover, can be opened; it contains a number of needles of smaller size, which are equally adorned with scenes in relief.

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ALBUMEN.

BY C. WIDEMANN.

The consumption of albumen as applied to different purposes is enormous; in calico printing alone for fixing on cloth the new aniline colors, Alsace, in France, alone uses 150,000 kilogrammes, or about 330,000 pounds a year of egg albumen, representing 37,500 eggs or the product of 250,000 hens. It is also used extensively in photography; a photographer in this city uses four barrels of eggs a day, the yolks of which are sold to the surrounding hotels for cooking purposes.

It is manufactured thus: The white of the eggs are desiccated to assure their preservation and alsoto reduce the bulk so as to facilitate their shipment, with little expense, to this country. The process of desiccation is as follows; namely, the egg is broken, the white separated from the yolk; in winter or spring by the cold weather the white is left to remain five or six days in cans, when it is beaten with a wooden "spatula" and filtered through a piece of linen in order to retain the impurities and the sperm, it is then desiccated by pouring the liquid thus prepared in very flat dishes, generally of zinc placed on cast-iron tables, heated by steam to 30° Centigrade. To facilitate the separation of the dry albumen from these dishes they are, before being used, rubbed with a greasy rag.

Every dish generally holds from one to two quarts of egg white, and after two or three days' desiccation the albumen is ready to be packed; 24 dozen eggs yield about 12 quarts egg white, 8 quarts yolk yielding a little over two pounds of dry albumen.

This operation is performed to better advantage, both as to quality and yield in the months of March, April, and May during the summer months the eggs are more expensive, and the quantity of the albumen less.

A great many substitutes have been employed to take the place of egg albumen, among which I shall mention the serum of the blood and the spawn of fishes—I mean the eggs laid by the female fish in large quantities at a certain time of the year after the process of fecundation.

The albumen is easily obtained from the serum of the blood, and answers very well as a substitute for egg albumen in calico printing.

In separating the liquid in which the clots of blood are seen floating 10 to 15 hours after the animal was kil ed, a a light yellow liquid is obtained, which is then allowed to stand for 6 or 10 hours more. This second liquid is decanted from its precipitate which has been formed during this operation, and is then dried in the same manner as egg albumen at a temperature of 40° Cent.; if the serum had remained colored after the second precipitation it must be treated with a small quantity of isinglass, which has the property of separating all impurities by a veritable coagulation; all these operations are carried on in deep dishes; the clear liquids thus collected are des'ccated as above.

The albumen from the spawnings of fishes can be obtained from the dry spawn as it is usually found in the market or from the fresh spawn taken immediately from the fresh fish and from the salted fish.

To use dry spawn, it is first ground into a coarse powder, then washed with water; this water is left to settle so as to allow all the impurities to collect at the bottom of the vessel, decanted and d siccated at 40° Cent. in the usual way.

Generally the albumen obtained from the fresh spawn is of better quality than that obtained from the dry or salted spawn, though it takes more care to separate the blood and certain greasy or oily impurities from it. It is desiccated in the usual way.

In operating with salted spawn it is thoroughly washed to eliminate the salt, then ground and dissolved in water, and treated as above.

A very large quantity of albumen is used in this country; there is a little egg albumen made in the West, but very irregularly; as for the blood albumen it is all imported.

Egg albumen brings in the market from $2 50 to $2·75, gold, the blood albumen from $1·25 to $1·40, gold, per pound.

As a general rule the blood in this country is considered as a waste; even in the large pork slaughter houses of the West it is lost, and very seldom used, even as manure, though being one of the best of fertilizers.

The reason I believe why blood albumen is not manufactured in this country is that there is no regular central slaughter house, every butcher having the right to kill his own meat, and so it has been difficult for those who have thought of establishing an albumen manufactory or Prussiate manufactory to collect a large quantity of blood with little cartage expenses.

But now that New York possess "Communipaw," I do not see, as the expenses of getting up such a manufacture are very small, why the calico printers and others using albumen continue to supply themselves from abroad at such high figures.

THE Amazon River drains 2,500,000 square miles, and is navigable 2,200 miles from its mouth.