IRON IN SHIPBUILDING.

The following from the last number of that profound publication, the *Edinburgh Review*, is not only interesting in a historical point of view, but is also scientifically instructive :—

Mr. Grantham has found, in a journal of the year 1787, an account of the arrival at Birmingham "of a canal-boat, built of iron by John Wilkinson, Esq., of Bradley Forge ;" and the writer then proceeds to describe the construction of the novel monster with as much care as the newspaper correspondent lately bestowed on the *Merrimac* and the *Monitor*. From this period, similar boats were frequently used in inland navigation ; and some of the earliest specimens, Mr. Grantham tells us, are still in existence—an incontestable proof of the durability of the materials. The first iron boat that was ever launched in salt water was a pleasure boat, built under the direction of Mr. Jevons, of Liverpool, in the year 1815 ; but it might have been long before iron was adopted as the material for ship building in good earnest, if, in the meantime, the art of propelling ships by steam had not been brought into practical operation.

A series of experiments instituted by the Forth and Clyde Canal Company in 1829-30, to ascertain the law of traction of light boats at high velocities on canals, led to the application of iron for the construction of vessels; and the lightness of these new vessels, combined with their increased strength, suggested the extended application of the material in the construction of vessels of much larger dimensions.

Iron, it was perceived, was better suited than wood to resist the strain of the engine, and would allow more space for the stowage, which was inconveniently curtailed by the coals and the engine. It was not till long afterward that the employment of iron in the construction of a sailing vessel was attempted.

The first iron steamboat that ever put to sea, the *Aaron Manby*, was built by the manufacturer whose name she bore, "under a patent which was taken out in France for steamboats, in 1820. She was built at the Horsley works at Tipton, in Staffordshire, was sent to London in parts, and was put together in dock." In September 1821, Captain, afterward Sir Charles Napier, who seems to have been a partner in the speculation, "took charge of her, and navigated her from London direct to Le Havre, and from thence to Paris, without unloading any part of her cargo—she being the first and only vessel that for thirty years afterward sailed direct from London to Paris." It is farther worthy of note that "from 1822 to 1830 her hull never needed any repairs, though she had been repeatedly aground with her cargo on board."

The iron vessels that were successively built are enumerated by Mr. Grantham in chronological order, and to most of them belongs some circumstance of interest. The *Alburkah* a little vessel, built in 1831, by Mr. M'Gregor Laird for the African expedition which he conducted himself, drew only 3 feet 6 inches of water, and her success dispelled the prejudice which had previously existed as to the danger of going to sea with so light a draught of water. The *Garryowen*, built in 1834, was the first that exhibited a "regular arrangement of water tight bulk heads," an improvement the adoption of which has since been rendered compulsory by the legislature. The *Nemesis* and *Phlegethon*, built in 1839, whose names seem ominous of their future destiny, were the first iron steamers that were engaged in active warfare, and they took a conspicuous part in the Chinese expedition. But, in our opinion, the greatest interest which attaches to these and all the other vessels mentioned by Mr. Grantham is, that whereas the average duration of wooden ships is thirteen years, they are all afloat at this day, with the exception of the first, the *Aaron Manby*, and she was not broken up till the year 1855.

Notwithstanding this success, the advocacy of iron steamboats was but uphill work, Mr. Grantham tells us, in the year 1842, when he published his first work on the subject. The judgment of practical men was convinced of the superiority of iron, but the feeling of the public was still in favor of the old marine. From that date, however, iron vessels have rapidly increased, and for some years past no ocean going steamer has been built of wood. In his first work, Mr. Grantham gives an account of the construction of the *Great Britain*, which was then on the stocks, and which was, he says, at "that time, the boldest effort ever made in iron shipbuilding, and formed the most remarkable feature in the history of that important science." The resistance which the *Great Britain* offered to the beating of a violent surf, when stranded on the coast of Ireland, and the triumphant style in which she has kept the sea since, without receiving damage from the elements or needing repair from the injuries of time, have often been cited as proofs of the durability of iron vessels. To this Mr. Grantham adds many other instances, the most striking of which is that of the *Persia* :—

On her first voyage, in 1857, she was preceded by the *Pacific*, a timber-built steamer, and both seem to have fallen in unexpectedly with large floes of ice. The *Pacific* went down with her immense living freight; the *Persia*, encountering a small iceberg when at full speed, split it in two, and received no injury, except by the fragments which floated into the wheels, and broke several of the floats.

We rejoice that the *Great Eastern*, after her disastrous trial trip, and her subsequent misfortune in the great Atlantic storm, has redeemed her character by two successful voyages to and from the United States. Of no other material than iron could so gigantic a vessel have been constructed.

The first question is, what material will produce the best ship ; and the superiority of iron over wood, we think, is triumphantly established by experience in the eight points on which Mr. Grantham institutes a comparison, and which he arranges, though not perhaps in very natural or logical order, as follows :—1. Strength combined with lightness. 2. Capacity for stowage. This in large vessels is as 6 to 5 ; in smaller ones as 5 to 4, an advantage which may often make the difference between profit and no profit. 3. Safety in matters not immediately connected with strength, such as increased buoyancy, and comparative safety from fire. 4. Speed. 5. Durability. 6. Economy in repairs. It is calculated that in twelve years the repairs of a wooden vessel equal its prime cost. The ship carpenter, like the carriage builder, when he turns out his work secures to himself an annuity for years to come. But the iron shipwright must make his profit in the first instance. For about twelve years the iron boat ought to need no repairs at all ; and when needed at last, or rendered necessary by an accident, the reparation is unexpensive and easy. Painting, it is true, must be frequent. We entirely agree with Mr. Grantham, that painting is preferable to galvanizing, which imparts rigidity to iron and impairs its toughness. A commission has recently been appointed to inquire into the expediency of sheathing iron vessels with copper, and great use has been made of a patent metal invented by the late Mr. Muntz for the purpose. 7. Cost of construction, the saving effected by the use of iron being about 10 per cent. 8. Draught of water.

Mezzotinto Engraving.

This is a kind of engraving very different from common engraving upon steel. The common or line engraving as it is called, is done by the graver, the lines made by that instrument producing the figures by shade. Mezzotinto, on the other hand, produces the shades as it were by minute dots and the light by scraping away dotted parts of the steel plate. The first operation is to trace out with chalk the space for the picture on a smooth steel plate. The grounding tool is then employed to go over the whole face of the plate for the picture. This tool is formed with a curved face serrated like the finest rasp. It is held steadily in the hand pressed with a moderate force rocking it from end to end till it has completely hacked all the face of the plate. The other lines are then drawn across the plate at right angles to these and the rocking operation repeated. These diagonal operations have to be repeated a number of times until the part of the plate for the picture produces a very dark ground. The design is then traced on the plate, some artists employing one way some another, and the picture is finished by scraping away parts of the serrated surface for the light by a tool formed something like a burnisher. The masses of the strongest light are first begun and scraped pretty smooth, and some parts are burnished. The next lower graduations of shade are then scraped down after which the reflected lights are entered upon. Various proofs of the work are taken during the progression of the engraving.

This style of engraving is exceedingly soft and rich in tone, so much so indeed that it has been condemned by some as being too tame in character throughout.

It is difficult to tell who was the first discoverer of mezzotinto engraving. It was practiced on copper for a long time before it was tried on steel. Mr. Turner, an eminent London engraver, states in the Transactions of the Society for the Encouragement of the Arts, that James Watt was the first who suggested unto him the use of steel plates for the mezzotint. This was in 1812. No work of the kind however, was produced until 1821, and this was upon a steel plate softened by the process discovered by Mr. Perkins, the ingenious American engineer, then residing in London. In 1821 Mr. Turner engraved a portrait on one of Perkins's plates which met the approbation of Sir Thomas Lawrence, and in 1822 some splendid engravings were produced and prizes given by the society mentioned. Since that time the art has spread over the whole civilized world, embellishing our parlor periodicals and adorning our choicest annuals.

Indian Madar as a Substitute for Cotton.

The following interesting communication is from a correspondent of the London *Chemical News* :—

Amongst the various proposed substitutes for cotton, there is one which has not as yet attracted the attention of scientific men—the Indian madar plant. It is, nevertheless, admirably adapted for this purpose, as both the fiber, the floss, and juice can be employed for commercial purposes. In the year 1854 the prisoners of the Shahpore Native Gaol, Bengal, were employed in making mats and cloth from this plant, under the auspices of an officer who took great interest in the scientific resources of India.

The madar is a wild jungle plant, which grows to a considerable hight, flourishing in almost any soil. Its leaves are ovate, very dark green, and very thick, somewhat resembling those of the laurel. The juice could be used instead of gutta percha, over which it possesses a considerable advantage, as the madar plant retains its vitality after being repeatedly cut down to obtain the fluid. Moreover, the great abundance of the madar compared with the rareness of the gutta percha tree would tend to augment the value of the madar juice. This fluid is at first milk white, but changes, on exposure to the sun and air, to a dull brown, like india rubber. It could be applied to every commercial use hitherto obtained from gutta percha.

To proceed : As regards the use in which it could be substituted for cotton, if the stalks be soaked either in water or, still better, in weak alkaline lye, the fibers separate and can be carded like flax by the ordinary process. The natives simply separate the fibers with their teeth. These filaments are pale yellowish, like flax. They are very strong, as the natives of India use them for fishing lines in place of catgut.

Even supposing the application of the madar to be but partial, its cultivation, together with that of the cotton plant, might be carried on with great advantage. So far for the fiber. The floss of the madar strongly resembles unspun silk, being yellow covered and very soft. It can be spun in a manner exactly similar to silk, to which it is scarcely inferior in quality. I have also a small portion of the cloth of the madar fiber made in the native gaol at Shahpore, Bengal Presidency. From it I am inclined to judge favorably of the probable quality of the cloth, if manufactured with greater care. Moreover, besides the cloth made from the fiber or the floss separately, a very useful fabric could be formed of both mixed, the woof being made of the floss. In this form, perhaps, the madar plant would be most useful, as the floss contributes softness, and the fiber strength and firmness. Were these remarks to excite the interest of any scientific men, I should be happy to enlarge on them with any further information in my possession, or to show specimens to any gentleman who might take an interest in the matter, or wish to investigate the subject more fully.

TIN PIPES.—*Le Géne Industriel*, states that the manufacture of tin pipes in France is monopolised by M. E. Lapan, of Lille, who patented machinery in 1852 and 1853, by which the cost of the manufacture was greatly reduced.

Improved Ship's Rudder.

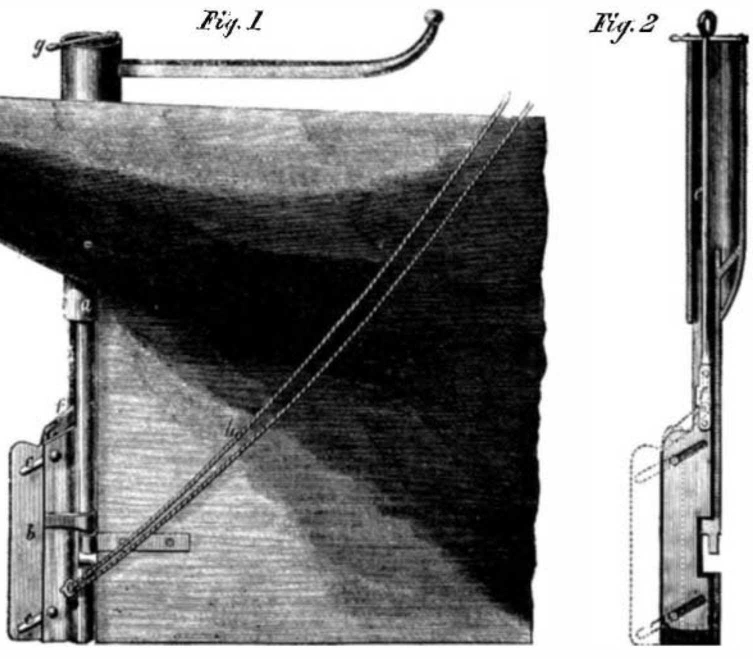
"Behold, we put bits in the horses' mouths, that they may obey us ; and we turn about their whole body. Behold also the ships, which though they be so great, and are driven of fierce winds, yet are they turned about with a very small helm, whithersoever the governor listeth."

The vessels of which James wrote this were mere cockle boats compared with the huge fabrics of modern art, and yet the statement is as true when applied to the *Great Eastern* herself as to any smaller craft ; as long as the rudder remains perfect the ship moves in obedience to her commander's will, as if she were a living thing ; but if the rudder is broken the vessel at once becomes an unmanageable mass, drifting at the mercy of the winds and waves. There is not a more helpless situation in which a man can be placed than in the wide ocean upon a vessel which will not obey her helm. To overcome the appalling effects of this accident is the object of the invention here illustrated.

The simple plan adopted is to construct an expanding rudder which may be made so narrow that it will pass through the port of the rudder stock, and will then spread to sufficient width to guide the vessel. This rudder is formed of iron plate, the first piece, *a*, being bent into the form of a cylinder at the upper end, while the lower end is fashioned in two leaves which embrace a second plate, *b*. This plate has two inclined slots, *c c*, through which bolts pass loosely and are riveted to the embracing leaves. It will be seen that if the plate, *b*, is allowed to rest upon the bolts, it will slide outward, owing to the inclination of the slots, and will thus form a blade of sufficient width to guide the vessel. If, however, it is drawn up and suspended by the rod, *e*, (see section Fig. 2) the same inclination of the slots will draw it within the fold of the piece, *a*, in which position the rudder is sufficiently narrow to pass through the port of the rudder stock.

In order that the plate, *b*, may have this diagonal motion while the motion of the rod, *e*, is vertical, it is necessary to connect the two by a link, *f*, with joints at its ends. The bar, *g*, is provided for holding the rod, *e*, suspended while the rudder is being lowered, and cords, *h*, on both sides of the vessel guide the pintles into their places.

The patent for this invention was granted through the Scientific American Patent Agency, August 5, 1862, and further information in relation to it may be obtained by addressing the inventor, John C. Raymond, at Brooklyn (E. D.), N. Y.



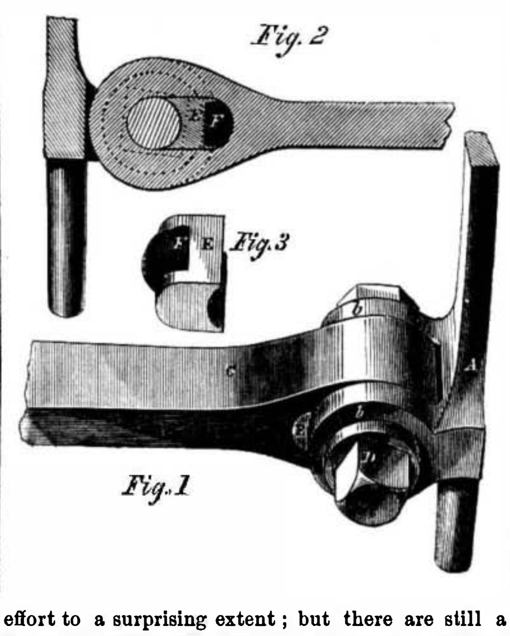
RAYMOND'S JURY RUDDER.

Experiments with Petroleum at Liverpool.

As great quantities of American petroleum are now imported into Liverpool, a number of the merchants in that city made complaints to the Town Council that it was explosive, very dangerous, and should not be permitted to be stored in the dock warehouses. In order to obtain positive information respecting its explosive and inflammable character, the Liverpool Town Council lately made several interesting experiments. A temporary brick vault was erected upon an empty lot of ground and a small cask of Canadian petroleum was first placed in it and ignited, and after burning for a short period it was extinguished by one of Phillip's Fire Annihilators. A second cask was then ignited and allowed to burn for five minutes, and extinguished in the same manner. A third cask containing thirty-four gallons was ignited and the fire allowed to acquire considerable headway and intensity, when two streams of water through hose were brought to bear upon it, after a short period the flames were extinguished. A barrel of petroleum was then placed upon the open ground and ignited and when the fire had become intense, two streams of water were applied, but were found very ineffectual. A fire annihilator was then placed in the fire and it also failed to extinguish the flame. More copious streams of water however accomplished the object at last. A barrel of Pennsylvania petroleum standing upon end, was then ignited on the open ground. Its flames rose higher than those of the Canadian petroleum, and they were ultimately extinguished by powerful streams of water. Those who witnessed these experiments were surprised that none of the barrels exploded, for they had expected such a result. Petroleum is not explosive, but its vapor mixed with atmospheric air is. The very inflammable nature of the petroleum however led the Town Council of Liverpool to conclude that it should not be stored adjacent to warehouses, or on docks containing common merchandise.

RICE'S SHAFT COUPLING FOR CARRIAGES.

Our carriage makers have long been striving to construct pleasure carriages that would run without any rattle or jingle, and they have succeeded in the



effort to a surprising extent ; but there are still a few parts which will rattle somewhat as soon as they become a little worn. One of these is the joint by which the shafts are secured to the front axle, and the annexed cut illustrates an invention deigned to overcome the difficulty at this point.

Fig. 1, is a perspective view of the coupling, and Fig. 2, a longitudinal section. The strap, A, is bent around the axle, and between its two ears, *b b*, the iron rod, C, is fitted ; this rod being fastened to the end of the shaft. A steel bolt, D, holds the two parts together, and this invention consists in a plan for preventing any rattle by this bolt or its connections. For this purpose a brass bushing, E, Fig. 3, is introduced into the hole in the rod, C, and is pressed backward against the bolt by a block, F, of india rubber, as shown in Fig. 2. The elasticity of the india rubber will press the brass bushing against the bolt, and will prevent any rattle ; thus perfecting the last improvement necessary to the production of a noiseless carriage.

This design is the invention of Benjamin Rice, of Hastings on the Hudson, N Y ; and one half the invention has been assigned to Wm. Lamb, who may be addressed for further information in relation to the matter, at Yonkers, N. Y.

Pneumatic Dispatch Company.—A meeting of the company organized for carrying dispatches and parcels through the exhaust tube, illustrated on page 209, Vol. V. (new series), Scientific American, was lately held in London, with a view to increase the capital of the association. It was proposed to extend the works and obtain new machinery at a cost of about $650,000. A resolution was passed to increase the capital $250,000 by issuing shares of $50 each. Several members present at the meeting opposed the motion. Mr. Preston, one of these, stated that, in his opinion, the system was a financial failure, and he thought it should be abandoned. The majority of the members, however, were of a different opinion.

Krupp's Steel Castings.

The works of H. Krupp, at Essen, Prussia, have obtained a world-wide celebrity for the production of the most massive and perfect steel castings. Krupp's display in the London Exhibition has astonished and puzzled the English workers in steel. He exhibits a cast-steel cylinder which weighs twenty-one tuns, and it has been broken across to show its grain. Not a single flaw has been detected in it under the scrutiny of a magnifying glass. Steel shafts, rolls, railway tyres and wheels are also exhibited ; also a steel cannon of 8-inch caliber. The processes by which such perfect steel castings are obtained has been kept somewhat secret.

The superiority of Krupp's castings is perhaps chiefly due to the perfection of the mechanism used and the mode of conducting the operations. The smelting crucibles contain 70 lbs. of steel each, and when a large casting is required the organization has been carried to such a degree of perfection that at a given signal all the crucibles are ready to be lifted at the same time and poured into a large receiver, whence the steel flows to the mold. In bronze casting on a large scale homogeneity of the alloy is obtained in the same manner.

The London *Engineer* states that Krupp's apparatus for making steel is the most gigantic in the world. He has a steam hammer which weighs 50 tuns, and an anvil that weighs 192 tuns, resting on eight blocks of cast iron, each weighing 135 tuns. The mold for a large steel casting is always made so as to avoid angles. It has been stated that puddled steel made with a mixture of German zinc cast-iron, similar to Franklinite, is employed for these purposes.

American Manufactures.—The London *Illustrated News*, of August 2d, says :—" The only exhibitors at the International Exhibition of cotton goods from the United States are Messrs. G. Brewer & Co., of Boston. The goods shown are a superior quality of fine shirtings, which were certainly not produced a few years ago in any part of the United States. These goods arrived very late, and have not been included in the awards of the jury, which they certainly ought to have been if in time for examination."