JOHN ROACH, OF NEW YORK.

HIS SHIP-BUILDING AND HIS VIEWS.

The Pilgrim, now in process of construction by Mr. John Roach for the Fall River Line, is the largest steamboat ever built. The company required the most commodious steamer, with the highest power and speed attainable, and this will in a few months be completed and delivered by the builder. Our engravings illustrate the forging of the shaft, one with the end in the furnace, for the "finishing beat," and the other "under the hammer."

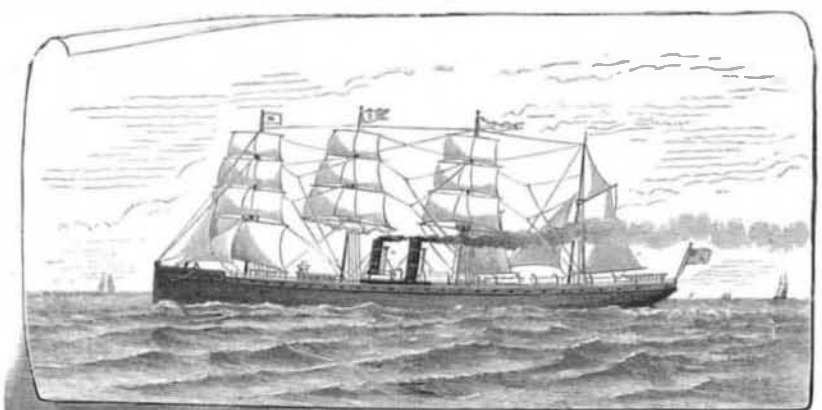
This shaft is the largest ever constructed. And it must be borne in mind that the illustration represents only the half shaft. The other half is to be connected with it amidship by the crank, and is, of course, of the same length. Each measures 39 feet 6 inches in length, and is 28¼ inches at its largest, and 26 inches at its smallest diameter, and weigh each 81,200 pounds. This enormous shaft implies the size of the engine, and also the size and power of the boat, though in respect to the stability and speed of the latter, other conditions are to be considered of which we will make mention hereafter In considering this statement, many will think of large side-wheel steamers, including the Great Eastern, but they must also remember that each of her wheels is driven by a separate engine, which calls for a smaller shaft as it does for a smaller engine, while in this case, one engine drives both wheels, and is intended to do so at the highest speed and attainable power. Hence the necessity of a large piece of machinery. It is said, without fear of contradiction, that no other shop in this country could turn out such an engine, or forge a shaft of such magnitude. The capacity of a forge for such work depends upon the power of the steam hammer, and this one, though perhaps not the largest, has proved equal to turning out the largest piece of work yet produced. The hammer itself weighs not less than seventeen thousand pounds, and in its fall, driven down by steam power, represents a blow of not less than sixty-six thousand pounds. But certain it is that, in this case, a mass of iron at a forging heat, three feet in thickness, was pounded into shape. The anvil and block rest on a massive foundation, and this on a foundation of piles, in all some twenty to thirty feet deep, and the force of the blow is felt in the ground at a distance of several blocks. The method of working the steam hammer is illustrated in the engraving.

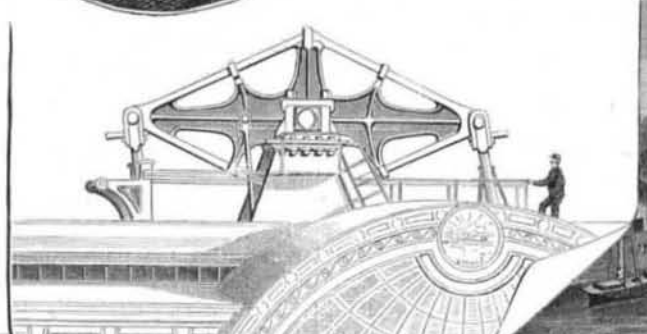
The process of forging was not different from that in somewhat smaller work, but, of course, called for the exercise of special skill, in consequence of the peculiar difficulty of the task. To begin at near the beginning, "blooms" are prepared from "scrap iron." This "scrap iron" consists of an endless variety of wrought iron scraps, such as horse shoes, bolts, rods, nails, boiler iron, etc., etc. These are in the blacksmith shop welded together under a small steam hammer into bars, somewhat of the shape of bars of pig iron. The iron thus prepared is better for this purpose than any other, being tough and fibrous, and the product is known as a "bloom." In building the shaft begins with the "porter bar," on the end of which are piled the "blooms" for that heat. This "porter bar" is designed only for the purpose of carrying the first "blooms" into the furnace for a welding heat, and carrying them out again under the hammer. But inasmuch as it becomes incorporated in the shaft in part, it is carefully weighed, as are the "blooms," to ascertain how much material is used in the work. Afterward the shaft grows to a length sufficient to carry the blooms for its increasing length.

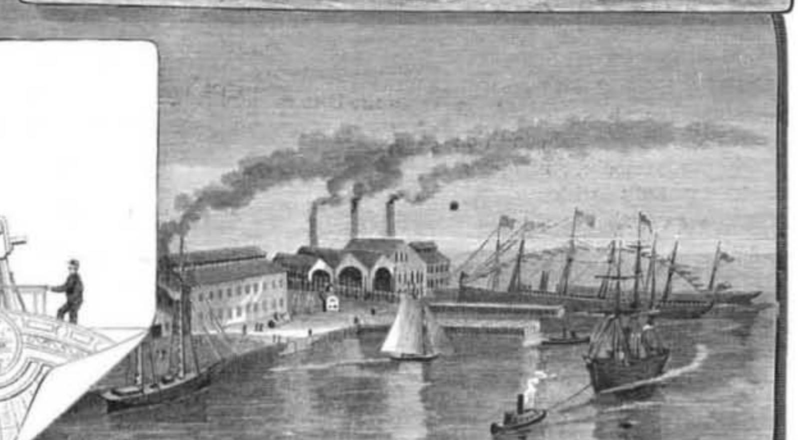
The process of hammering naturally increases the length of the mass of iron while it is being reduced to its proper thickness, and this increased length is hammered into two flat surfaces above, and below, known as a "scarf." On this "scarf," for the next heating, are piled from fifteen to twenty blooms, which are carried into the furnace, brought to a welding heat, and then put under the hammer, and welded into one mass. The shaft is turned over and a new supply of blooms piled upon the opposite side of the "scarf." These are then carried into the furnace, brought to a welding heat, put under the hammer, and welded. After another heating this whole mass is rounded into the desired size and shape. And so the process goes on of piling on the blooms, heating, forging, shaping, building up the scarf, and piling on more blooms. And the shaft goes on increasing in length. To do this work on each half shaft required about fourteen days' constant work. And to handle the shaft in heating and shaping required a gang of upwards of twenty men. This is, of course, apart from the work of preparing blooms, tending the furnaces, running the crane engines, handling material, the extent and cost of which are perhaps only known to the members of the firm and the book-keeper of the works. After each half shaft is completed in the forge, it is taken into the shop and then turned. This turning is done as perfectly and as neatly as if the iron, 39 feet 6 inches long, and not far from one yard in thickness, were intended for a gold watch. The machinery, appliances, and skill for such work are too well known to require description.

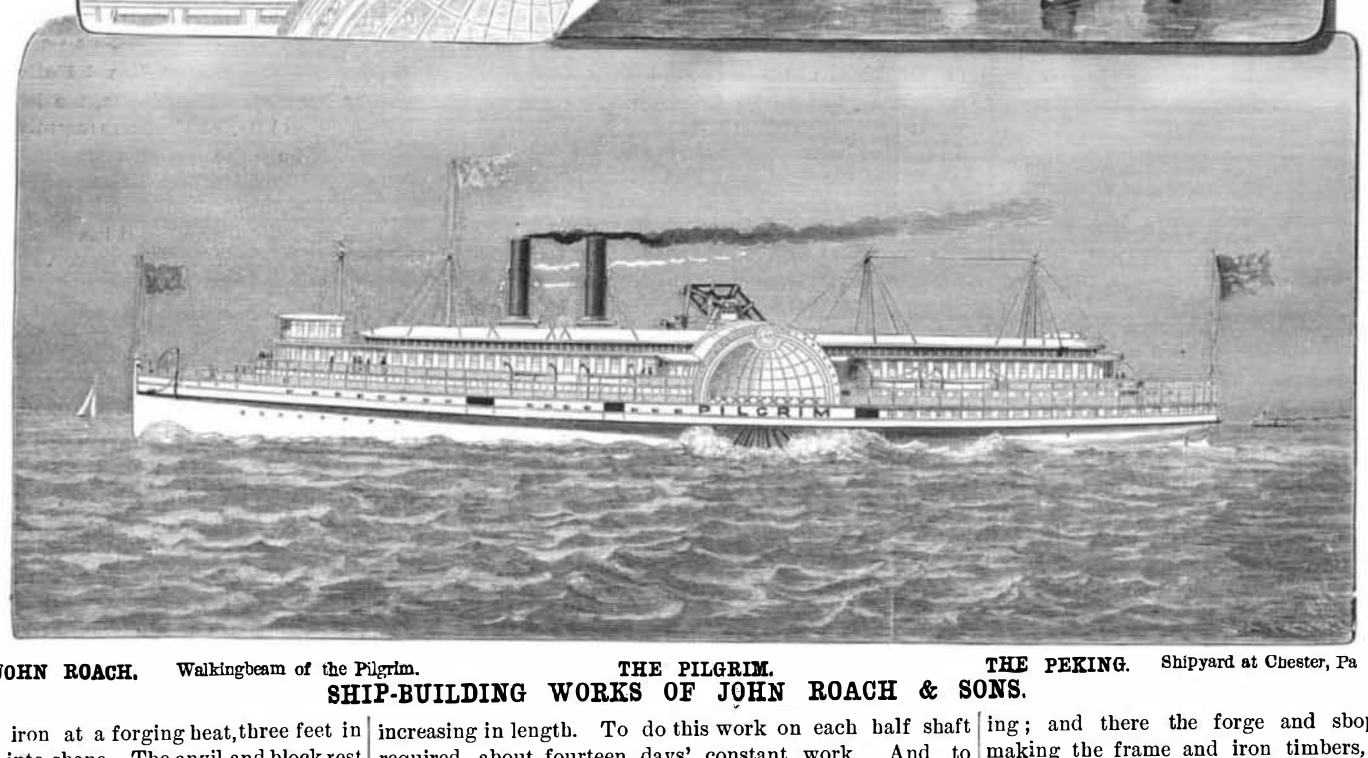
What is implied by the size of the shaft is carried out in all parts of the engine. The cylinder is 9 feet 2 inches in interior diameter, with 14 feet stroke, and was cast in the same works. The working beam from center to center is 29 feet long, by 14 feet 6 inches across, and weighs 38 tons. The paddle wheels are 41 feet in diameter.

These figures alone will convey a just appreciation of the magnitude of the work. The entire engine in all its material, casting, forging, turning, and putting together, was done in this shop. Needless to say the building is not large enough for the setting up the entire engine, and consequently the separate parts can alone be fitted, and after proper adjustment and numbering, removed. The niceness of the work done may be further illustrated by recalling the circumstance that we have witnessed the putting together a shaft and crank piece, an operation requiring so great promptitude and accuracy, that the slightest or smallest error will, in a few minutes, destroy thousands of dollars' worth of material. The crank is bored something like an eighth of an inch less in diameter than the diameter of the shaft. To admit of inserting the shaft the crank has to be heated sufficiently to expand the metal until the bore is of the same size with the shaft. Then the shaft, which has been kept at a uniform temperature, is inserted. If this is done too slowly, or the shaft does not go home to its proper place, or, from irregular turning, is not true in its bearing to the crank, the whole work is destroyed, and the iron has to be again broken up, for the hot crank piece has already closed upon the cold shaft with a grip making it impossible ever to separate them, and the two pieces are now one piece of iron. Considering that these pieces are of many tons in weight, the difficulty of the job and the requisite skill of the men become apparent.









JOHN ROACH. Walkingbeam of the Pilgrim. THE PILGRIM. THE PEKING. Shipyard at Chester, Pa

SHIP-BUILDING WORKS OF JOHN ROACH & SONS.

Mr. Roach employs in this yard, where he builds most of his machinery, foot of East Ninth street, New York, from eight hundred to nine hundred men. The industries fostered, indirectly, by his enterprise are perhaps tenfold greater in number of men employed.

He builds his great iron ships at Chester, Pennsylvania, and there, alongside the unfinished ironclad Puritan, lies the Pilgrim on the ways. Here, as in the machine shop in New York, the entire work of building the ship is done, from its inception in the mind of the constructor to its launching and fitting up. Here is the furnace for smelting the iron; there the rolling mill for rolling plates and armor plating; and there the forge and shops and furnace for making the frame and iron timbers, so to speak, of an iron ship. On another page is a sketch of the water front of this yard, which is much larger than that in New York.

The general subject of ship-building is familiar to most of our readers, but we will insert here a brief reference to what is done in the yard at Chester. The constructor designs his miniature ship in wood, and therein exercises his peculiar talent and creative faculty, somewhat as the sculptor creates in his art. From this a sectional drawing of the same size is made, and from that again a larger scale drawing, and from that a table is constructed showing the measurements of all parts of the hull in feet and to the fraction of an inch.

The "displacement" of the ship, loaded and unloaded, is calculated, and so accurately is this ascertained that the constructor has been known to draw a chalk line on the hull of his ship before launching which showed her exact water line when launched. The water line of the ship in every possible position is known, and consequently her stability. From the table of proportions the shape of the cross sections or frame at any given point is laid out on the "mould loft" floor with great accuracy, in the actual size of the ship to be built. And from this wooden patterns are made to correspond with every part of the frame. These patterns are now in turn placed upon an iron floor, covered all over with square holes intended to receive iron pins, and its curvature accurately marked in and out among the holes, which are then supplied with pins and bolts. The angle iron intended for that particular rib or part of the frame is brought from the furnace at a red heat, and after being drawn into this curved line, is bolted down until it cools into permanent shape. Two are made alike, corresponding for the opposite sides of the ship; so of every part of the frame from stem to stern. The iron plates are rolled in the mill, with equal care, into the required curvature for each part of the ship, sharp or gradual as to the position required. Each plate has its number and place to which it is brought ready shapen to be laid in place, where and when alone it can be placed, and then riveted to the frame.

The drawing room of this yard presents to the visitor perhaps a more perfect idea of the extent of the works than any other part. It has the appearance almost of an art gallery of marine subjects. Every object the eye rests upon is a reminder of ships. The walls are covered with pictures and models of every form of ocean steamer, steamboat, and yacht built or now building, these models beautifully executed, while the cases are filled with working drawings of every part of the ship, finished in the most elaborate manner. The party for whom the ship is to be built indicates generally what is to be her carrying capacity, and possibly expresses some fancy as to her lines, but beyond this the constructor designs the ship, whether as to practical considerations or matters of fancy.

On another page we give a sketch of the City of Peking, the largest ship yet built by Mr. Roach, turned out of this yard, and of a design in construction which has been largely followed, and has received very general commendation. There are in process of building here six or more iron ships, designed for foreign trade, the work as well done as can be produced in any shipyard in the world. The United States ironclad, Puritan, lies on the stocks in an unfinished condition. It seems incomprehensible that the Government should leave so magnificent a ship in an unfinished condition for so many years. Near by, on the stocks, and almost complete, is the Pilgrim. She is built with a double hull, that is, two iron hulls, one somewhat smaller and inside the other, braced together. This gives increased strength on the principle of the tubular bridge, and safety in case of injury to the outer hull. Her length over all is 390 feet, 87 feet beam outside the guards amidship, and 12 feet draught, with a proposed speed of twenty miles an hour. The American ensign, presumably in proportion, is to be 30 x 20 feet. She appears on the stocks like an iron mountain, and that, too, without saloons or deck houses. As the shaft implies the engine, so the work turned out implies the magnitude of the works, the capital, skill, and enterprise of its organizer, as well as the labor, skill, and materials utilized. The average number of laborers in this yard is 1,800 to 3,000.

During the past ten years the firm of John Roach & Sons has built and delivered over one hundred iron steamers. That is to say, ten per year on an average, that is, one in a little over a month each—building the ship and the machinery; these representing contracts with the South American States, Spain, and our own people.

Ship building in Chester was practically unknown until Mr. Roach established his yard there, some ten years since. And now, as we have said, he finds employment for 1,800 to 3,000 men, with all that is incidental to such employment for the benefit of a place.

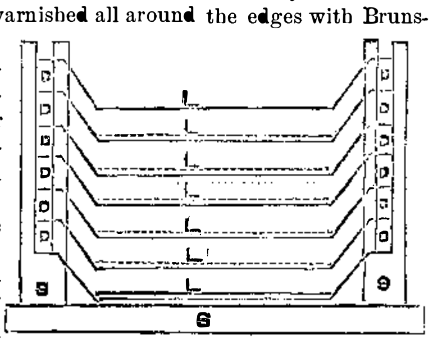
The story of the career of this man, who is the father of American iron ship-building, has that simplicity which attaches to the lives of most eminent men, an oft told tale, but in his case one of almost unparalleled success. He commenced business life as a boy in the foundry of the Allaire Iron Works, in New York, as a moulder, at a time when the best workmen received a precarious compensation of one dollar per day, and it may be easily conjectured what a poor boy must have received. He there learned his trade, passing through the daily experience of young men in that capacity.

Subsequently, when he had acquired sufficient knowledge and saved up sufficient capital, say, fifty dollars, he established a foundry of his own, "ridiculously small," as some one has said. But it grew, though at first no one would have believed it to be a foundry, until it became to be the celebrated "Etna Iron Works." Commencing with small castings, the contracts grew to large castings, then a machine shop, and boiler shop. During his early days it is not recorded that he was one of the strikers, but after he started his little foundry he continued to be one of the hard workers. It is pleasant to know that since then he has bought out some of the tools, machinery, and appliances of the Allaire works, in which he was employed as a boy. About the year 1868 he came into occupation of what is known as the "Morgan Iron Works," and about 1872 purchased most of his property at Chester. It has often been predicted by companies, in his line of business, that he must fail, because one man *could not* succeed where a corporation could not prosper and often has failed. But he has prospered, and the beginner with fifty dollars now has a property representing millions. The secret lies within the man. Extraordinary physical and mental energy, at work night and day from year to year, frugal in habits and democratic in feeling, practical, strictly reliable in all his engagements, he is a representative man of a thrifty and enterprising age. And with it all he is kindly and charitable. No one complains of his being rough and coarse, and many can testify to his considerateness. One who has known him for years remarked, and the figures prove it, "If Mr. Roach should die to-day it would be a *calamity* to New York and to Chester." Many things have been said about him in reference to "monopoly" and "protection," but it would seem that a man who has been able to build up as he has builded, and to represent an industry such as this is, is qualified to judge of the needs of the country in ship-building, and to give "protection" to the hundreds for whom he finds employment. The portrait of Mr. Roach that accompanies our sketches gives an idea of his personal appearance.

Mr. Roach is known to be a man of decided opinions in respect to the promotion of American industries, and our sketch would be quite incomplete did we not give our readers some notion of his ideas relating thereto; these, naturally, form the second branch of our subject, and are so extensive and interesting that we present them in a special article printed in this week's SCIENTIFIC AMERICAN SUPPLEMENT.

A SIMPLE FORM OF STORAGE OR SECONDARY BATTERY.

It consists of a series of shallow thin lead trays, L, about one-fortieth of an inch thick, pressed and hammered into shape in a wooden mould. These trays are arranged one over another in a wooden frame, S. The trays are kept at an equal distance from each other by pieces of wood, which slide up and down in the stand, the ends of the slides being shown at D. The dotted lines in the bottom of the tray represent layers of red lead, or oxide or reduced lead. On this is poured an acid solution of sulphate of copper, just deep enough to immerse the bottom of the tray above. The trays should be varnished all around the edges with Brunswick black, or some other acid-resisting varnish. Wires for poles are soldered to the bottom of the bottom tray, and to the top of the top tray. The battery may, of course, consist of a greater number of trays, and a series of batteries may be connected together.



The advantages of this form of battery are, the oxide of lead can always be kept at the most advantageous thickness. The plates or trays can also be arranged at the most advantageous distance from each other. No diaphragm of any kind is required, and therefore, however long in action, no reduced lead can weaken its action. The battery must always be kept level. Of course, it could not be used in tramcars, etc.

In making batteries on a large scale it would be well, perhaps, to cas the trays in an iron mould, and then it would be well to have one corner of each cell cut off; and let this be done on alternate sides, to facilitate the inspection and supply of liquid. It would be well then to mix antimony with the lead to harden it. Possibly the trays may be made of carbon.—W. *Symons, F.C.S., in English Mechanic.*

The Census of Canada.

The first volume of the Canadian Census Statistics of 1881 have just been submitted to the Dominion Parliament by the Hon. J. H. Pope, the Minister of Agriculture, and contains various interesting schedules, among which are those relating to the religions and nationalities of the population. With regard to the former the particulars are as follows: Roman Catholics, 1,791,982; Presbyterians, 676,155; Adventists, 7,211; Baptists, 225,236; Free Will Baptists, 50,055; Mennonites, 21,234; Brethren, 8,831; Church of England, 574,818; Congregationalists, 26,900; Disciples, 20,193; Episcopal (Reformed), 2,596; Jews, 2,393; Lutherans, 46,350; Methodists, of all classes, 742,981; Pagans, 4,478; Protestants, 6,519; Quakers, 6,533; Unitarians, 2,126; Universalist, 4,517; no religion, 2,634; other denominations, 14,269; not given, 86,769. Total, 4,324,810. The population of Canada includes the following nationalities: Africans, 21,394; Chinese, 4,383; Dutch, 30,412; English, 881,301; French, 1,298,929; German, 255,319; Icelanders, 1,099; Indians, 108,547; Irish, 957,403, Italians, 1,849; Jews, 667; Russians, 1,227; Scandinavians, 4,214; Scotch, 699,863; Spanish and Portuguese, 1,172; Swiss, 4,588; Welsh, 9,947; all others, 43,587. According to nativity, the population of the Dominion stands thus: Natives of England, 169,504; Ireland, 185,526; Scotland, 115,062; Ontario, 1,467,988; Quebec, 1,227,809; Prince Edward Island, 101,047; Nova Scotia, 420,088; New Brunswick, 288,265; British Columbia, 32,775; Manitoba, 19,599; Territories, 58,430; other British possessions, 10,368; France, 4,389; Germany, 25,328; Italy, 777; Russia, 6,376; Spain, 215; Sweden and Norway, 2,076; United States, 77,753; other countries, 14,169. The male population of Canada number 2,188,854, and the females, 2,135,956; married, 1,380,084; widowed, 160,330; unmarried, 2,784,396. Canada was divided for census purposes into 192 districts, and 2,139 sub-districts.

Train Brakes for Freight Cars.

The committee on train brakes for freight cars, appointed by the Master Car Builders' Association, reported at the late meeting that very satisfactory progress has been made in the last three years.

The Reed train brake has been considerably simplified in construction during the past year, and is doing good work on the Harlem Division, where it has been in operation for nearly two years.

The American Brake Company report having their train brake in successful operation on 500 cars on the St. Louis and San Francisco Railway, and that for cheapness, efficiency, and durability it is all they claim for it. Reports from the above railroad company give some 500 cars equipped with this brake running over a period of some fifteen months, and in that time several bad wrecks have been avoided by its use. The weight of the brake applied to one truck is 140 pounds per car, and the first cost $11.75, while the annual cost of repair is very small.

The Tallman train brake, which has been working successfully on the Harlem Division for nearly two years, is also running on ten cars of the New York Live Stock Express Company between Chicago and New York. At two trials of this brake in February, on the Central Railroad of New Jersey, excellent stops were made, some of them as follows:

Speed 20 miles per hour, down grade, stopped in 360 feet in 18 seconds; speed 25 miles per hour, down grade, stopped in 450 feet in 22 seconds; speed 35 miles per hour, down grade, 23 feet to the mile, stopped in 1,080 feet. A trial of this brake on the Chicago, Rock Island, and Pacific Railroad proved quite satisfactory. Exact data not given.

The Pennsylvania Railroad has some 75 stock cars equipped with the Westinghouse air brake, but are not yet satisfied in regard to its practicability for freight service.

There have been two new brakes brought out since the last annual meeting of the association, which the committee think worthy of mention. The Fuller and Salvadge brake is in successful operation on a construction train on the Grand Trunk, Georgian Bay, and Lake Erie Railway. This brake is independent on each car, being operated by compression of draw-bar. The cost is about $20 per car.

Also the Stowe brake, which is of peculiar construction, requiring neither air, steam, compression, nor electricity to operate it, for which the following is claimed: A short chain between the cars sets the brake automatically on all cars equipped with it, which are connected together. Where a train breaks in two, and should the brake be out of order on one or more cars, it does not affect the efficiency of the others, each car taking care of its own slack chain while transmitting the power unimpaired to its neighbor, and when the brake is applied, and the train brought to a stop, the power is automatically stored up on each car ready for the next stop.

A Novel Balloon.

A NEW steerable balloon, the invention of Herr Baumgarten and Dr. Wälfert, was recently tried at Charlottenburg. It is of huge size, having a capacity of about 473 cubic yards, and is ellipsoid in form, the longer diameter being about 58 feet. It differs in principle from all other aerostats in that, although inflated with hydrogen, it has no ascensional force; its total weight is about 2 1-5 lb. above that of the air it displaces. The means of displacement in the horizontal or the vertical direction are a helical system of vanes actuated by machinery in the car. Hence, in making land, the balloon does not require to be partly emptied, and on reaching the ground it has nearly the same quantity of gas as when it rose.

Another novelty consists in the mode of connection of the car. This is rigid. Thus the dangerous bounds or jerks to which the ordinary balloon-car is liable in landing are to some extent avoided. The car being usually suspended by ropes, the system is suddenly relieved of its weight when it touches the ground, so that the balloon shoots up again, giving a series of violent shocks. With a rigid connection the total weight cannot be thus temporarily diminished. The mechanism has a double action, one helix of vanes, or screw propeller, driven in one direction or the opposite, produces ascent or descent, while a couple of screws give horizontal propulsion; in a pretty calm atmosphere the horizontal direction may be modified by working one of the couple alone. The first experiments, it appears, were quite successful. The weather was exceptionally calm. In a second trial a slight accident ruptured the envelope of the balloon, and the car mechanism was also injured. The experiments are soon to be resumed. The motor, it may be mentioned, has a force of 4 horse power and weighs 80 lb. The cost of charging each time the balloon is filled anew is about $100.

Fast Speed from China to London.

The new steamship Stirling Castle, from Hankow, China, lately reached London, after a run of 29 days 22 hours, the fastest on record. The distance from Hankow to London is 11,250 miles, so that the Stirling Castle made an average of more than 375 miles a day, making no allowance for detention at coaling ports and time occupied in passing through the Suez Canal.

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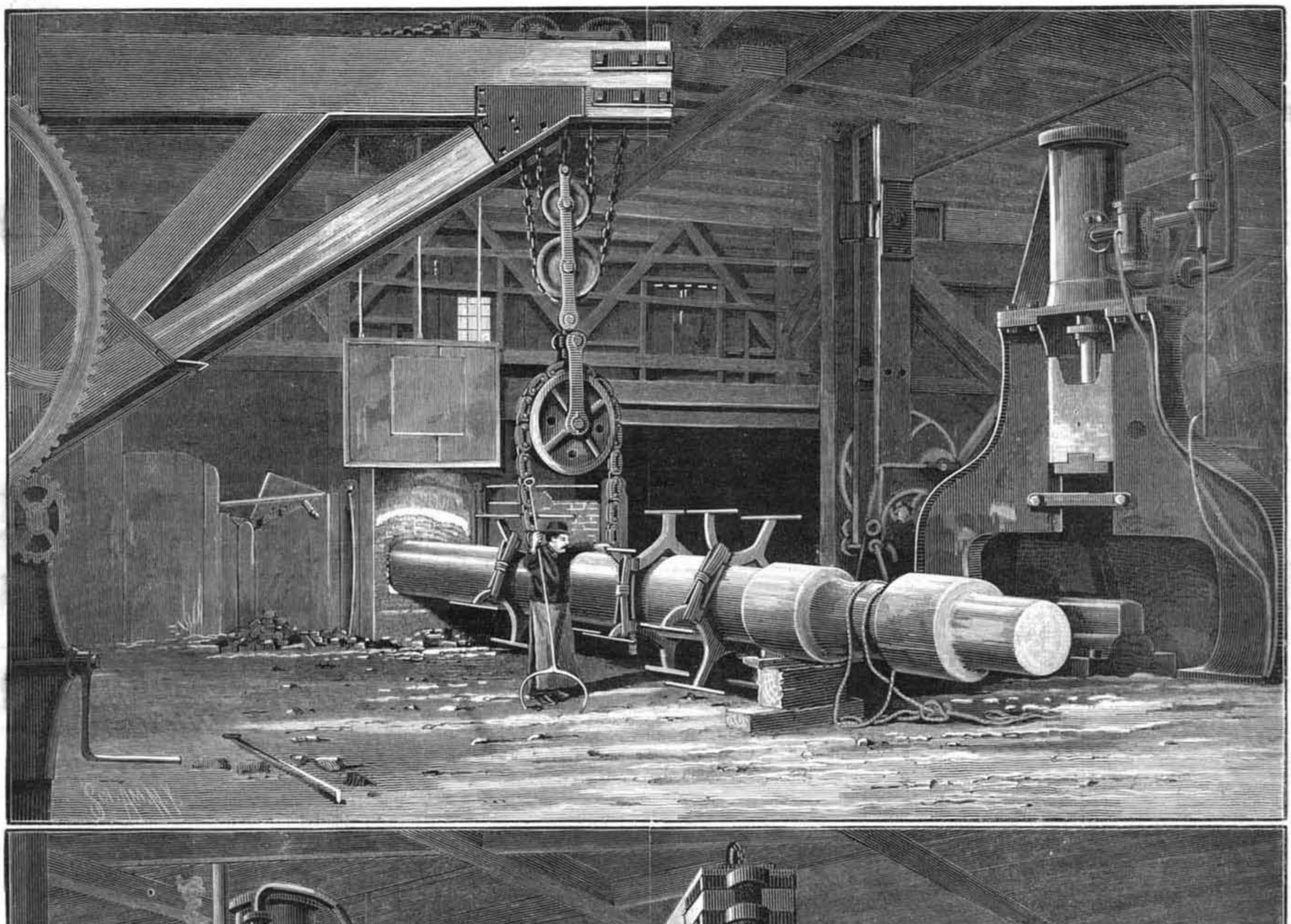

SHIP-BUILDING WORKS OF JOHN ROACH & SONS.—FORGING THE GREAT SHAFT FOR THE PILGRIM.—[See page 19.]