



Marine Exhibits in the Palace of Transportation.—Entering the Transportation Palace by the "Golden Door," the first object that attracts attention is a large model of the Santa Maria, the arrival of which on our shores in 1492 is being celebrated by this great Fair. The larger reproduction of Columbus' vessel that sailed across the ocean to take part in the celebration is moored in the South Inlet, near the Convent of La Rabida, where crowds of people visit her daily. We have already published a cut of this quaint structure and the vessel.

Just beyond this model is Grace Darling's boat, in which she rescued so many shipwrecked people. Turning from this exhibit, so suggestive of admiration of courage and thankfulness for lives saved, we come upon one that prompts only sorrowful thoughts. We refer to a large model of the Victoria, which was so needlessly wrecked, carrying down with her many brave men. The sad catastrophe made this model doubly interesting, and it was constantly surrounded by visitors, many of whom expressed sympathy for the families of those who were lost. The model is perfect in every detail, even to the screen for protecting the hull from torpedoes, and a little placard marks the spot where the vessel was struck by the Camperdown. Armstrong, Mitchell & Co., of Newcastle-on-Tyne, are the owners of this and many other interesting models, among which is one of the Spanish cruiser Reina Regente, one of the vessels sent to participate in the naval review at New York last spring. The active part taken by English and Scotch firms in the construction of the navies of the world is demonstrated by the numerous models of war vessels belonging to different nations, contained in the British section.

An excellent opportunity is also offered for the study of the evolution of the transatlantic steamer. The Cunard Line, for instance, shows models of many of its vessels, beginning with its pioneer side wheeler, Britannia, which was built in 1840, and was probably considered a marvel at that time, for it was 207 feet long, its gross tonnage is 2,050, and its engines developed 403 horse power. These figures seem very small when compared with the dimensions of the beautiful new twin screw propellers the Campania and the Lucania, which have been completed this year and are now making such fine records in actual service. The length of these vessels is 620 feet, their displacement 18,000 tons, and their horse power 30,000.

The German section contains other interesting models of transatlantic steamers, among which are those of the Kaiser Wilhelm (length 449 feet, tonnage 3,675, horse power 6,400), of the North German Lloyds Line, and the Furst Bismarck (length 502 feet, horse power 14,000) and the Augusta Victoria, of the Hamburg-American Packet Company. The names of these steamers are so familiar that it seems like being among old friends when we are surrounded by the models.

Messrs. Laird Bros., of Birkenhead, England, had an interesting exhibit consisting of a long glass case filled with tiny models of vessels made by them, and so arranged as to give a chronological record of different types from 1830 to the present time.

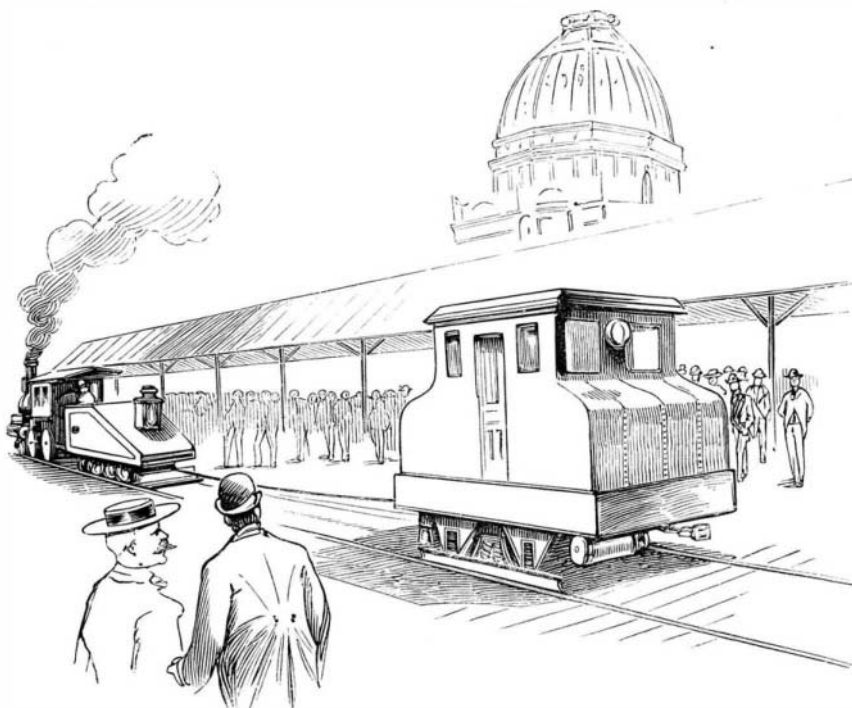
An exhibit which is very interesting in a different way is that of Thomas Cook & Son, of London, the firm whose name is so well known to tourists in all parts of the world. They exhibit models illustrative of modes of travel used at different periods, the oldest being models of funeral boats, each containing several figures, that were found in tombs in Egypt. Some of these are said to be 4,000 years old. There are also models of Venetian gondolas and of modern excursion steamers used on the Nile. It is interesting to note the difference between them and the vessels generally used for the same purpose in this country. They are fitted to accommodate from 10 to 78 saloon passengers. They are appropriately named for ancient Egyptian rulers and gods, one being called Rameses the Great and another Hathor. But the most striking object in this pavilion is a fine model of the Temple of Edfou, which is perfect in every detail. Interest in this model is enhanced by the explanations of its various courts

and passages given, in perfect English, by a real Egyptian. After Mohammed had finished his little lecture he produced coins, both ancient and modern, from pockets hidden in different parts of his voluminous garments (the concealed pockets of the "Heathen Chinee" are not worthy of mention with those of Mohammed), which he is very ready to exchange for United States coin, in spite of the uncertainty of the fate of the Sherman bill. He vouched for the authenticity of the ancient coins by saying that he was from Luxor himself and knew the excavations well; in fact, he gave us to understand that he was the best guide of the Nile country, to which he expects to return after the close of the Exposition.

Not far from this pavilion is a model of the yacht Livadia, built for the Czar of Russia, which, when afloat, must be a very odd-looking craft, for it is so broad as to give the impression of being round. Its bottom is flat and is provided with three ridges, that seem to be equivalent to three keels, one in the middle and one on each side. It has three screws and three smoke stacks, the latter being arranged side by side instead of one in front of the other.

A visit to the Japanese section shows that this little country is doing her best to keep abreast of the rest of the world in the construction of war vessels as well as in other branches of industry.

In the Brazilian section there is an odd boat built of logs, bound together after the fashion of a raft, but the logs are sharpened at the ends so as to give some shape to the bow and stern. On this is built a little hut with a thatched roof. It carries a good sized sail, and for a rudder there is only a paddle. Near it is a dugout that is capable of carrying over 4,500 lb. of sugar and twelve or more passengers. It can



STEAM LOCOMOTIVE VS. ELECTRICAL LOCOMOTIVE—A TUG OF WAR.

be rowed or sailed, and in either case is managed by one man.

Although it seems as if there were models enough on the main floor to represent every variety of vessel that was ever made, there are still more in the gallery; besides full sized Indian canoes and dugouts, modern sculling skiffs, and beautiful gondolas. The latter are very richly finished, although they are, of course, entirely black, this being required by the law that was passed to prevent the ostentatious display that formerly produced such a contrast between the gondolas of the rich and the poor. In the gallery there are many little toy-like models of devices used in Asia and Africa. One of the crudest of these resembles an immense gourd across which the boatman, if the term may be allowed, throws himself face downward, his arms extending beyond it so that he can propel himself by means of a paddle which he holds in his hand.

These are a few of the exhibits contained in the great Transportation building, a thorough examination of which would require days.

Some State Exhibits of Minerals.—In the Palace of Mining in the center of the main aisle is a shaft of anthracite coal fifty-four feet high, representing a columnar section of the mammoth coal vein in the mines of the Lehigh Valley Coal Company, and near it is a monument of cubes, each block illustrating a product of the mines of the United States for one second of time as estimated from the records of the United States Geological Survey. The base of the monument is bituminous coal. Then come anthracite coal, limestone, natural gas in its coal equivalent, petroleum, iron ore, granite, salt, and so on, descending down the list until precious stones are reached, this cube being very minute. The Pennsylvania exhibit is particularly complete in its display of coal, both anthracite and bituminous, and petroleum. The

West Virginia exhibit contains a fine display of bituminous and semi-bituminous coal, coke, iron ores, building stones, petroleum, both crude and manufactured products, and salt.

In the New York exhibit is an obelisk made up of the geological formations occurring in this State from the Archæan to the Trias, the four sides of the obelisk representing the four points of the compass, showing the occurrences of the several formations in the respective quarters of the State. The exhibit comprises petroleum, magnetite, red and brown hematites and other iron ores, paint minerals, a complete line of building stones, lime, cement, commercial clays and clay manufactures, salt and mineral waters.

The facade of the Kentucky section is an arch of cannel coal, while the floor of the entire section is covered with tiles manufactured in this State. The exhibit comprises chiefly clays, fire and other bricks, terra cotta and other manufactures of clay, building stones, coke, coal from several veins, and many specimens of iron ores.

The facade of the Ohio exhibit is built of brick and sandstone, carrying a large display of glass, cements and clays. The floor of the section is covered with artistic tiles manufactured in Ohio. The conspicuous feature of this exhibit is a miniature salt plant, showing how salt is evaporated, dried, ground and packed. Another particularly attractive exhibit is a reproduction in miniature of a Lima oil well from which crude petroleum is pumped. Ohio also shows some fine samples of iron ore, pig iron and coal. One large block of coal, weighing fourteen tons, shows a section of a vein in the Hocking Valley which is 15 feet 3 inches in thickness.

Indiana's display is mostly of bituminous coal. There are also samples of coal dust worked up into balls the size of an egg by the use of agglutinating substances. Petroleum, both crude and refined, commercial clays, building materials, ornamental and fire-proofing terra cotta, and cannel coal complete the exhibit.

In the Michigan exhibit a large share of the space is devoted to the iron and copper mining industries of this State. There are immense blocks of native copper and piles of ingot copper, copper bars and cakes, reels of copper wire and rolls of sheet copper, while in one of the cases are shown many copper tools, relics of aboriginal copper workers.

The Cleveland Cliffs Iron Company exhibits a model of a cross section of the Cliffs' shaft mine, constructed on a scale of a quarter of an inch to the foot. The surface of this model is covered with the actual material represented, which has been granulated and cemented in place. The various shafts and levels are shown, and the method of timbering.

The Iowa State exhibit presents the "Black Diamond Hollow," representing a section of a coal mine level, with a miner at work with his pick upon the seam, with lumps of coal scattered about

and the mine car in the foreground, nearly loaded with blocks of coal. All the tools used in coal mining are shown. There is a grotto filled with fine specimens of crystalline formations from caves in various parts of Iowa.

Several propositions have been made looking toward keeping the Exposition open later than October 30, but it is doubtful if such a venture will be entirely satisfactory to visitors, as many exhibitors are determined to pack up and get away immediately after the legal time of closing, which is October 30. The buildings themselves are anticipating the closing day, as the plastering is cracking off in places and the staff work is generally stained and in some places broken; not enough as yet, however, to seriously affect the appearance of the buildings. The foundations of some of the buildings have settled considerably. This is especially true of the Horticultural building.

Saturday, September 16, was Railroad day, and an interesting programme was prepared to entertain the public, but nothing seemed of so much consequence to the public as the "tug of war" between a steam locomotive and an electric locomotive.

The steam locomotive was No. 10, that has been in service on the Baltimore and Ohio Railroad for some fifteen years. It has 16x24 cylinders, uses steam at 140 pounds pressure, and weighs on the drivers about 35 tons, while the tender gives an additional weight of about eight tons. The electric locomotive is one recently built by the General Electric Company and has thirty tons on the wheels. Its motor capacity is 250 horse power. This locomotive was designed to operate on an overhead trolley, but as none was at hand, temporary cables connected the motors to the Exposition 500 volt circuit. The steam locomotive easily drew the electric locomotive all over the track. The two engines were fastened together by a heavy

wire cable twenty feet long. We give a rough sketch of the contest; the electric locomotive is at the right, the steam locomotive at the left.

The Columbus caravels have been officially turned over to the United States government by representatives of Spain and have been formally accepted. They have been towed into the South Canal beyond the reach of possible damage by the waves of Lake Michigan and will remain there until the Exposition closes. The Spanish sailors who have been in charge have re-

wants of fine tool makers, model makers, electricians and watch tool makers. An illustrated catalogue, which will be sent on application, shows the lathe with its different attachments and a variety of samples of the work done therewith. The office of the company is at No. 474 Washington Street, Boston.

A GAS ENGINE EXHIBIT AT THE FAIR.

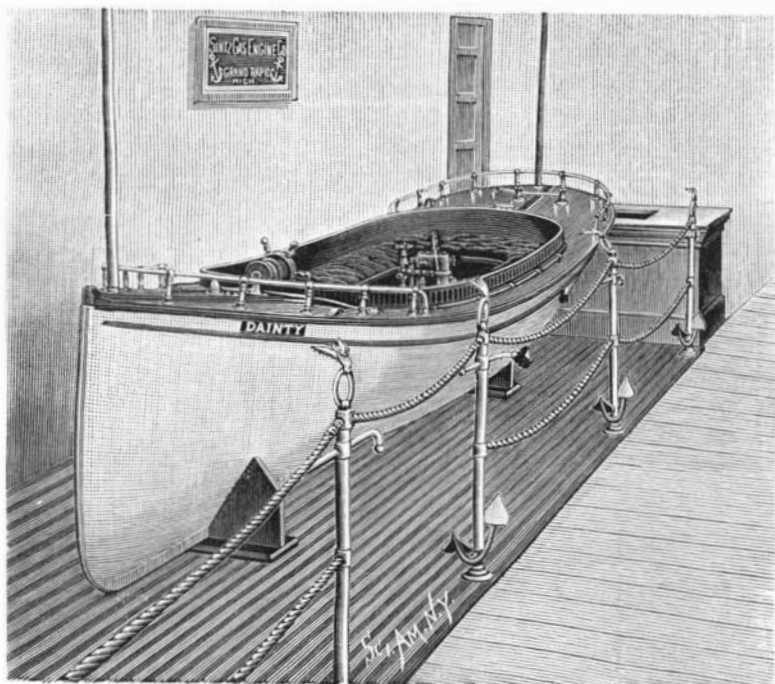
The exhibit at the World's Columbian Exposition of the Sintz Gas Engine Company, of Grand Rapids, Mich., comprising a small boat with a special adaptation therefor of their well known gas and gasoline engines, attracts not a little attention. Their marine engine, shown in a separate view, is the same as the stationary engine made by the firm, except that it has but one small flywheel and has a different base, to suit the foundation in boat. It also has an attachment for changing speed of engine while running. The propeller wheel is of a new design, and in smaller sizes has only two blades. The blades are reversible, and the wheel can be made a right or left hand screw while the boat is running, the pitch of the blades being regulated as desired. The engine makes its own gas from gasoline, as it is used, no boiler, coal, wood, or water being required, except the small amount of water in the jacket of the outside cylinder. The explosive charge is ignited from a small electric battery, obviating the possibility of accidental explosion of the gasoline, and it is said that the expense of running the engine does not exceed the cost of

is set in rotation after filling, or the latter operation may be performed while the table is actually in motion.

There is a modification of the apparatus, in which the rotating table, being smaller in diameter than that previously adopted, can be driven at a higher speed, up to 200 revolutions per minute. There are eight pivoted moulds, each divided by internal walls, so as to give nine small ingots, suitable for wire billets or thin sheets. By means of a central annular funnel, lined with refractory material, and provided with eight feeding spouts, or one for each group of moulds, the whole number of 72 ingots are cast by a single pouring from the ladle, which contains from four to six tons of steel.

Difficulties of Railway Development in China.

A curious example of the difficulties of railway construction in China is afforded by the conduct of the Tartar general of Moukden, the capital of Manchuria, in connection with the surveying work for the railway from Kirin, another large Manchurian town, to Newchwang, the seaport of the province. It was proposed to make a junction on this line for Moukden at a place called Lanpien, a short distance outside the city; but the general got a number of geomancers to investigate the effect of this selection upon Moukden. These sages reported that the vertebrae of the dragon which encircles the holy city of Moukden would be broken by driving the long nails of the railway sleepers into them, and accordingly the general vetoed the decision of the engineers, and directed them to carry the railway in a straight line from Kirin to Newchwang without approaching Moukden at all. This was, no doubt, much shorter; but the engineers objected that the country which the line would cross by this route was a low and marshy tract of land, liable to floods during the wet season, and also that it was sparsely populated, so that no traffic would be got. By the route which had been decided upon, the line, though longer, would pass through thickly populated country



THE WORLD'S COLUMBIAN EXPOSITION—THE SINTZ GAS ENGINE COMPANY'S EXHIBIT.

turned to Spain, and sailors from the United States navy are now on board.

FINE WATCH TOOLS AND MACHINERY.

The exhibit at the World's Fair of the Faneuil Watch Tool Co., illustrated herewith, occupies a space of 15 x 20 ft. in Machinery Hall annex, and is shown in two cases of ebony and plate glass which present a fine appearance. The principal feature of the exhibit is the No. 4 Rivett bench lathe, which has a swing of 8 in., length of bed 36 in. and a distance between the centers of 18 in. Four of these lathes are shown. This lathe is used by first-class tool makers and in building fine machinery, and the great feature of the lathe is the many valuable patent attachments. The lathe can be converted into a milling machine in a minute's time, and the quill and the headstock both take the same size chuck. The case contains fifty different shaped cutters—round, oval, and all kinds of irregular shapes made on this machine. The lathes are arranged in the case to show the different attachments in position for work. One shows the patent slide rest, the rigidity of the tool holder of which makes this tool so valuable, another lathe shows the turret attachment, a third the milling attachment, and a fourth the grinding attachment.

With this lathe is used the self-centering split chucks, a set of which comprises all the sizes from $\frac{1}{8}$ in. to $\frac{1}{2}$ in. by 64ths. Two of the No. 3 lathes are shown, of which may be said all that has been said of the No. 4, except in regard to its capacity, which is smaller than the No. 4. Thirteen of the watchmaker's lathes are shown, each arranged to show some different attachment in position for work.

The Rivett lathes, as is well known, stand in the front rank of appliances for executing all kinds of fine, nice work, being especially adapted to satisfy the

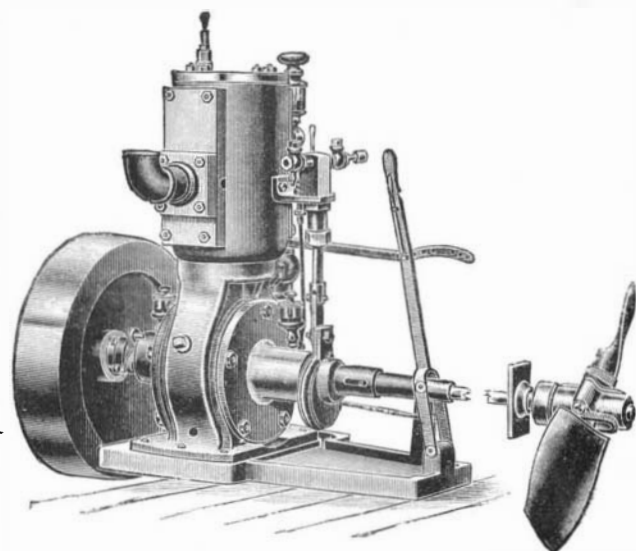
three-fourths of a pint of common gasoline per hour for each horse power. The engine has all the necessary appliances for working automatically, the governor regulating the charge of oil or gas, and thus controlling the speed.

Compression of Steel Ingots by Centrifugal Force.

At the Nykroppa Iron Works, in Sweden, a method of consolidating steel ingots, by subjecting the freshly filled mould to pressure developed by centrifugal action, has been introduced by the manager, Mr. L. Sebenius.

The apparatus consists of an upright shaft in the center of a cylindrical casting pit, carrying a frame of four arms, to each of which is articulated a platform supporting four ingot moulds. While the shaft is at rest the moulds are upright, and are filled in the usual way; but when it is set in rapid rotation they fly up into the horizontal position, and a pressure in the direction of the length of the ingot is developed equal to thirty times that due to the column of liquid metal in the mould, which drives the gases out, and produces a perfect solid casting. Uniformity of composition is also induced, as, on account of the rapid cooling, liquation is prevented. The process, which has now been in use about two years, has been applied to both the Bessemer converter and to the open-hearth furnace. The ingots are free from external defects, and the loss by defective ends has been diminished 40 per cent, the metal being so compact as to bear rolling to finished sizes without the use of the cogging mill. The cost of the apparatus is about \$400 for a three-ton charge and \$800 for a ten-ton charge.

The circumference described by the bottom of the moulds, when spun up into the horizontal position, is about 67 feet, corresponding to the working speed adopted of 125 revolutions, to a velocity of nearly 10,000 feet per minute. The pressure on the mould, taken at thirty times the pressure on the ingots, will be about 150 feet of iron, or from 500 pounds to 600 pounds per square inch. In the form of the apparatus intended for smaller ingots, the moulds are arranged in an inclined position, and radially to a central fixed vertical feeding tube up on a turntable, which

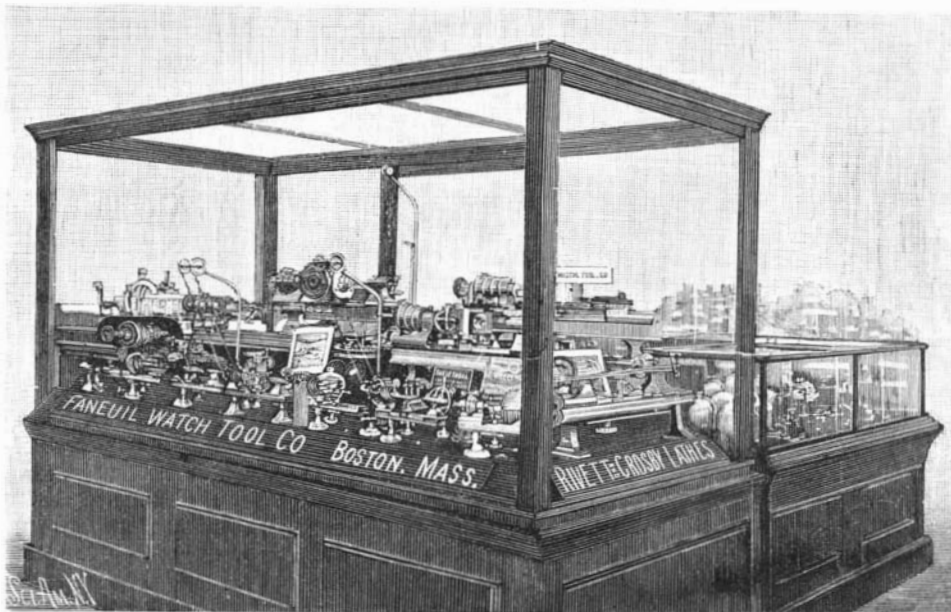


THE SINTZ MARINE ENGINE.

and on high and level ground. The engineers reported the matter to Li Hung Chang, who wrote commending the Tartar general for his anxiety for the geomantic influences of the ancestral home of the reigning dynasty, but adding, as his candid opinion, that these influences would be improved by the junction rather than otherwise. However, the viceroy said, as the general had vetoed the decision of the engineers, the matter must be laid before the Emperor and the works stopped until his Majesty's decision was known. This seriously alarmed the general, who promptly wrote asking that the works should go on, and in the meantime he would think about it. A place a few hundred yards from the former site was chosen, and the geomancers declared that this would not affect the dragon's pulse, whereupon the general wrote to the viceroy that he was now satisfied, and that he trusted no report would be made to the Emperor of the delay.

Origin of Atmospheric Oxygen.

Dr. T. L. Phipson, who has devoted a considerable amount of attention to problems concerning the constitution of the atmosphere, is led to the conclusion that the original atmosphere of the globe consisted of nitrogen alone, and that the oxygen now present is the product of vegetable life. In a paper in the *Chemical News* he states that minute microscopic plants (*Proto-coccus pluvialis* and *P. palustris*) can be easily transformed into manufacturers of oxygen gas. As the result of experiments, some of which we recently referred to (see *ante*, p. 83), he concludes that plants absorb carbonic acid by the roots and secrete oxygen by the leaves, from which it is subsequently given off. Into the primitive atmosphere of nitrogen, the early vegetation would thus pour oxygen during countless years until its composition became practically what it now is.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE FANEUIL WATCH TOOL CO.