spoken. The contents of the case, giving the exact weight, net, tare, and gross, should be plainly marked. To these matters the English and German merchant, who control the South American trade, pay strict attention, and this is one of the reasons why they receive the preference.

Americans will not lay any strong hold upon the great South American trade so long as the existing conditions in those countries are not made the subject of more careful study. Their credit system does not appeal to us, for it is a long time credit, six months on the average, but European houses vie with each other in the persistent effort to control the rapidly-growing markets of South America. Commercially it is a land of present importance and great future promise. Two cities on the east coast have each a population of one million; on the west coast there are also many cities densely populated.

The objections to the credit system could be overcome, but we must first learn to pack our merchandise in small, light and strong cases, suitable to the conditions exacted by the unavoidable circumstances of primitive transportation. Although it is true that many railroads exist, and that several of consequence are in course of construction, this vast continent contains millions of inhabitants who depend absolutely on the burro and llama for transportation.

THE GREAT FLOATING DOCKS OF BERMUDA AND ALGIERS, LA.

BY ROBERT C. FYFE.

Particular interest attaches just now to the question of dry docks, on account of the fact that the "Illinois," the latest of our battleships to be put in commission, is now in drydock abroad, for the repair of serious damage done to her hull by running aground while she was on the European station. It was this fine vessel that was chosen to represent the United States at the great naval review at Spithead, which was organized as part of the ceremonies attendant on the coronation of King Edward VII. After the postponement of the review, the "Illinois" had the misfortune to run aground on rocky bottom and tear open the forward part of her hull, thereby flooding one of the forward compartments and rendering extensive repairs in drydock necessary.

This sudden crippling of our finest battleship will naturally direct renewed attention to the two great floating drydocks which have recently been constructed and placed in service. One of these, constructed for Bermuda, was built by Messrs C. S. Swan & Huster, of Wallsend-on-Tyne; another, which is now at Algiers, La., was built by the Maryland Steel Company at Sparrow Point. Both of these were designed by Messrs. Clark & Standfield, London. Although the Bermuda dock is actually the largest, the Algiers dock is the more powerful. It may be interesting here to institute a comparison between these two and also the old floating dock, which was towed out to Bermuda in 1869, and which is to-day one of the largest floating docks in the world.

	New Bermuda Dock.	Algiers Dock.	Old Bermuda Dock.
Length of dock	545 feet	525	381
Length of end pontoon	120 feet		
Length of middle pontoons	300 feet		
Width between fenders	100 feet		84
Width of pontoons	96 feet		
Height of vertical walls	53 feet 3 in.		
Length of vertical walls	435 feet		
Thickness of wall	13 feet 1 in.		
Total width of structure	126 feet	100 feet	123 feet 9 in.
Lifting power up to deck level	15,500 tons	18,000 tons	8,000 tons
Extreme lifting power	17,500 tons	20,000 tons	10,000 tons
Weight of hull	6,500 tons	5,850	

When it became evident that a new dock must be made at Bermuda the Admiralty were anxious to get an ordinary graving dock made. Borings were made, but everywhere the geological formation proved unsuitable for the purpose. The old dock was rendered obsolete, not from decay, but because ships have increased so greatly in weight and in dimensions.

The simplest definition of a graving dock (by which we mean the sunken or excavated type) is a hole dug out in the foreshore below high tide level, with its seaend closed by a caisson or gate. The vessel is floated into the excavation, the ends closed by a gate, and the water then pumped out. Similarly a floating dock may be defined as a box built of wood or steel, which is allowed to fill with water so that it sinks. The vessel to be docked is drawn over it, the water in it pumped out, and by its buoyancy it lifts the vessel out of the water.

The modern floating dock is "self-docking." This means that it is capable of taking itself to pieces and lifting any one part out of the water when necessary for cleaning or repair. This is a very necessary condition in a hot climate, where floating structures are exceedingly liable to have their bottoms incrusted with marine organisms and slime.

The new Bermuda floating dock consists mainly of five chief parts, comprising three pontoons and two side walls. The three pontoons form the bottom of the dock and are placed between the side walls; they form the main lifting portion of the dock. The two side walls are chiefly designed to give stability and to afford control over the dock in sinking it to take the ship on board; they also do some of the lifting work. The center pontoon is 300 feet long and is rectangular in shape; the two end pontoons are each 120 feet long and have each 70 feet of the length rectangular in plan, the outer portions being beveled off in a way that will facilitate towing. The side walls are each 435 feet long and 53 feet 3 inches high. For the purpose of admitting light and air under the bottom of a vessel when docked there are two large openings in each of the side walls. The ends of the side walls are beveled off to carry out the lines of the end pontoons. The vertical side walls are firmly attached to the pontoon bottom, being fastened by double fish-plates and tapered pins, to take which there are steel lugs built into the structure, both of the walls and pontoons.

The new Bermuda dock is both longer and heavier than any floating dock that has ever before been built. It is 545 feet long, and its clear width between rubbing-fenders is 100 feet. As the side walls are a little over 13 feet across, the total width of the structure is somewhat above 126 feet. The lifting power up to the floating deck level is 15,500 tons; but by using the shallow pound this can be increased to 17,500 tons. The weight of the hull is 6,500 tons. The sides or walls are high enough to enable a vessel of 32 feet draught to be berthed on the keel block, the latter being 3 feet 6 inches high.

The new dock is capable both of docking itself and also of docking a battleship or cruiser. Each of the side walls can be lifted separately out of the water, and each of the pontoons can be lifted separately, so that any portion of the dock can be examined, cleaned, repaired or painted as occasion requires.

For the docking of a vessel the dock is sunk to a certain depth by taking in water ballast; the ship is then floated over, and, the water being pumped out, the vessel is lifted out of the water, thus allowing of repairs being made in her under portions. The three pontoons are divided into 40 pumping divisions, and of these 32 are water-tight. The side walls have also 8 water-tight compartments in each. All these divisions are provided with a separate pipe each, with a valve. All the pipes on each side lead directly into the main drain of their respective side. There are four 18-inch centrifugal pumps in each wall, and any one pump can empty all the compartments in its half of the dock. If the whole of the pumping machinery on one side were to break down, the other half could still empty the dock, though, of course, at a slow pace. The pumps are driven each by a separate compound condensing engine directly attached.

Although the new Bermuda dock exceeds the Algiers structure in length by 20 feet and in weight by 650 tons, the latter has greater lifting capacity. It recently lifted the United States battleship "Illinois," a vessel of 11,565 tons displacement. Up to positive level it will raise 18,000 tons, and if the "pound" be utilized the capacity could be increased to 20,000 tons.

The battleship "Sans Pareil" was selected to test the new dock. This battleship is a sister ship to the ill-fated "Victoria," rammed by the "Camperdown" in the Mediterrean in June, 1893. She is 340 feet long and 70 feet wide. Her armor is 18 inches, tapering to 16, and she carries ten 16¼ 110-ton guns in one heavily armored turret well forward. These guns are the largest carried in any fleet. The "Sans Pareil" entered the dock about 12 o'clock, and she was then drawing about 27 feet 4 inches.

At a little after 2 o'clock the pumps were started and they were kept at work until the battleship was lifted out of the water and the pontoon deck was high and dry. The lifting of the "Sans Pareil" took about an hour, and the port guardship at Sheerness was then towed back to her moorings. During the docking care had to be taken that both sides of the dock rose equally, and on this occasion all fortunately went well.

The new Algiers floating dock recently successfully lifted the United States battleship "Illinois," of 11,565 tons displacement, and a word may be said here as to the different methods employed for docking vessels in the British and American navies. The American plan is to attach to the bottom of the ship exterior longitudinals or stout side keels. Rows of blocks are placed for these in the dock, as well as the usual blocks for the central keel. The vessel then sits upright on level blocks and requires no shoring except for centering. The British method is to poise the ship on her keel and prop it up by a large number of raking struts and bilge shores. The former plan certainly saves time, and it is stated that the docking keels have no appreciable effect on the speed of the ship with which they are built. Those who are against the American plan argue that as a ship passes very little of her time in dry dock it is better that such a weight should be at rest in one drydock than that hundreds of ships should have to transport the burden all over the world.

In certain quarters there has been, and is perhaps still, a prejudice against floating docks, but the successful docking of the "Sans Pareil" and the "Illinois" in the two new great docks should do much to convince critics that the floating dock is capable of performing any work that may be required of it. It would perhaps surprise many people to hear what an amount of sea these docks can stand. Floating docks have been moored in the open Pacific for a number of years, and we learn that they have succeeded in dealing with vessels in quite a respectable swell. The two floating docks of this type have often been at work in bad weather when the graving docks in the vicinity have been unworkable.

London, Eng.

British Trade.

Notwithstanding the heavy competition which Great Britain is experiencing in the shipbuilding industry, according to the recent issued official statement of navigation and shipbuilding, the United Kingdom is easily holding its own in this ramification of trade. During 1901 775,681 tons of vessels were built in British yards, being an increase of 40,000 tons over the tonnage for the previous year. The total tonnage of British merchant shipping in 1901 was 9,524,496 tons, or 130,000 tons in excess of what it was in 1900. Vessels totaling over 200,000 tons were built for foreign buyers. A very comprehensive estimation of the extent of British shipping may be gathered from the fact that during 1901 more than one-half of the total imports were brought on British vessels, and two-thirds of the exports were carried on vessels flying the English flag.

Wreck of the World's Largest Locomotive.

The huge locomotive recently built for the Santa Fé Railway to haul freight over the Step Raton Mountain Road, was wrecked on July 29. In company with two other engines the giant locomotive was taking a very long train over the mountains. Three times the train broke in two. When the last break came the long train started to back down the steep grade and the giant locomotive was unable to hold it. The brakemen, after having tightened every available brake, were finally compelled to jump for their lives. After a mad downward plunge of three miles the train jumped the rails on a bridge, 50 feet high, near Seymour. The engine and all the cars plunged down the cañon. The engine is the largest freight engine in the world.

The Krupps and the St. Louis Exposition.

News comes from Berlin that the Krupps have refused to exhibit at the St. Louis Exposition because the United States did not purchase the great gun which they sent to Chicago in 1893. Whether any reliance is to be placed upon this piece of information cannot at present be determined. At all events it cannot be denied that since it is against the policy of this country to confer decorations, many exhibitors will have nothing to show for their trouble. It is suggested that Emperor William recognize the best German exhibitors by bestowing orders upon them. No doubt this would overcome a difficulty which may hamper the officials of the exposition.

The Current Supplement.

The current SUPPLEMENT is opened by a well-illustrated article on the French sardine industry. The passage of the Panama Canal Bill has been of interest not only to Americans, but also to Europeans. For that reason a discussion of the canal from the English point of view is timely. An article written from such a point of view will be found in the SUPPLEMENT. Dr. Marcus Benjamin has prepared a digest of the public lectures read at the American Association for the Advancement of Science. "Counterfeiting and Counterfeiting-Protecting" is the title of a paper which tells much that is probably new to the general public. Mr. Howard Crosby Butler writes on the "Sculpture of Northern Central Syria." His paper is illustrated by photographs. Two natural history articles, the one on "The Dragon-Fly's Flight and the Means of Its Accomplishment," and the other on "The Nesting Season of Birds of Prey," are both entertaining and valuable. Just now the claims of rival inventors in the field of wireless telegraphy are attracting much attention in the daily press. Consequently a very exhaustive and very fully illustrated paper on the "Paternity of Wireless Telegraphy" is of rare interest. The miscellaneous notes and consular information will be found in their usual places.

A portable garbage crematory, the invention of Morgan J. Cragin, of Chicago, was recently tested at a New York apartment house. One of the features of the apparatus is the employment of a grate constructed of hollow piping, by means of which it is possible to combine the disposal of the garbage with the heating of water. In this manner it is possible to use garbage as a fuel.

Sir John Aird announces that the last coping stone of the Nile Dam at Assouan was laid on July 30.

Electrical Notes.

It is announced that a company has been formed with a nominal capital of £175,000 for the purpose of operating the Armstrong-Orling system of wireless telegraphy. Factories are to be erected in Buckinghamshire and in France. The step is the outcome of experiments made in Hughenden in the autumn of 1901, when electrical impulses were sent through the ground without wires and without poles. It will be remembered that the SCIENTIFIC AMERICAN described very fully how, during the experiments, a torpedo was moved at will to the right or left by pressing a releasing lever of a small transmitter.

Osmium has the highest melting point of any metal, viz., about 2600 deg. C., and it can, therefore, be used at a higher temperature than carbon in an incandescent lamp, making the efficiency correspondingly higher. The lamp is the invention of Dr. Auer von Welsbach, and the Auer Company, who are making it, will shortly be letting out lamps on hire. Owing to the rarity of osmium, it is found worth while to employ the metal remaining in the filaments after they have burned out. The chief difficulty appears to be the low resistivity of osmium. Owing to this, up to the present lamps of 25, 35 and 50 volts only have been produced, and the smallest candlepower of a 35-volt lamp has so far been 40. The lecturer described experiments made with a 20-volt lamp at different pressures. At 20.5 volts the lamp gave 22 candle power, and required 1.48 watts per candle. At 25 volts the efficiency rose to 0.99 watts per candle and the candle power to 46. At 30 volts the figures were 0.654 watts per candle and 99 candle power; at 35 volts 0.487 watts per candle and 171 candle power; at 40 volts 0.38 watts per candle and 275 candle power; and at 50 volts 0.32 watts per candle and 460 candle power. At this pressure the lamp burned out. A life test was made on another lamp at its normal pressure. This lamp required 1.5 watts per candle at the commencement, dropped gradually to 1.36 and 1.32 watts per candle, and finished at 1.4 watts per candle after 1100 hours. During this time the candle power, which started at 14.8, rose gradually to 16.8 after 250 hours, and then dropped to 15 candle power after 1000 hours' use.

One of the most important substitutions of electric for steam traction in Italy has been carried out by the Mediterranean Railroad Company upon a system of lines starting from Milan. The main branch goes from Milan to Gallarate, 25 miles, and thence start three separate branches which supply the Lago Maggiore region and have their termini at Arona, Laveno and Porte Ceresio, with lengths of 16, 19 and 20 miles. The Milan-Gallarate line passes through a densely populated region and the traffic is constant throughout the year, while the three branches supply the tourist traffic, which is considerable in the summer and autumn. In order to meet the competition of the local tramway lines the company was obliged to change its system. Since the new system was inaugurated last October the passenger traffic has increased 50 per cent. The direct-current system is used for the motors, and the trains have a speed of 50 miles an hour. The energy is supplied by a hydraulic and a steam plant on the Tessin, which generate 3-phase current at 12,000 volts, and this is fed to the line by sub-stations at 650 volts. The third-rail contact system is used. The hydraulic plant, at Tornavento, is under construction. Meanwhile the road is fed from the steam plant. A fall of 25 feet is obtained here by a branch canal, which delivers 140 cubic yards per second, representing 11,000 horse power. The dam upon the Tessin is constructed upon the Poirée movable system, with 179 sections. The canal, which is over 40 feet wide and 12 feet deep, is navigable. The station has eight large turbines, which drive the alternators, and two smaller ones for the exciters. The main turbines generate 1200 horse power and the dynamos 742 kilowatts. The steam plant will be used as a reserve when the hydraulic station is finished; it has eight boilers and three horizontal Corliss engines of 1400 horse power, which drive triphase alternators. The latter give 13,000 volts at 25 reversals. From the station the current is transmitted by two main lines at high tension, and these supply the five sub-stations for the road, where the current is transformed to 420 volts direct current by sets of rotary converters. The third rail, carrying the current, is supported along the road every 12 feet upon earthenware insulators protected by a cast-iron cap which receives the rail flange. The rolling stock consists of 20 motor cars and 20 trailers, of 55 feet length, having two first-class compartments containing 24 passengers, and two third-class containing 39. The cars have a vestibule at each end, in which is also the motorman's cab. The motor cars will hold in all 75 passengers, and the trailers 90; the former have four Thomson-Houston motors per car, which take current from the side rail by four sliding contacts. The express trains make a speed of 55 miles an hour, and the ordinary trains 20. The road started last November with 38 trains per day, but since January 42 trains have been running.

Engineering Notes.

Considerable prominence has lately been given in the press of the world to the fact that not a passenger on the English railroads was killed during the year 1901. It may prove of interest to know that on the Mexican National Narrow Gage Road, from Corpus Christi through Laredo to the city of Mexico, with its branches amounting to more than 1,200 miles of operated road, for more than twenty years no passenger has been killed. This, in the face of the fact that this road climbs more mountains, turns more curves than any road in the United States.

According to Engineering News, a special trolley car for conveying fire engines is in use at Springfield, Mass. The engine is carried on a platform only nine and one-half inches above the top of the rail, mounted on a truck at each end. The front truck is detached and the front end of the platform lowered to the ground when the engine is to be loaded on the car. Platforms over each truck afford space for firemen and equipment. The length of the car over all is 30 feet 10½ inches, and its net weight is 14,000 pounds. The Springfield Fire Department has loaded an engine on one of these cars in two and one-quarter minutes from the time the car was in position to its being ready to start, and has unloaded an engine and attached the horses to it in one and one-quarter minutes.

Most of the roads reaching the recently developed oil fields in the Southwest are actively engaged in making the necessary changes, or have preliminary arrangements under way, whereby oil will be used as locomotive fuel on the equipment operating locally in this territory. There is economy in the use of oil in comparison with coal in this district, where the cost of coal is above and the quality below the average, but just how much is as yet undetermined from reliable information. Conservative estimates, says the Railway Age, place the saving at from 15 to 20 per cent. This reduction is not based on the relative cost of actually producing one horse power by use of coal or oil as fuel, but involves the comparative cost of the handling of both, and it is from this source that the greater proportion of the economy must be looked for, as in some instances the actual cost of the amount of oil used for fuel has exceeded the cost of coal in performing similar service. This may possibly have been due to improper combustion, but it illustrates the fact that care must be taken in the selection of the proper appliances for using oil to effect an economical consumption.

The production of pig iron in the first half of 1902 was 8,808,574 gross tons, against 7,674,613 tons in the same period of 1901 and 8,203,741 tons in the second half of 1901. The production of pig iron in the United States for the first half of 1902 was more than a million tons greater than the production of either Great Britain or Germany during the whole year of 1901, the total production of these countries being 7,761,830 and 7,736,663 gross tons during that period. The production of Bessemer pig iron during the first half of 1902 was 5,105,932 gross tons, against 4,582,187 tons during the same period of 1901. The production of basic pig iron during the first half of 1902 was 1,053,274 gross tons, against 645,105 tons in the same period of 1901. Charcoal pig iron production for the first six months of 1902 was 186-098 gross tons, against 194,231 tons in the same period of 1901. The stocks of pig iron unsold in the hands of manufacturers on June 30, 1902, amounted to 29,861 tons, against 70,647 tons on December 31, 1901, and 372,560 tons on June 30, 1901. The total number of furnaces in blast June 30, 1902, was 286, against 259 at the same period of 1901.

Mr. Charles Rous-Marten recently read a paper before the English Society of Engineers, in which he stated that a large proportion of English locomotives are 20 years old, and that some are even 30 and 40 years old. British locomotives only 20 years old, he remarked, were regarded as comparatively modern. While the longevity of these engines certainly spoke well for the material of which they were built, it could not be denied that they were out of date and unfit for modern railway purposes. The loads of the older engines were limited to five-sixths of that hauled by modern machines; in other words, six engines with six separate trains were required to perform the work of five improved machines on roads already congested. Furthermore, the cost of labor and working expenses were increased. In comparing English with American practice, Mr. Rous-Marten stated that our engines were not expected or even desired to last more than 10 or 15 years at the most, and that they were then displaced by new engines fitted with modern improvements and possessing a large margin of power. Although he deemed the extreme longevity of English locomotives distinctly undesirable, he also questioned the wisdom of using inferior material and workmanship which, it must be confessed, is often characteristic of the American locomotive.

Correspondence.

A Substitute for Coal-Burning Apparatus Wanted.

To the Editor of SCIENTIFIC AMERICAN:

Since the coal strike has promised to interfere with the domestic supply of coal for the winter, I have scanned your columns each week for advertisements of hydrocarbon burners, suitable for ranges and the ordinary house-heating steam boiler, but in vain. Do you not think the present a fine opportunity for manufacturers of the above apparatus, in all the branches thereof, to push the sale of such articles? And, doubtless, many who could successfully use oil for fuel would not return to coal. In my house, a frame dwelling in a nearby Jersey town, I have a range connected to a hot-water tank, water-back or boiler, etc., and a cast iron "pot" form of steam boiler supplying eleven radiators. As prudence in trying a new burning agent would dictate, beginning early to investigate the subject, I appeal to you to help me to get in touch with manufacturers of oil burners for ranges and small steam heating plants.

F. T. CAMP,
Asst. to Supts. Construction L. S. S.
New York City, July 31, 1902.

Gravitation as a Cause of Volcanic Action.

To the Editor of SCIENTIFIC AMERICAN:

In relation to the action of the sun and moon on intensifying volcanic disturbances, it seems quite possible that a volcano on the point of eruption would be more liable to burst forth with the combined action or gravitational pull of the sun and moon acting in conjunction on a part of the earth that stood square before the sun. The action, if any, must be due to the gravitational pull or tidal effect on the liquid interior of the earth.

The electrical disturbances being of a secondary nature, no doubt caused by the heat from the volcano, the planetary influence or their positions are insignificant as compared with the attraction of the sun and moon. With the possible exception of the planet Venus its gravitational pull, although slight, if added to that of the sun and moon while in conjunction might be the means of opening one of nature's safety valves. As for comparison pass a large magnet over the safety valve of a steam boiler that is on the point of blowing off and note the effect.

On referring to the almanac we find the sun and moon May 7 in conjunction almost directly overhead of the island of Martinique, and allowing a few hours tidal lag of the liquid interior we find the greatest effect at about the time Mont Pelée blew up. Similar conditions are again due on the 3d of August. And if the pressure has not been greatly reduced by the last eruption we may look for increased activity at about that date.

A. H. BARBER.
Watertown, N. Y.

The Telephone as a Surgical Instrument.

According to a London medical journal, several London hospital surgeons are now using the telephone, whenever they have occasion to probe for bullets, or other metallic objects embedded in the body of a person. The receiver of the telephone is placed on the head of the operator, and the patient is placed in the usual manner, in contact with a plate; the general medium employed being a wet sponge or some paper saturated with a saline solution, which is spread over the plate. The latter is connected with a telephone by wire, and the probe after it has been introduced into the body vibrates as soon as the foreign metallic substance comes in contact with it. The probe is also connected with the telephone by a wire, and thus no such blunder is possible as sometimes happens when an ordinary battery is used. When a telephone is used in this way, the plate acts as one pole and the probe as the other. Needles, bullets, grains of shot, and pieces of steel and copper have been easily located by use of this simple method. The only instances when the telephone does not work satisfactorily are when the objects to be located are of the same metal as the probe. French and German surgeons have been following these experiments in London, with the intention of introducing the same method into the hospitals of Berlin and Paris.

Abandonment of the Oiled Roadbed.

After having oiled their roadbed for three years for the purpose of preventing dust, the Boston & Albany road has decided to abandon the practice. The oil-soaked sand and fine cinders have been removed and in their place broken stone is now used. The reason for the change is to be found in the bitter complaints which have been received by the railway company. A particle of the oil-laden sand sticks to whatever it strikes. Women have protested against the spattering of oily dirt. That oil is certainly a most effective dust-preventer was graphically shown some time ago in the columns of the SCIENTIFIC AMERICAN by the comparative illustrations of oiled and unoiled roadbeds.

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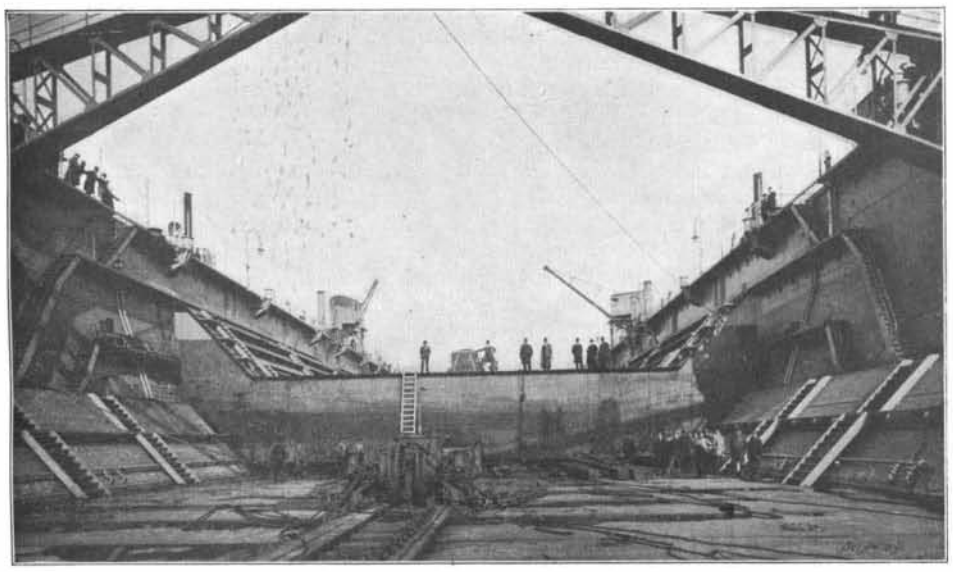
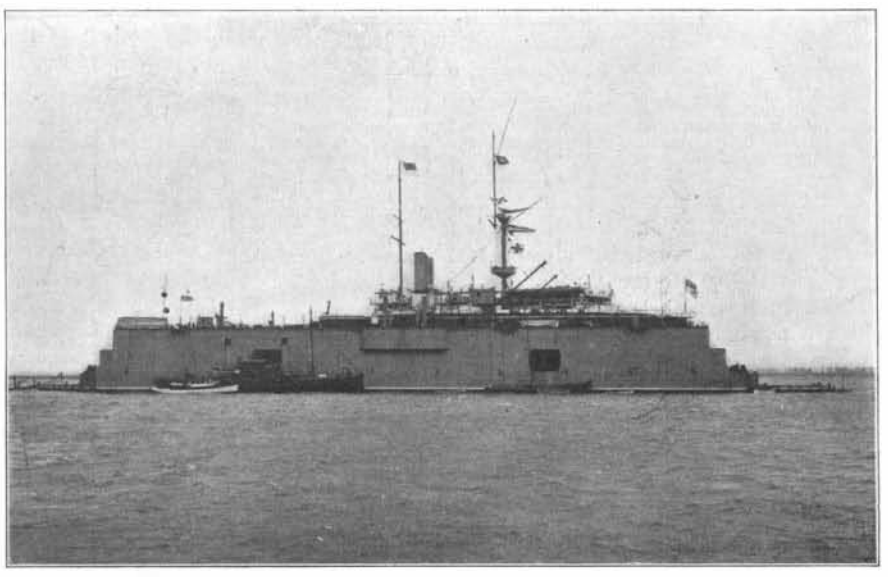
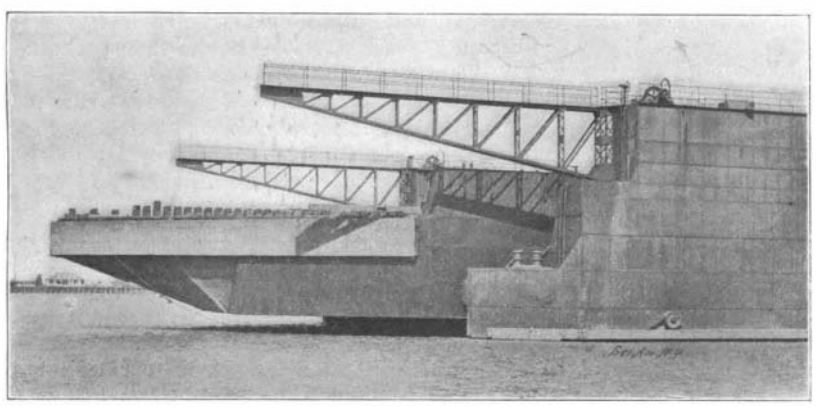


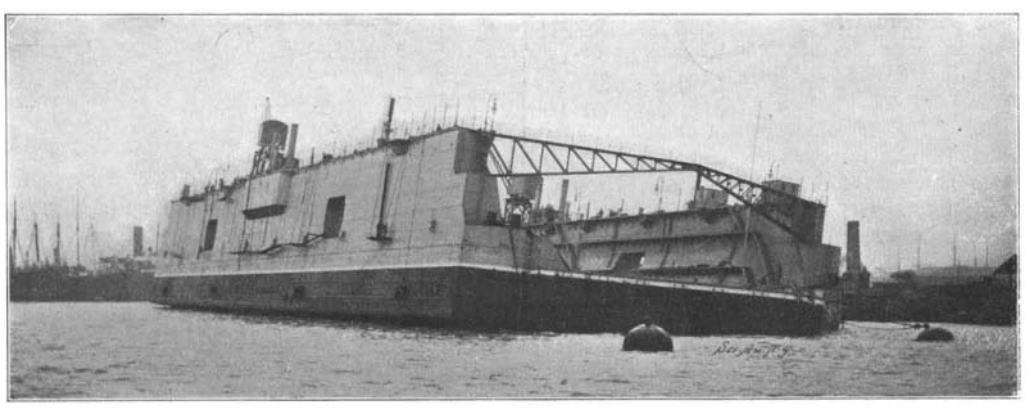
The Center Pontoon of the Bermuda Dock Raised for Painting.



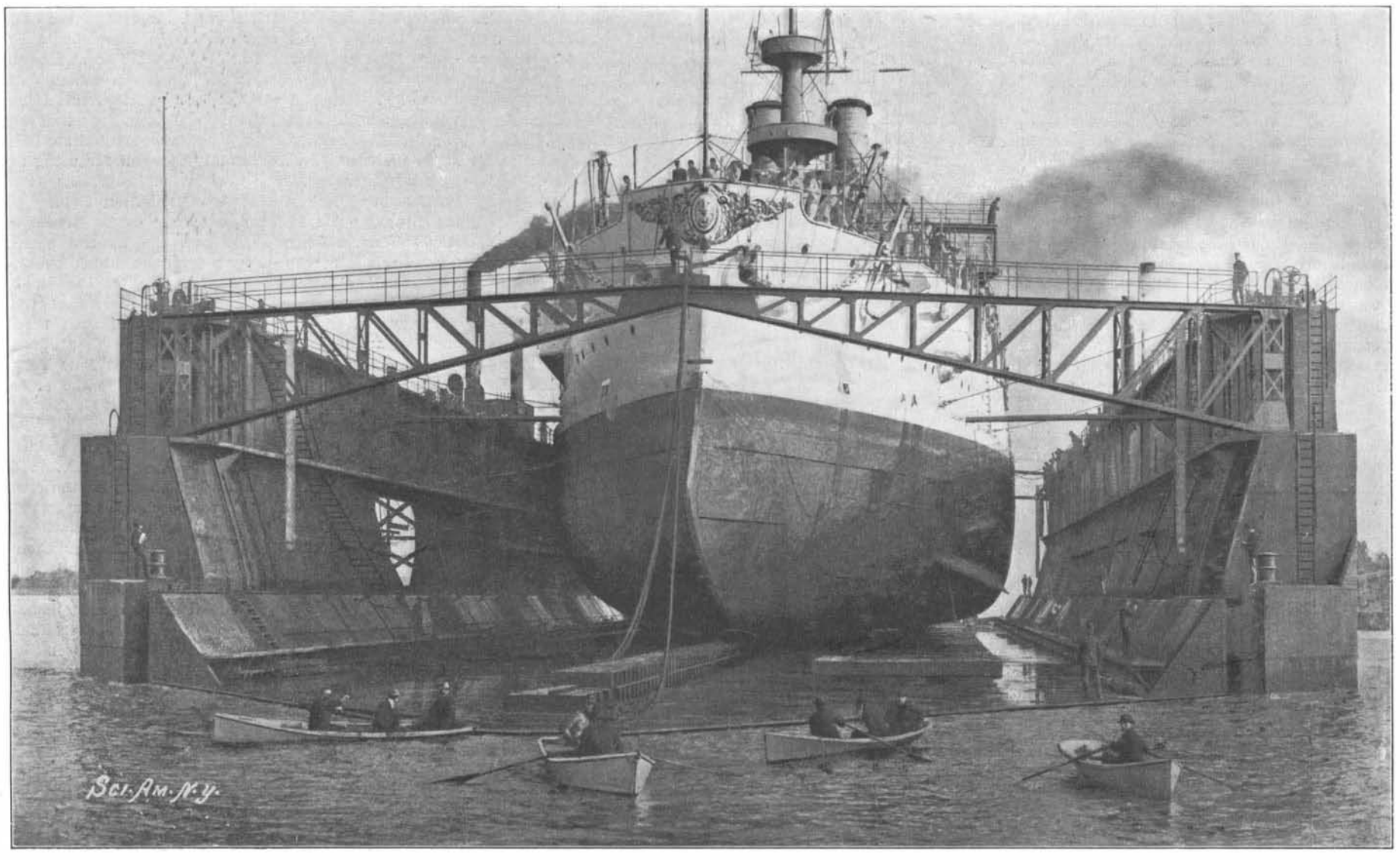
H. M. S. "Sans Pareil" (10,470 Tons) Lifted by the Bermuda Dock.



The Algiers Floating Dock, with Foot-Bridges Opened and End Pontoon Raised.



The Great Bermuda Dock Careened for Painting and Repair.



The "Illinois" in the New Floating Drydock at Algiers, La.

THE GREAT FLOATING DOCKS OF BERMUDA AND ALGIERS, LA.—[See page 88.]