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THE NEW UNITED STATES CRUISERS.

Of the four cruisers now being built for the government, one, the Atlanta, was described and illustrated in the SCIENTIFIC AMERICAN of November 17, 1883; the Boston is identical in every respect to the Atlanta. In regard to size these two vessels are between the Dolphin and Chicago, which are described and illustrated in the present issue.

U. S. DISPATCH BOAT DOLPHIN.

The governing condition in the design of the Dolphin has been high speed capable of being maintained for several days. It is intended for a dispatch boat for furnishing rapid communication from the seat of government to any point on the coast, or to act as fleet dispatch boat if a United States squadron should need its services. In designing it all attempt at protection was abandoned, and machinery of the most durable and efficient type adopted.

The principal features of the Dolphin, represented in the engraving upon this page, are:

Length between perpendiculars.....	240 feet.
Length, extreme.....	256.5 "
Breadth, moulded.....	31.85 "
Breadth, extreme.....	32 "
Depth from top of floors to top of main deck beams.....	18.25 "
Depth from base line to top of main deck beams.....	20.07 "
Top of main deck at side above load water line.....	6.28 "
Mean draught.....	14.25 "
Displacement at mean draught.....	1,485 tons.
Complement of men.....	80
Battery—One 6-inch pivot, four revolving cannon.	
Indicated horse power.....	2,300
Speed.....	15 knots.
Capacity of coal bunkers.....	310 tons.

It will have a flush open spar deck, with no poop cabin or forecabin. Near the cabin gangway will be a small central deck house, and, with the exception of another around the boiler and engine hatches, the deck will be uninter-

rupted fore and aft. The armament will consist of one 6-inch B. L. R. mounted upon a shifting pivot forward of the fire bridge, and four 47 mm. Hotchkiss revolving cannons, mounted at the end of each bridge in fixed armored towers. It will have a three masted schooner rig with small and light spars and no head gear. The plan shows that the structural arrangements will be similar to those of merchant vessels, except that care has been taken to divide the hull into six water-tight compartments by transverse bulkheads extending to the upper deck. Greater longitudinal strength than usual has been provided for. The bow will be strong and slightly ram-shaped. It will have a steam steering engine, will be lighted by electricity, and will have electric search lights and head lights. The ventilation will be as perfect as it is possible to make it.

A two cylinder compound vertical direct acting engine of 2,300 indicated horse power will actuate the single screw. There will be one high pressure cylinder 42 inches in diameter and one low pressure 78 inches in diameter, the stroke being 48 inches. The cylinders are to be placed immediately over the crank shaft, each being supported by two wrought iron columns secured to the bed plate of the engine, and by two cast iron brackets attached to the condenser and also forming the cross head guides. The valves and levers for working and regulating the engines will be operated from the starboard side of a gallery running around the engines on a level with the berth deck. An upper gallery will be on a level with the spar deck. The propeller will have four adjustable blades 14 feet 3 inches in diameter with a mean pitch of 21 feet 4 inches.

Cylindrical boilers will be used with a pressure of 100 pounds per square inch above the atmosphere. The grate surface will aggregate 270 square feet, and the heating surface 6,600 square feet. They will have internal cylindrical furnaces and horizontal fire tubes returning above the fur-

naces. There will be two single end boilers having a length of 9 feet 6 inches and a diameter of 11 feet, and each furnished with two furnaces. There will also be two double end boilers with a length of 18 feet 3 inches, and a diameter of 11 feet, each having four furnaces. The longitudinal axes of the boilers will be placed in a fore and aft direction, the single end boilers aft facing the double end, the fire room between them being 9 feet 6 inches. At the other end of the double end boilers will be a fire space 9 feet long. The fire room hatches and other openings can be closed airtight.

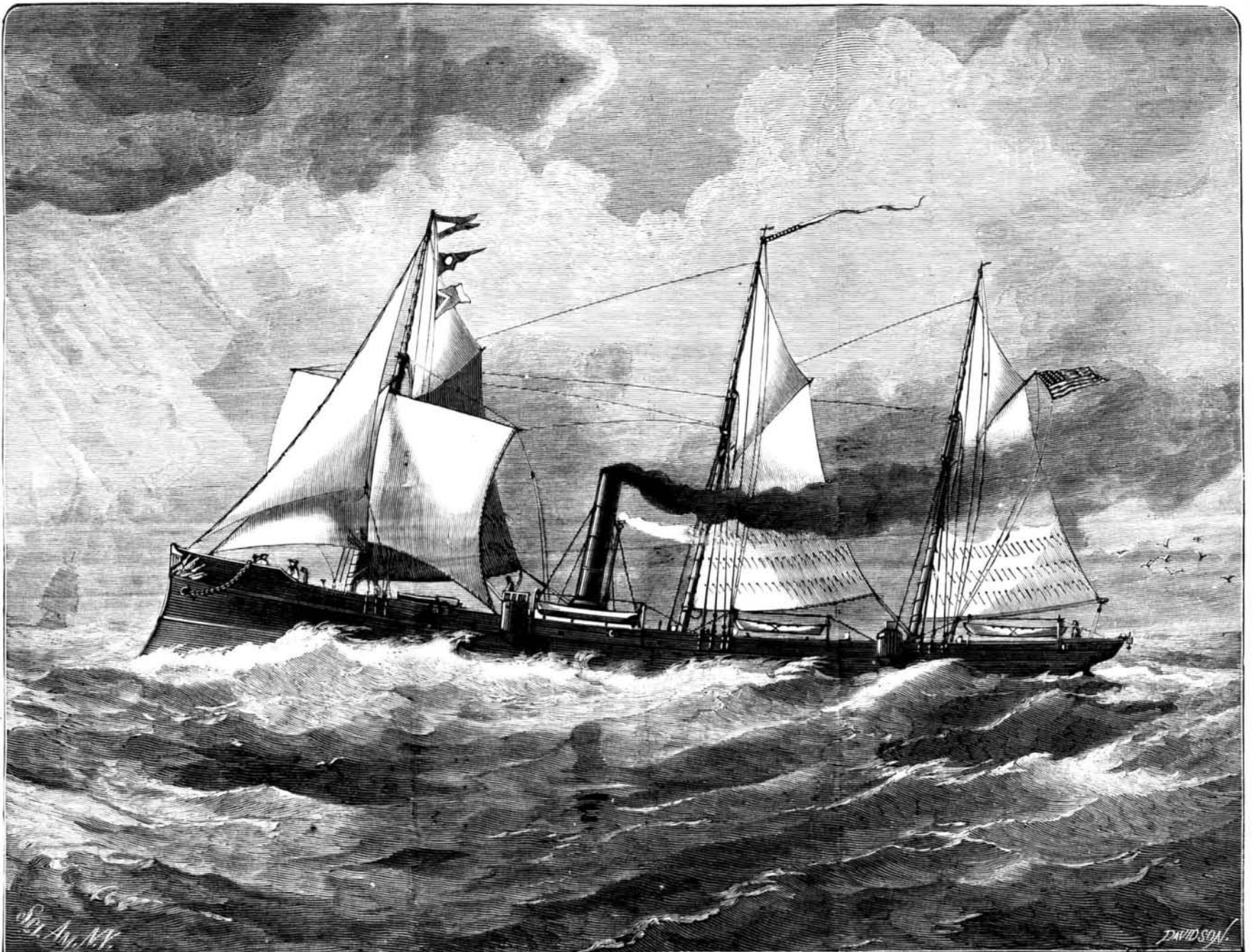
The contract price for the hull, machinery, and fittings of the Dolphin, exclusive of the masts, spars, rigging, sails, boats, etc., was \$315,000.

U. S. TWIN SCREW STEAM CRUISER CHICAGO.

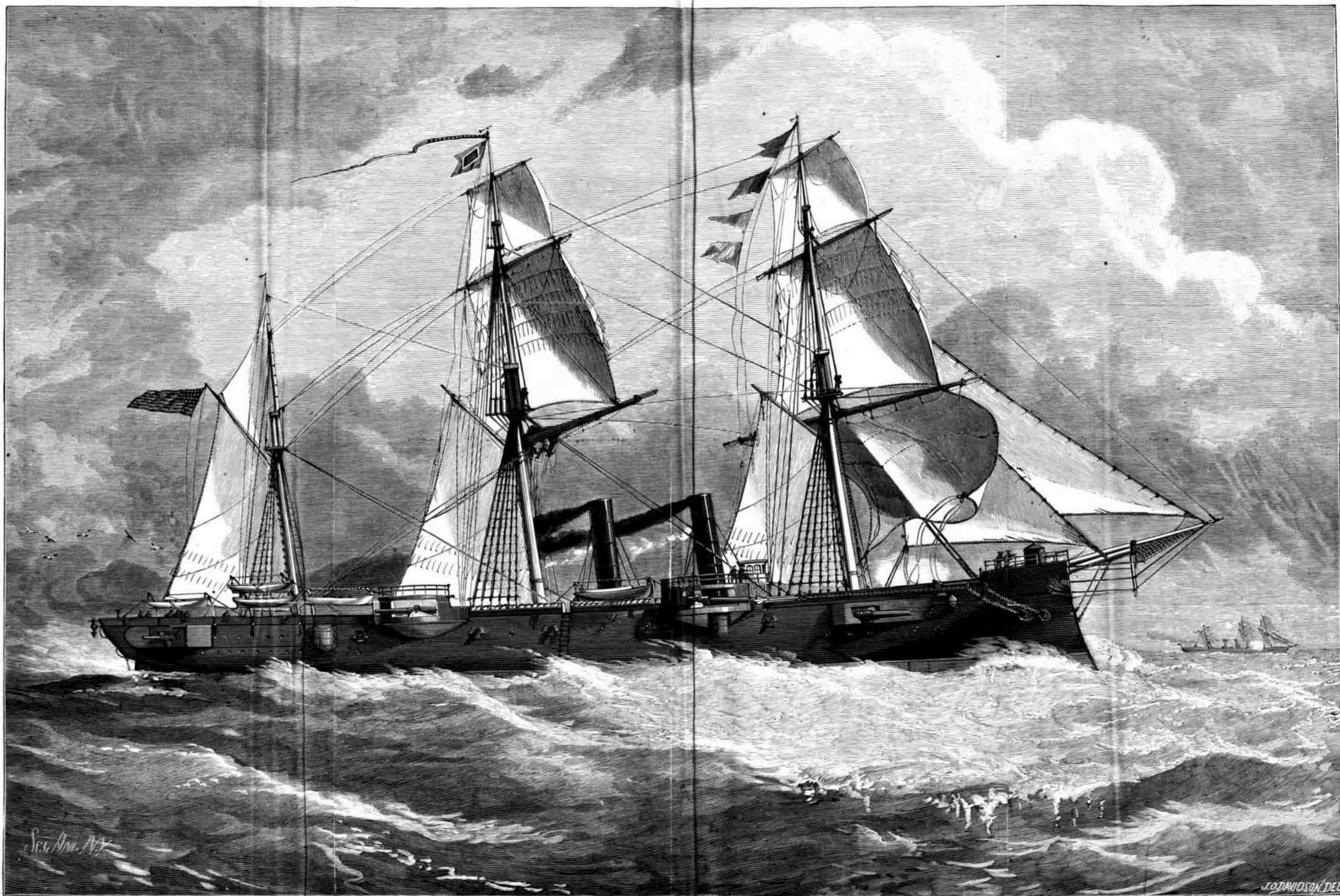
Length between perpendiculars.....	315 ft.
Length on water line.....	325 ft.
Length over all.....	334 ft. 4 in.
Depth, garboard strake to under side of spar deck.....	34 ft. 9 in.
Height of gun deck port sill from load water line.....	10 ft.
Height of spar deck port sill from load water line.....	18 ft. 6 in.
Breadth, extreme.....	48 ft. 2½ in.
Draught of water at load line, mean.....	19 ft.
Displacement.....	4,500 tons.
Area of plain sail.....	14,880 sq. ft.
Complement of men.....	300
Battery, four 8-inch long breech loaders in half turrets, eight 6-inch and two 5-inch on gun deck.	
Indicated horse power.....	5,000
Sea speed.....	14 knots.
Capacity of coal bunkers.....	940 tons.

This vessel, represented in the engraving on page 390, will be built throughout of mild steel, with no wood sheathing. It will be divided into ten water-tight compartments by nine transverse bulkheads extending to the gun deck. The boilers and machinery are to be in the four amidship com-

(Continued on page 391.)



THE NEW UNITED STATES CRUISERS.—THE DISPATCH BOAT DOLPHIN.



THE NEW UNITED STATES WAR STEAMER CHICAGO

THE NEW UNITED STATES CRUISERS.

(Continued from first page.)

partments having a length of 136 feet. This space will have a double bottom $3\frac{1}{2}$ feet deep, divided into fourteen watertight cells. A steel deck $1\frac{1}{2}$ inches thick will cover the machinery.

These compartments will be divided on each side by vertical longitudinal bulkheads, and the space between them and the sides of the boat will be filled with coal. From the water line to 8 feet above it this coal armor will be 9 feet thick, and aft will have a thickness of 5 feet from the water line to 14 feet below it. When the doors are shut, the coal bunkers and the pockets in the boiler rooms form thirty-four watertight compartments. The deck covering the machinery compartments will afford protection by preventing the access of shot and water to the main compartments, but it is not expected to resist a 6-inch shot even at inclinations of from six to eight degrees; entering shot would in all likelihood explode in the coal without doing injury to the machinery.

The magazine rooms will be in the hold amidships, before and abaft the machinery space. The deck above them will be covered by a protecting plating three-quarters of an inch thick. All hatches through it are to have watertight covers, and coffer dams reaching to the berth deck will surround the magazine hatches. Other divisions in the hold by bulkheads of steel and the shaft alley bulkheads, together with those already noted, divide the vessel into eighty-five watertight compartments.

A system of drainage has been adopted by which the combined power of the steam and circulating pumps, having a capacity of 2,500 tons per hour, can be concentrated on any main compartment. In addition to this there will be six continuous acting hand pumps on the berth deck, having independent suction to each main compartment, and each compartment of the double bottom; they deliver either directly overboard or into the fire main, which will extend about three-fourths of the length of the vessel amidships on the berth deck, with stand pipes to gun and spar decks.

The outside plating of the vessel will be nine-sixteenths of an inch thick, will weigh twenty-three pounds per square foot, and there will be a double plate at the water line from the stem to within 70 feet of the stern. The stem and stern posts are to be of hammered steel. The watertight inner bottom will be plating 10 and $12\frac{1}{2}$ pounds per foot. The berth deck will have a protective plating over the engine and boilers for 136 feet. The bow of the vessel will be strengthened for ramming.

The rudder and steering gear will be below water line. A fighting hand wheel and steam steering engine will be placed on the watertight flat, to which communication can be had by telegraph from the bridges. In addition there will be a hand steering wheel on the spar deck and a steam steering wheel in the pilot house.

The vessel will be bark rigged, with an area of plain sail of 14,880 square feet. The coal bunker capacity will be 940 tons, while 300 tons additional can be stored away on the berth deck. This will enable the Chicago to steam 3,000 miles at 15 knots, or 6,000 miles at 10 or 11 knots per hour. The vessel will be ventilated by an exhaust system.

There will be twin screws operated by two pairs of two cylinder compound overhead beam engines, each of which will be placed in a separate watertight compartment 22 feet long, and inclosed by a deck for protection. The high and low pressure cylinders will be situated side by side, are vertical, 8 feet apart, and 2 feet 1 inch and 3 feet 5 inches respectively from the midship line. The diameters of the cylinders will be 45 and 78 inches, and the stroke 52 inches. Each cylinder will be steam jacketed, and fitted with two double ported main slide valves, actuated by eccentrics through arms and rock shafts, each furnished with a steam cylinder and piston to balance the weight of the valves. The cut-off valves will be adjustable between the limits of one-eighth and five-eighths of the stroke. The exhaust steam

from the high pressure cylinder will pass directly to the low pressure steam chests; suitable pipes will exhaust the steam into the condenser and atmosphere. The condensers will be furnished with tinned brass tubes having a cooling surface of 5,000 square feet each. Beside each condenser will be placed an independent, double-acting, combined air and circulating pump. Worked from the crosshead of each pump piston will be two double-acting feed pumps 5 inches in diameter.

There will be fourteen horizontal return tubular boilers, constructed of steel, and capable of carrying a pressure of 100 pounds. They will be placed in two separate watertight compartments. The fire rooms will run fore and aft, and will be 10 feet wide. Each boiler will be 9 feet in external diameter and 9 feet 10 inches in length on the bottom, and will be set inclining from front to back, over a single furnace. Each furnace will have about $57\frac{1}{2}$ square feet of grate surface, or an aggregate of 802 square feet in all the boilers. The shells will be five-eighths of an inch thick, and the heads three-quarters and five-eighths. The tubes will be lap-welded iron. In each smoke pipe, concentric with it, there will be a steam drum 9 feet in diameter and 9 feet long, with a shell seven-eighths of an inch thick; this will have eight 18-inch and four 15-inch lap-welded

THE BERNISSART IGUANODONS.

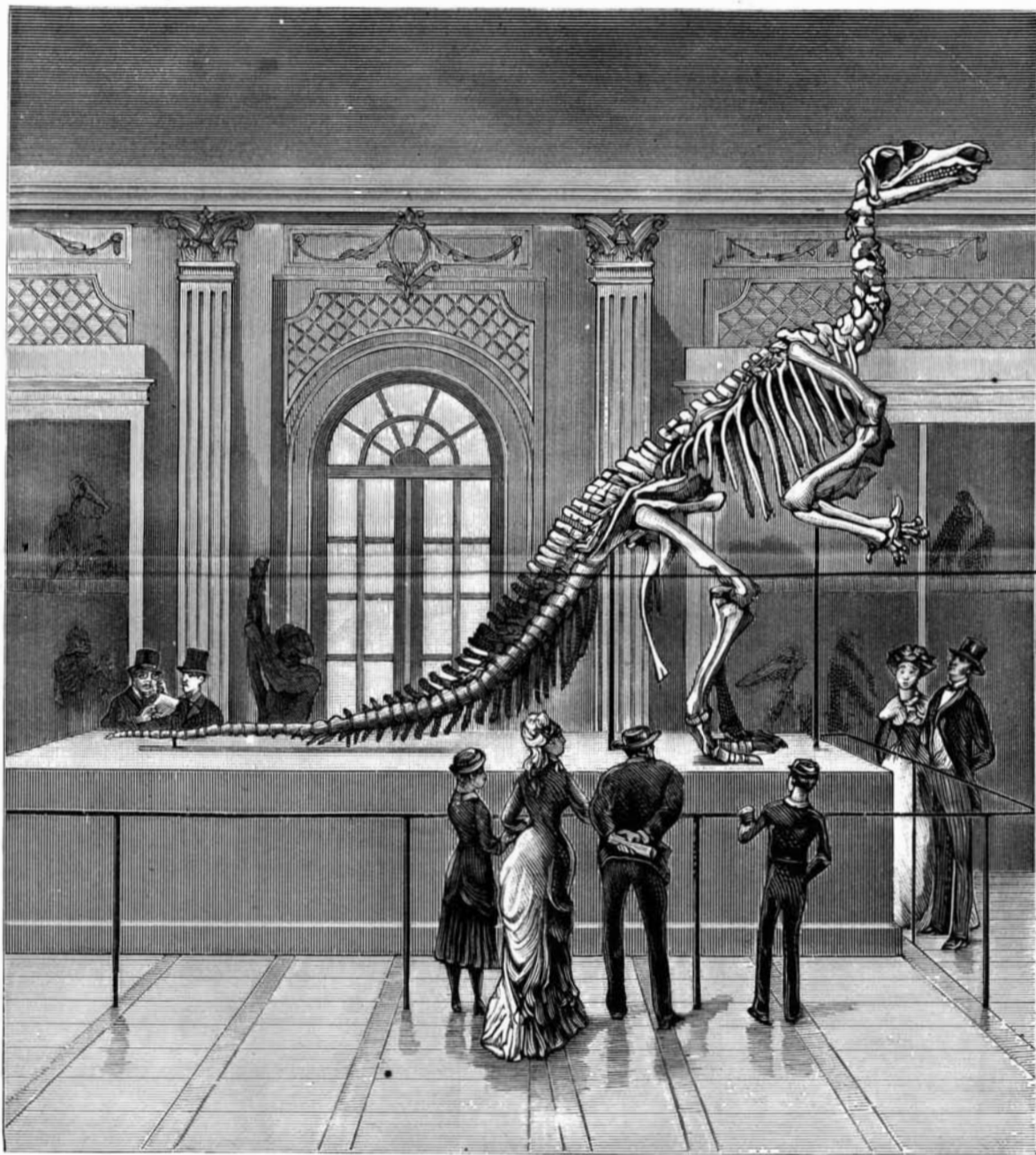
The animal whose skeleton is represented in our engraving is, at a first glance, surprising by reason of its colossal size and its resemblance to the giant kangaroo. Like the latter, it has an enormous tail, very long hind legs, and very short fore ones. It seems as if it ought to be placed near that marsupial; but paleontologists, rightly setting aside all vulgar ideas, make it out a reptile. A reptile! A biped like man and like birds, capable of seizing his aggressor between his arms! It must be avowed that reptiles have changed much during the long route that they have traversed since geological times up to our own.

Surely, had any one in former times had any idea in regard to paleontology, and had any one suspected the existence of these forms so carefully preserved in the terrestrial crust, and so different from those of to-day, naturalists would have perhaps been embarrassed, but they most certainly would not have given the name of crawling animals to the interesting class in which are arranged, among others, the *Iguanodon*, a walking animal, the *Pterodactyl*, provided with wings, and the *Ichthyosaurus*, a swimmer which could only live in the bosom of the sea. And, what is worthy of remark, in secondary times, when these surprising beings were in their glory, reptiles seemed to outline, in a vague and colossal

way, the principal types of those vertebrates which were destined to reign over the world, each in his time—the fish, the bird, and the mammal.

Two years ago, I myself saw iguanodons in the course of preparation at the Brussels Museum. The bones of two individuals of these sufficed to fill a very large hall. One of them measured 10 meters in length, and the other 14. They had been found in 1878 at Bernissart, a locality situated between Mons and Tournai, very famous for its coal mines. It must not be thought, however, that these reptiles belonged to the coal epoch, for their remains lie buried in the *Lower Cretaceous* (Wealden), known by miners as "dead lands," and which must be traversed to a depth of 300 to 400 meters before coal is reached.

Mr. Fages saw the first bones, Mr. Van Beneden determined the species, and Mr. Depauw, superintendent of the museum workshops, took upon himself the difficult task of working this rich vein of fossils. For this purpose he adopted the life of a miner and pursued his labors for three years at a depth varying from 322 to 356 meters. He was fortunate enough to exhume twenty-two iguanodons, fifteen of which are now mounted. He attained this result by inventing ingenious processes of solidifying the bones, which, being im-



THE GREAT IGUANODON AT THE BRUSSELS MUSEUM.

pregnated with pyrites, would otherwise have crumbled away upon contact with the air.

The following are, according to Mr. Dollo, who has made a very profound study of the *Iguanodon Bernissartensis*, a few details in regard to the structure of the gigantic reptile. It belongs to the sub-class of Dinosaurians and to the order Ornithopoda. The individual described by the learned Belgian is 9.5 m. from the end of the nose to the extremity of the tail, and, when standing upright upon its hind legs, rises 4.36 m. above the level of the earth. Its head is relatively small, and much compressed in the direction of the bilateral diameter. The nostrils are spacious, and apparently partitioned in their anterior region. The orbits are of medium size, and are elongated in the direction of the vertical. The temporal fossa is limited above and beneath by a bony arc—an arrangement that is no longer met with except in a single lizard of our own time (*Hatteria*). As in our present reptiles, the teeth, ninety-two in number, replaced one another indefinitely; that is to say, as soon as one was worn out another succeeded it.

The neck is moderately long, and contains ten vertebrae, each of which, excepting the first, bears a pair of small ribs. It must have been very flexible. The trunk consists of 24 vertebrae strongly united by ossified ligaments. The vertebrae, 1 to 17, each bears a pair of strong ribs. The six last

flues passing through it. The fire rooms will be air-tight, and each will be provided with two large blowers.

The battery of the Chicago will consist of four 8-inch high-powered breech loaders, weighing 12 tons each, mounted on the flush spar deck in projecting half turrets, the center of the trunnions being $20\frac{1}{4}$ feet above water. The turrets will be unarmored and the men will be protected only by shields on the guns. Six 6-inch B. L. R., weighing 4 tons each, will be mounted broadside on the gun deck, which will also be arranged for two additional 6-inch guns if found desirable. One 6-inch will be mounted in a recessed gun deck port on each bow. Two 5-inch guns will be placed in recessed ports abaft the captain's cabin. The 8-inch projectile weighs 250 pounds; the 6-inch 100 pounds, and the 5-inch 60 pounds. In addition there will be four 47 mm. and two 37 mm. Hotchkiss revolving cannons, mounted in fixed bullet proof towers.

The contract price for the hull and fittings of the Chicago, exclusive of the masts, spars, rigging, sails, etc., is \$889,000.

EXPERTS in chemistry have estimated that the cost of London's winter smoke and fog is \$25,000,000 annually; that is to say, constituents of coal to this value escape unconsumed, and assist in forming the sooty vapor.