IRON AND STEEL IN LARGE BUILDINGS.

Out first page picture affords a vivid representation of the manner in which large, high buildings, in all the principal cities, are now erected. The contrast it presents to the old method of building, with wooden posts, beams, joists and stringers, the structure all supported by the walls, is very great. The revolution in building construction which this change represents may be said to have commenced about 1850. In 1845 Peter Cooper erected the largest rolling mill at that time in the United States, for making railroad iron, and at this mill he was the first, soon afterward, to roll wrought iron beams for fireproof buildings. In the building of the Cooper Institute in New York City, in 1857, he was the first to employ such beams with brick arches to support the floors, in a large structure designed to be fireproof. In this building, however, as in all similar structures up to a very recent period, the walls were depended upon to furnish the principal support of the several floors and give the necessary strength and stability to the building. Such dependence upon the walls alone has been found to be increasingly difficult and vastly more expensive with every addition to the height of the building; and where it was necessary to make the walls, at the first story, four or five feet or more thick, as has often been the case in eight or nine story buildings, a large proportion of the most valuable room was thus taken up. The modern method of building obviates this difficulty, and enables the architect to put up structures twenty or more stories high having every desired element of strength and stability, but with the walls forming only a mere shell inclosing the building, and in no way depended upon for its support. This is accomplished by making a good foundation for each of the iron columns of the interior, the weight of the structure in all its parts being carefully figured out, with due allowance for the uses to which the building is to be put, and the several foundations for interior pillars, columns, and piers being prepared in accordance with the manner in which the weight and strains of the completed building will be distributed. In this way of building the walls are only intended to support their own weight, serving such purposes of ornamentation or embellishment as may be sought, the openings for the admission of light and air to the interior being largely increased, or, as has been followed in some cases, the exterior may be formed almost entirely of glass.

The building in course of construction shown on our first page gives a good idea of this modern method of putting up great business and office edifices. It is the H. C. Brown Palace Hotel in Denver, Col., designed to be ready for occupancy this summer. It is triangular in ground plan, the measurements on the three sides being 230, 231 and 326 feet respectively, and the corners of the triangle being rounded. It is nine stories high, with a basement 18 feet deep extending to the outer limits of the sidewalk, while the highest part of the cornice is 131 feet above the sidewalk. The building is of the Italian renaissance style, and Messrs. F. E. Edbrooke & Co., the architects, have personally superintended the construction in all particulars, the work requiring nearly three years. It is said that the drawings required nearly two tons of paper.

The first story is of Platte Cañon pink granite up to the second story sills, all facing above being of Arizona brownstone. There is a series of arches in the seventh story spanning 12 feet between piers, and under the arches is a very rich carved cornice 3 feet high extending entirely around the building. The cornice is moulded with dentils and carving, forming a very beautiful and dignified finish. Over the main entrance is a series of projecting bays supported by cantilever beams. The entrances are spanned with elliptical arches beautifully carved throughout. The entire building is well decorated with relief carving costing about $40,000.

The backing of the walls from the second to the fourth floors is extra-hard flagstone from the vicinity of Fort Collins, Col. Above the fourth floor the walls are backed with pressed brick, manufactured at Golden, Col. The piers in the basement under the granite piers are built of dimension flagstone, 16 inches thick. These piers are 5 by 6 feet, with flagstone footings and concrete bed. The concrete was made of Denver Portland cement, which has proved where it has been unearthed to be very hard and satisfactory in every respect. The granite piers in the first story are 4 feet square, battered 6 inches on the face. The piers from the second to the fourth floors are 3 feet 4 inches by 8 feet. The piers above the fourth floor are 3 feet by 8 feet. There are over 100,000 cubic feet of masonry in the building exclusive of the fire-proofing.

The construction of the interior is upon cast iron columns and steel beams arranged to receive the tile arches. The general spacing of columns is between 20 and 21 feet apart. The principal floor beams are 12 inches deep, and the cross girders are 15 inches deep.

There is an interior court fifty-six feet square in the center of the building. On the first floor under this open court is the hotel lobby. At the third floor is a 27 inch box girder for the purpose of carrying a solid wall to the top of the building in case it should be desired, in which case there will be a skylight at the third floor closing over this court. At present, however, the building will be finished with the entire court separated from the upper corridors only by a four-foot bronze-plated railing.

The court is covered with a flat ceiling of stained glass and plated iron ribs suspended at the ninth floor. Above this is a skylight covering the entire court supported by steel trusses. The kitchen and grand dining rooms are on the eighth floor. The main grand dining room is 110 feet by 36 feet. The ladies ordinary is 80 feet by 36 feet. These dining rooms have 18 foot ceilings, spanned by 24 inch steel beams and box girders.

The false ceilings under the roof are constructed with T irons suspended from roof, filled in with fireproofing. The roof is constructed of I beams and T irons filled in with fireproofing. The total amount of iron and steel used in the construction of the building is over 2,500 tons. The first and second stories of iron were constructed by the Colorado Iron Works, and the remainder was constructed by the Lane Bridge and Iron Works. The fireproofing comprises all floors, arches, concreting, and all partitions. The arches are about 6 foot span, except in some cases, which are as great as 8 feet. The depth of the arch used is 10 inches. There is 4½ inches of concrete and cement above the floor arch. The finished floor is unglazed tile throughout the building, except in the chambers, where it is cement. The partitions are all built of 4 inch tile except the partitions around the grand dining rooms and the penthouses on the roof, which are 6 inch tile. All tile partitions exposed to the weather are plastered with a heavy coat of cement, blocked off to imitate stone. All inside partitions are plastered with Acme cement.

The total amount of fireproof tile and concrete used in the building is over 350,000 cubic feet.

In the building there are six hydraulic elevators, four Corliss engines, four boilers, six dynamos, 90,000 feet of electric light wire, 4,200 incandescent lights and 88 arc lights, five electric motors, seven ventilating fans, a large steam laundry, an ice manufacturing plant, two bakeries, a crematory, 160 tile mantels, 142 bath and toilet rooms, in which there are 13 car loads of plumbing fixtures, and 75,000 lb. of ornamental iron copper-bronze plated.

All the wood finish throughout the building is hard wood. The stairways are marble. The wainscoting and finish in the rotunda, all corridors, the cafe, the grand dining rooms, and the grand drawing rooms are real oynx.

There are 318 chambers above the first floor, all opening on the street fronts, with not less than two windows each; there are 18 large stores on the first floor besides all necessary room for the hotel, cafe, bar, private offices, etc. The cost of the building is $1,250,000.

The New Gunboat Castine.

This latest addition to our new navy, launched at Bath, Me., May 11, is a twin vessel to the Machias, built at the same place, and illustrated in the SCIENTIFIC AMERICAN of December 19 last. The launch was in every way a great success and witnessed by numerous officials and a vast number of people. Work upon the vessel was begun in 1890, and it is expected she will be completed in November next. She is a twin screw steel gunboat of 1,050 tons displacement. She measures 190 ft. in length and has a beam of 32 ft. When coaled and provisioned for sea, she will have a mean draught of 12 feet. She is 160 tons larger than the Petrel, the first of this class which was launched, and her tonnage exceeds that of the recently completed practice cruiser Bancroft by 212 tons. Her twin screws are revolved by vertical triple expansion engines inclosed in a water-tight compartment. She is expected to show an indicated horse power of 1,600, and to develop a speed of 14 knots an hour. Her radius of action at 10 knots speed is 4,668, and 2,452 miles at her maximum speed. She will carry a crew of 150 men. The Castine will mount a very effective battery for a vessel of her class. The main armament will comprise eight four-inch rapid-firing guns. The secondary battery will consist of two 47 mm. revolving cannon, two 37 mm. revolving cannon, one one-pounder rapid-fire, and one Gatling.

In several respects the Castine and her sister ship will be peculiarly well adapted for service in Asiatic and South American waters. Their slight draught will enable them to ascend the rivers where vessels of deeper draught could not navigate. Their batteries are heavy enough for any service they are likely to be called upon to perform, and the effectiveness of the four-inch gun on its rapid-fire mount has been recently demonstrated by the Bureau of Ordnance trials. The rig of the Castine will be that of a two-masted schooner with a square sail on the fore. She will spread 6,506 ft. of canvas, which will be sufficient to enable her to make her way to port should her machinery be disabled at sea.

Correspondence.

Permanence of Water in a Bored Well.

To the Editor of the Scientific American:

A manufacturing concern using about 10,000 gallons of water a day have bored a well on their plant 115 feet deep and have struck nice, clear, and suitable water, drawn up by a pump and a 100 foot plunger, 2 inch pipe. The water rises 2½ to 3 feet above the ground without the pump. Sometimes, when starting in the morning, the water is cloudy, but soon clear again. There can be pumped 8,000 gallons in ten hours now. The concern has been getting water from a river about one third of a mile distant, but wishes to be independent of it, as the pipes, ground, and pump station are not their property. Is there any chance of this water giving out, or what are the prospects for permanency in depending upon this well; and can you advise anything to increase or protect the flow? A reservoir to hold about 200,000 gallons of water is contemplated to be built.

We are situated about 80 to 90 feet above Lake Michigan, about 10 miles west of it, and one-half mile west of the Desplaines River. Our well is 115 feet deep, the soil is clay to about within 3 feet of the water, then follows 1 foot of cemented gravel, then 18 inches of very coarse gravel, in which we found the water, and below the water cemented gravel again. The well has a steady, natural flow of about 800 gallons in 24 hours.

In the meantime we have followed your advice of increasing and utilizing all possible pumping facilities, and are well supplied with plenty of water at present.

P. K.

[The indications as described are most favorable for a large and permanent supply of water to the extent of your pumping capacity. The only possible obstruction that could occur will be from gravel coming into the pipe, which can be soon cleared by the boring tools. We have no record of failure from an artesian well drawing its water from a coarse gravel bed under a thick clay bed. The gravel bed in which your well terminates probably outcrops to the north and west, toward the Wisconsin line, and where the country is somewhat higher than at your place. Your well seems to be in a geological water basin, that is shut off from Lake Michigan by the outcrop of the Silurian limestone between the lake shore and the Desplaines River, having its drainage to the south through the Desplaines River, and deriving its water supply from the ridge land to the north and west.—EDITOR.]

A New Steel Bridge Over the Mississippi.

ON the 12th of May a great steel bridge over the Mississippi River, at Memphis, was formally opened for traffic, amid appropriate festivities and with not a little public rejoicing. It was built by the Kansas City, Memphis & Birmingham Railroad Co. It is situated on the spot where Ferdinand De Soto crossed the Mississippi in 1541, and in excavating for the shore pier on the Tennessee side some Spanish halberds, supposed to have been used by him, were found. The bridge is the third largest of its kind in the world. Active work upon it began in the fall of 1888, when the first caissons were sunk. There are five spans and six piers, including the anchorage pier. The east shore, or cantilever, span is 225·83 ft.; the main span, consisting of two cantilever arms and one intermediate span, is 794·42 ft.; one continuous span, 621·06 ft.; one deck span, 338·75 ft. The total length of the bridge is 2,597·12 ft. The structure is extended west of the main bridge by an iron viaduct 2,500 ft. in length, followed by a 3,100 ft. timber trestle, and nearly a mile of embankment to a junction with the existing track of the Kansas City, Fort Scott & Memphis Railroad, a few hundred feet west of Sibley, Ark. The river piers are sunk to depths varying from 75 to 131 ft. below high-water mark. All were sunk by the pneumatic caisson process, and are of masonry from the caissons to the bridge seats. The material of the main bridge is steel. The main posts are 80 ft. high and weigh 28 tons. Many of the pieces weigh 10, 12, and 16 tons. The main pin of the cantilever truss is 14 in. in diameter, and weighs 2,200 pounds.

A Railway Ferry Across Lake Michigan.

The bold idea of ferrying loaded freight cars across Lake Michigan is soon to be put into practice. A large propeller is under construction at Toledo which will have a capacity of 21 cars, and it is expected to tow a barge carrying 15 cars, making 36 cars, or more than an average freight train. The cost of transferring grain and other freight from cars to steamer and from steamer to cars forms a very heavy item of cost which the proposed plan, if successful, will save. Lake Michigan, however, is a treacherous water and considerable risk will be involved in ferrying cars across it, especially in winter when ice abounds. The new boats are to ply between Frankfort, on the Michigan shore, and Kewaunee, on the Wisconsin shore, a distance of 52 miles, connecting the Toledo, Ann Arbor & North-ern with the Green Bay, Winona & St. Paul Railway. —*Railway Age.*