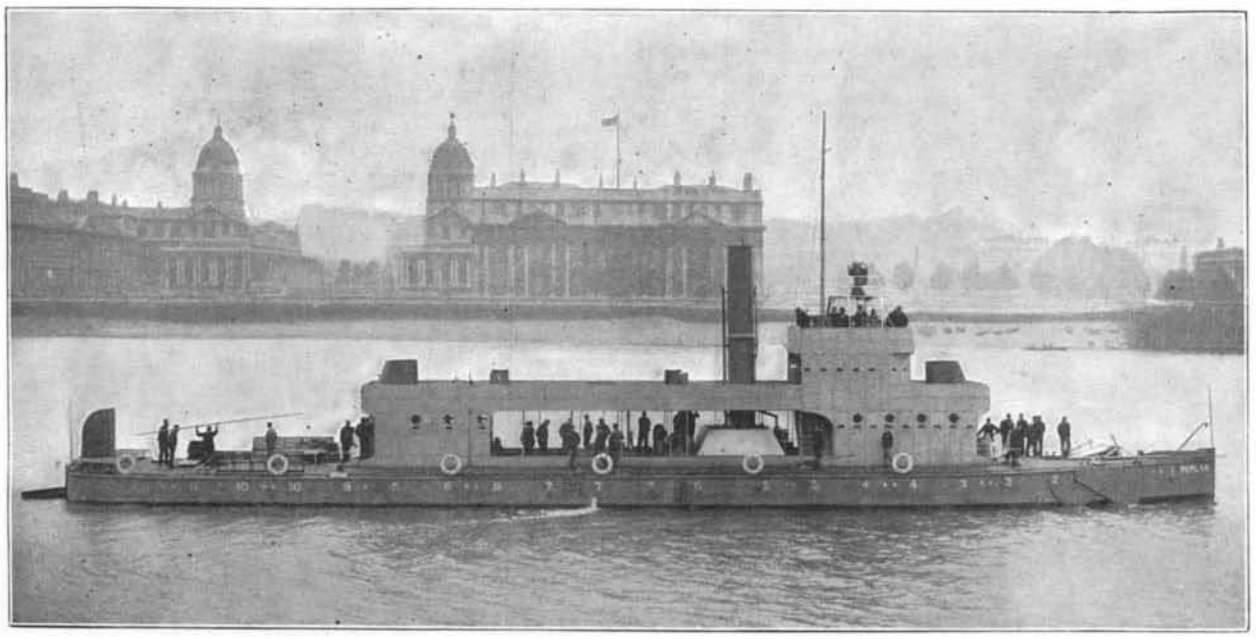
that it offers exceptional advantages for going astern, or what is the same thing, stopping headway; in fact, on the trial it was found that from full speed ahead to a state of rest the vessel would only travel about two lengths. This power of going astern is of the utmost value when navigating rivers which are shallow, the beds of which are continually changing, because on going down stream it is clearly necessary, on approaching a shallow, to stop the progress of the vessel as quickly as possible.

The superstructure, which forms the fighting and inhabited part, is well shown in the illustration. A distinctive feature about these boats is the fitting of leeboards in the fore part, the object of which is to take the place of "deadwood," which is necessarily absent in a flat-bottomed craft drawing only two feet of water. These leeboards perform exactly the same function as leeboards do in a Thames barge by offering lateral resistance, which prevents the vessel blowing off to leeward. Light high-sided vessels are extremely difficult to handle when there is a side wind; and it is to render them easily handled and maneuvered when a side wind is blowing that these leeboards are required. It may be added, however, that the steering when going ahead is so rapid that leeboards under these conditions need not be used; it is only when going astern that they are required. The steering is arranged by means of three rudders worked by steam steering gear.



LIGHT DRAUGHT GUNBOAT FOR THE NILE MILITARY EXPEDITION.

The superstructure consists of two deck houses as shown. These are connected by a flying bridge, 38 feet long by 13 feet wide, while above this is a bridge deck, 14 feet long by 13 feet wide, and above this again is a platform on which is fixed a search light. The deck houses and the central portion of the vessel are made of chrome steel, and the parts surrounding the boiler and engine are of such a thickness as to be proof against the Lee-Metford bullets at 20 yards point blank. The bulwarks of the flying deck also are of the same material, and it will be seen that the cabin sides are loopholed for rifle fire.

The armament consists of two 12 pounder quick firing guns, placed at each end of the flying deck, the bulwarks being hinged so as to fold down at the ends to form an extension of the platform when the guns are brought into use. On the flying deck also are four automatic Maxim guns, two on each side. Four similar guns are placed in the upper battery or bridge deck, and these are 21 feet above waterline, at which level it is anticipated that these guns will have perfect range over the banks on each side of the Nile.

It is worthy of remark that the arrangement of propellers adopted by Messrs. Yarrow & Company offers a considerable advantage in the fact that the screws can be taken off and replaced while the vessel is afloat. This is effected by means of a movable cover, which is placed on the top of the tunnel, immediately over the propeller itself. By opening this the water in the tunnel at once falls to the general water level surrounding the vessel, and the screw is, consequently, more than half out of the water. The propellers are not likely to get damaged, because they do not work below the bottom of the boat, and are surrounded on all sides by the hull itself. At the same time, it is an immense advantage, if they do get damaged or fouled by any means, that they can be at once got at. As a matter of fact, on a trial made specially to test the time occupied in removing the propeller and replacing it by another, it was found that it could be readily done in eight minutes.

The name of the vessel is now the "Sultan," but she was originally known as the "Poplar." She has already been sent out to the Nile and is probably by this time half-way between Cairo and Abu Hammed, where she is to be put together. A second vessel of the same type is on the point of being dispatched from England, and her erection, it is contemplated, will follow immediately after that of the "Sultan." It may be added that these vessels are calculated to be able to carry, on an emergency, 1,000 troops. There is little doubt that before long we shall hear of the part that these vessels will play in the operations on the Upper Nile in the expedition against the Madhi.

MOUNTAIN FREIGHT LOCOMOTIVE FOR THE MEXICAN CENTRAL RAILWAY.

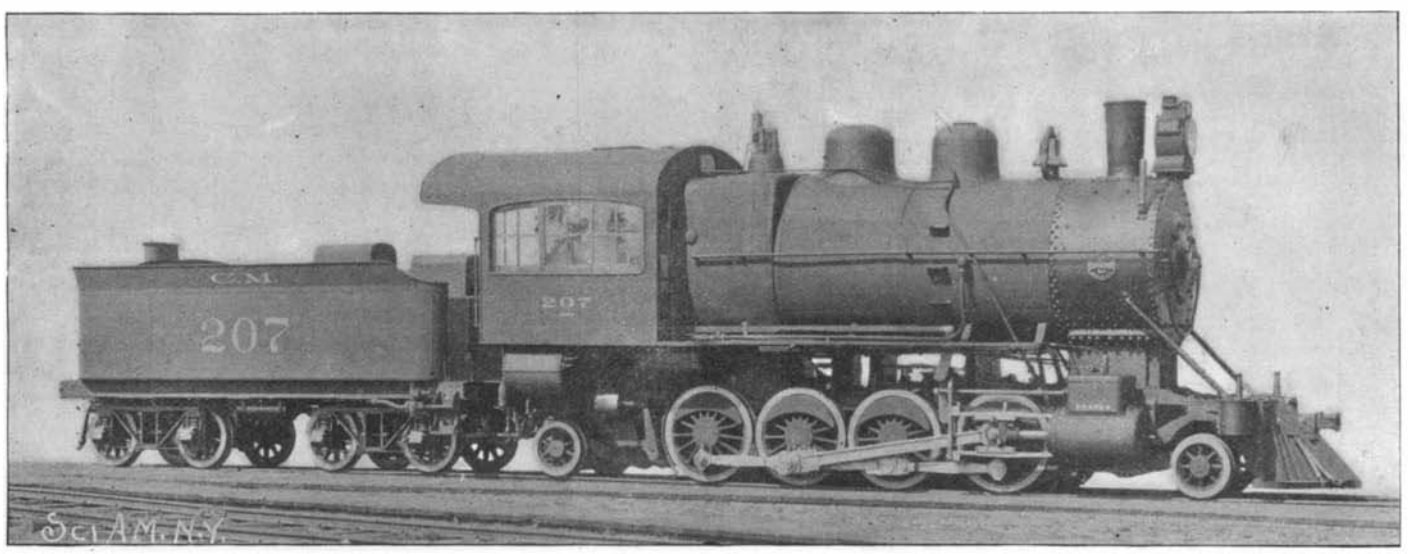
The accompanying engraving represents the latest and in some respects the largest of those enormous freight locomotives which are being turned out in increasing numbers by American locomotive builders. The tendency in all branches of industry toward concentration, not merely in the vast manufacturing establishments, but in the objects of manufacture themselves, is very marked. In the great field of transportation we see it exemplified in such enormous ships as the Pennsylvania, the Kaiser Wilhelm, and the Oceanic, shortly to be launched, and on land the same tendency is seen in such powerful machines as the mountain locomotives of the Northern Pacific, recently illustrated in this journal, and in the locomotive which forms the subject of this article. The economy of these engines, whose hauling power is fully double that of the locomotives of fifteen or twenty years ago, lies in the fact that they will haul double the amount of freight with the same train crew, besides encumbering the too often overtaxed freight lines less than would two separate trains. Moreover, now that roadbed, rails, and bridges have been brought up to such a high state of efficiency, there is no more wear and tear of the road than there was in the days of lighter rolling stock.

The engine was designed by Mr. F. W. Johnstone, superintendent of motive power on the Mexican Central Railroad, and has just been completed by the Brooks Locomotive Works, of Dunkirk, N. Y. It is of course exceeded in power and size by the great Johnstone double bogie compounds built in 1892 for the same road, but as these were practically two locomotives combined in one, they constitute a class by themselves. The total weight of the engine in working order is 193,450 pounds. Of this, 145,200 pounds is on the drivers, 23,450 pounds on the front truck and 24,800 pounds on the rear truck. The engine measures 36 feet 6¾ inches over all, and the total length of tender and engine over all is 61 feet 4¼ inches. The boiler is of the Belpaire type and carries a steam pressure of 180 pounds to the square inch. The firebox, which is carried above the frames, is of steel; it measures 3 feet 2½ inches in width by 10 feet 1 inch in length, and the grate area is 31·45 square feet. In diameter the boiler is probably the largest ever carried by a locomotive, the first course measuring 78 inches and the smokebox 81 inches. It contains 412 two inch tubes whose aggregate heating surface is 2,585 square feet. This added to the 218 square feet of surface in the firebox gives a total of 2,803 square feet for the boiler.

The cab and the running boards are of steel, the former being of an exceptionally neat design, with large side windows. Special attention has been given to the internal fittings of the cab, with a view to placing them conveniently within reach of the engineer and fireman.

The cylinder cock lever is just in front of the engineer, near the floor, while the brake valve and air signal whistle are attached to the right side of the cab. The reversing lever is to the left, and just above it, on the boiler, are the levers which operate the sand box, whistle and throttle valve. A whistle lever is also mounted on the fireman's side of the cab. The steam and air gages face the engineer, while the fireman's steam gage is at the center of the boiler head.

The cylinders are 21 inches diameter by 26 inches stroke, and the driving wheels are 49 inches in diameter. The rigid wheel base is 13 feet and the engine wheel base 28 feet. The shortness of the rigid base was necessary to enable the engine to travel round the many sharp curves of the mountain roads, several of which are as high as 18°. It is expected that it will haul a train of 210 tons weight up a 3 per cent grade 30 miles in length, and it is on this grade that the 18° curves occur. When we bear in mind that the total weight of train and engine will be 355 tons, it will be realized that this will be a great performance.



POWERFUL MOUNTAIN FREIGHT LOCOMOTIVE FOR THE MEXICAN CENTRAL RAILROAD.

Cylinders, 21 in. diameter by 26 in. stroke; heating surface, 2,803 sq. ft.; steam pressure, 180 pounds; weight, 193,450 pounds.

A NEW PACIFIC STEAMSHIP COMPANY.—The States Steamship Company was chartered under the laws of the State of New Jersey, November 11, with $7,000,000 capital and Charles H. Cramp as president. The company acquires from the International Navigation Company five steamers—Pennsylvania, Ohio, Indiana, Illinois and Conemaugh. They will place them in service between Seattle and Alaskan ports. The Ohio will sail from Philadelphia for Pacific ports. The steamers are due at Seattle by March 1.

BEAUTIFUL black chalk is obtained by mixing ordinary chalk with a suitable quantity of a decoction of logwood to which either green vitriol solution or chromate of potassium is added. By means of either of these substances logwood extract becomes black. The chalk is intimately incorporated with this black solution and from the doughy mass pencils are formed, which are ready for use after drying.