REINFORCED CONCRETE FOR SHIPS.*

IT is sometimes supposed that the idea of using reinforced concrete for the construction of ships and other floating structures is a novelty. This, however, is a mistake, for the first application of the material in this way dates from a period when the building of steel ships had not even been begun.

The first reinforced vessel was in the form of a small boat built in 1849 by a Frenchman named Lambot, at Miravel, and the boat is still in service after a practical test of 68 years. It was inspected in 1850 by the French government, but, as too often happens when government officials are concerned, the further development of the idea was left to private enterprise. Towards the end of last century, the possibilities of reinforced concrete for all kinds of structural work began to be more widely recognized, and the material was applied to the construction of vessels of various classes in different parts of the world.

Some Early Examples.

One of the first examples was a floating chalet supported by a reinforced concrete pontoon, measuring 67 ft. long by 21 ft. wide, built in Rome during the year 1897. Another interesting example built in the succeeding year was a schooner employed for some years in the North Atlantic coasting trade, the serviceability of this form of construction having been practically demonstrated by the fact that the vessel escaped without injury after having been driven on the rocks near Cape Charles. One of the first reinforced concrete barges in Europe was completed early in the present century from the designs of M. Hennebique, of Paris, on the River Lozere, where it has since been in continuous operation for dredging purposes. The vessel measures 50 ft. long by 13 ft. wide by 3 ft. 4 ins. deep, and it is recorded that the initial cost was much less than that of a timber or steel structure of the same dimensions, while the practical absence of maintenance charges has added very considerably to the ultimate economy effected.

Other barges, lighters and pontoons followed in fairly rapid succession, the firm of Gabellini, of Rome, having been particularly enterprising in the new branch of work. By the end of 1912 they had constructed at least 20 vessels of the lighter class and over 60 pontoons for floating bridges. Included in the former category were several large lighters for the Italian government and a steam collier, these and all other vessels of the same class having been constructed with double hulls and watertight compartments. In Germany, reinforced concrete vessels of the motor launch and barge types have been constructed, among the latter being a barge 130 ft. long by 20 ft. beam, said to have been built at a cost of 25 per cent. less than that of a steel barge. In North and South America a good many barges and pontoons have been constructed in reinforced concrete during the last ten years. Typical examples are furnished by a barge at Ontario, 81 ft. long by 24 ft. beam by 7 ft. deep; a fleet of lighters, 100 ft. long by 30 ft. beam, built at San Francisco for the coasting trade; several lighters and pontoons on the Panama Canal; and some scows 112 ft. long by 28 ft. beam built at Fairfield.

Comparatively little has been done in Great Britain towards the development of reinforced concrete shipbuilding up to the present date, with the exception of a lighter constructed in 1910 on the Mouchel-Hennebique system for the Manchester Ship Canal Company. This vessel carries machinery and coal representing a load of some 200 tons, and contains chambers for the reception of large quantities of sludge dredged from the canal. It is 100 ft. long by 28 ft. wide by 13 ft. deep, and draws 5 ft. 6 ins. of water when fully loaded. The skin of the hull is 3 ins. thick, and the lighter is constructed in several watertight compartments. Some activity in the development of barge and shipbuilding has been reported from Norway, where several barges have recently been built, and it is stated that a reinforced concrete steamship of 3,000 tons is now in hand. Last month it was stated in a Copenhagen paper that the first Danish building yard for reinforced concrete vessels is almost complete, and that two barges, of 80 tons and 43 tons respectively, are expected to be launched this summer.

Future Possibilities.

It is evident from the examples cited that reinforced concrete has earned a definite claim to be regarded as a real shipbuilding material, particularly for vessels of moderate size. Whether it will prove equally suitable for the construction of large steamships, including ocean liners and warships, is a question that can be answered only by the results of future experience. In the meantime the material possesses obvious advantages for the building of many useful types of craft. Among its recommendations are simplicity and rapidity of construction, the readiness with which repairs can be executed, high resistance to strain and shock, incombustibility and fire-resistance, relatively low cost, and the virtual elimination of maintenance charges. Experience appears to show that the skin-resistance of a reinforced concrete vessel to passage through water is slight, owing to the smoothness of the surface and the absence of joints, and the ease with which scraping can be effected.

Thanks to the elastic strength of the material, reinforced concrete lends itself to the most modern developments in shipbuilding design, and although the skin of the hull must necessarily be thicker than when steel plates are used, it need scarcely be thicker than would be the case if timber were employed. Assuming 3 ins. to be the thickness adopted the weight per square foot would be less than that of steel 1 in. thick. Therefore, the question of deadweight does not appear to constitute a very serious objection, especially in view of the fact that the weight of the hull of a vessel is small in comparison with the weight of equipment, fittings and cargo.

A Torpedo Testing Station.

Turning now from ships, barges and pontoons, attention will be drawn to some other types of floating structures in which reinforced concrete can be employed with advantage. The most interesting example of the caisson class is furnished by the "Batterie des Maures," a torpedo-testing station built for the firm of Schneider, of Le Creusot. At present forming a kind of artificial island in the Mediterranean, this structure was built partly in a dry dock belonging to the Forges et Chantiers de la Mediteranee, and completed at moorings outside the dock. The battery was then towed by a couple of steam tugs for a distance of some 30 miles through the sea and sunk upon a prepared bed in deep water.

The lower part of the Batterie des Maures is a caisson, above which rises a superstructure of two stories surmounted by a spacious deck. The caisson is 50 ft. high by 77 ft. long by 45 ft. wide at the base, and 65 ft. long by 35 ft. wide at the top, the outer walls being 6 ins. thick, and the interior partition walls 4 ins. thick. The superstructure rises about 20 ft. above the top of the

*From the London Times.