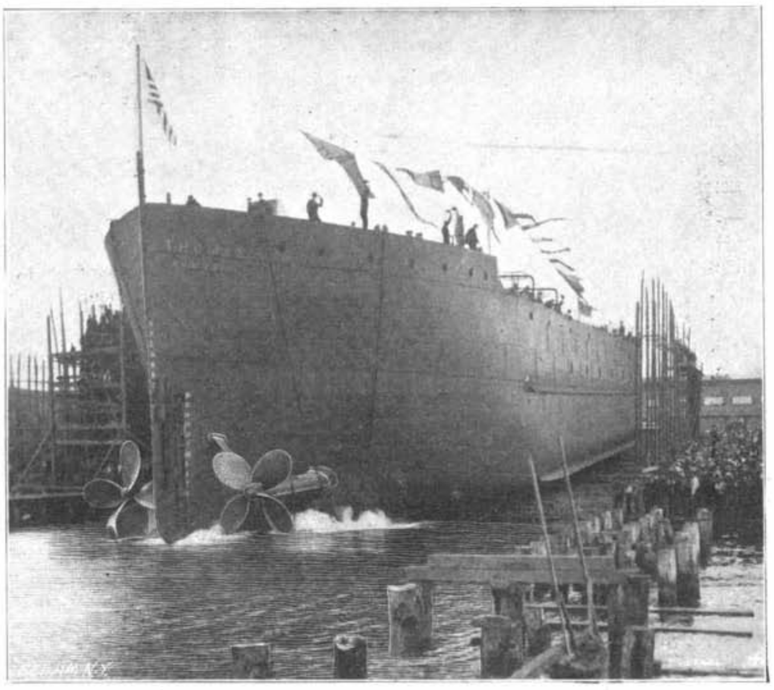
drums of a boiler were blown through the side of the boiler house and landed uninjured on the outside of the building. The accompanying illustrations were prepared from photographs secured through the courtesy of the Hartford Steam Boiler Inspection and Insurance Company, of Hartford, Conn.

DREDGES FOR THE NEW 40-FOOT CHANNELS OF NEW YORK HARBOR.

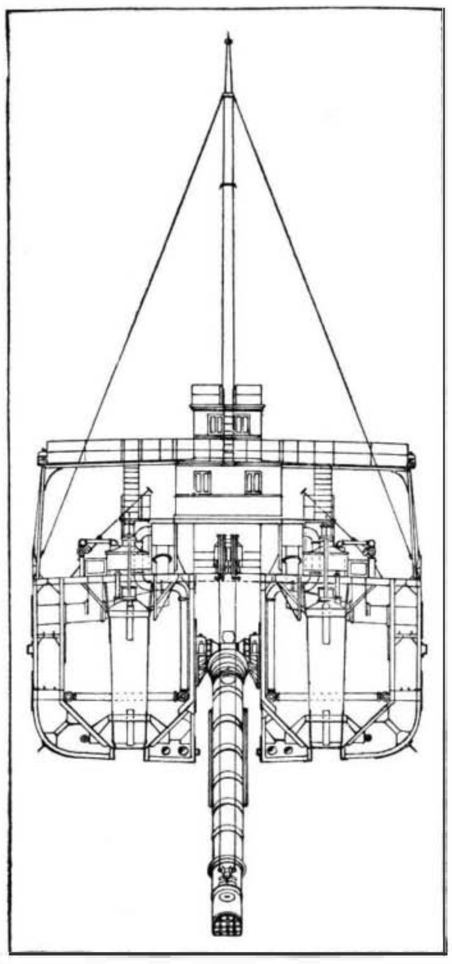
The rapid increase which has taken place of recent years in the size and draught of ocean steamers has necessitated considerable deepening of the channels both in the approach to New York harbor and in the harbor itself. According to statements emanating from the steamship companies in this cty, the largest of the modern freighters have left New York harbor drawing on more than one occasion from 30 to 31 feet of water, and there is now in service one steamship, the "Oceanic," which was designed to draw at full load 35 feet of water, this extreme draught being adopted in the expectation that the New York harbor channels would shortly be deepened.

The scheme of improvement which has received the sanction of Congress contemplates cutting a channel from the 40-foot line, 3 miles outside of Sandy Hook, to a junction with the present main ship channel at a point off the southwesterly end of Coney Island, a distance of 7 miles, and also the dredging of three channels, to be known as Bay Ridge, the Red Hook and the Buttermilk channels, which will extend along the Brooklyn shore from near the northerly entrance to the Narrows to and around Governor's Island until a junction is made with the 40-foot line from the East River to the Hudson River. In the accompanying sketch these new channels are shown in shaoing. The new channel at the entrance to the harbor will be 40 feet in depth at mean low water and 2,000 feet wide. Bay Ridge, Red Hook and Buttermilk channels are also to be 40 feet deep at mean low water, and each will have a width of 1,200 feet.

The most important waterway, of course, is the entrance channel which will be cut from the 40-foot contour line outside Sandy Hook, across the bar, and will extend in a straight line for 4 miles, to finally swing in to a junction with the deep natural channel through the Narrows. The amount of excavation necessary to complete this great work, which by a recent Act of Congress is to be known as Ambrose Channel, is estimated at 39,020,000 cubic yards, measured in place. The Ambrose Channel will take the place of the present main ship channel, which runs in a general southerly direction from the Narrows to a point opposite Sandy Hook Point, when it takes a sharp turn of over 90 degrees to the east and runs out in a fairly straight line to deep water. This turn has always been a hindrance to navigation, especially since ocean-going steamships have increased to lengths of from 600 to 700 feet. By the Ambrose Channel, as will be seen from the map, shipping can steam from the North River to the deep sea without having to make any turn that necessitates such extreme caution as must be observed in



LAUNCH OF THE DREDGE "THOMAS."



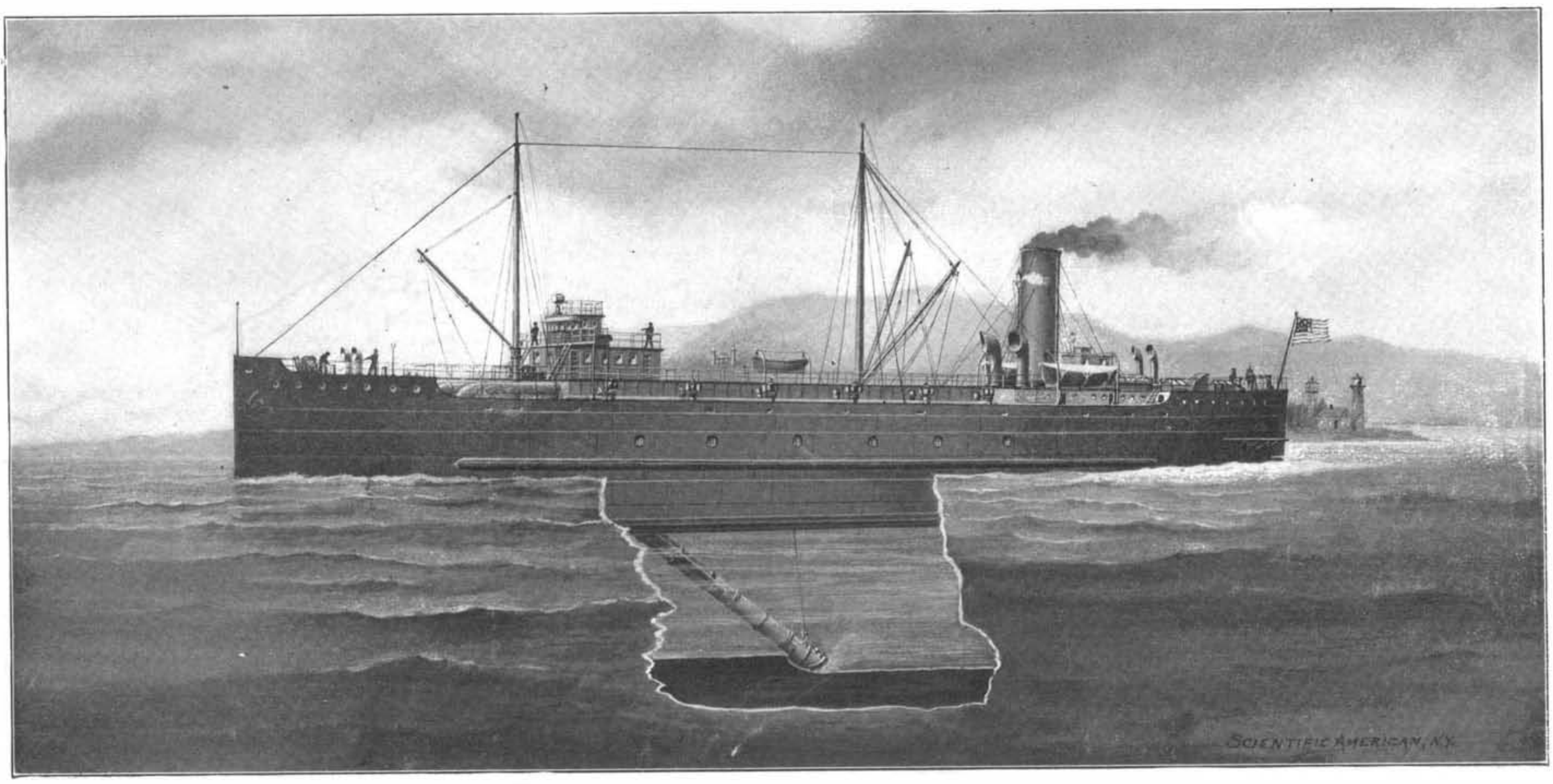
SECTION THROUGH HOPPERS.

navigating the present waterway. The dredging that is to be done along the Brooklyn shore will necessitate taking out 16,400,000 cubic yards measured in place, and when the work is completed the whole of this important waterfront, with the wharves, elevators, and warehouses, adjacent to these channels will be available, not merely for the largest vessels which are now afloat, but for the largest which are likely to be built for many a decade to come. We illustrate herewith one of the two dredges (the most powerful of their kind in the world) which have been specially constructed for the work of excavating the Ambrose Channel. It will be seen from their dimensions that they are veritabe sea-going steamships. It was necessary to build them of great power and size to enable them to work in the exposed positions in which most of the dredging must be carried on. The first of the two, which has been named the "Thomas," recently came up from the Maryland Steel Company's works at Sparrow Point, Md., where the two dredges have been constructed. They are of what are known as the hydraulic hopper type, and they are the first sea-going dredges to be built in the United States. Preliminary trials of the "Thomas" have been made by the Metropolitan Dredging Company of New York, which has the contract for cutting this channel.

In a general way the "Thomas" is modeled on the lines of the "Brancker," the first of two large sea-going dredges which have been doing excellent work in maintaining a proper depth of water in the Mersey, England, but the capacity of the "Thomas" and the sister dredge will be some 30 per cent greater than that of the Mersey dredges.

The principal dimensions are as follows: Length, 300 feet; beam, 52 feet 6 inches; molded depth, 25 feet. Outside of the space which is necessary for machinery, bunkers, and the crew, the body of the ship is utilized for holding the material which is sucked up from the bottom of the channel. The quarters for the crew are located forward, while the main engines and boilers are aft. The vessel is propelled by twin-screw, triple-expansion engines, with cylinders 18 inches, 28 inches and 45 inches in diameter by 30 inches stroke, and the estimated speed when she is loaded is 8 knots an hour. Steam is furnished by two Scotch boilers at a working pressure of 180 pounds to the square inch. The body of the vessel is occupied by twelve large receiving hoppers, which are arranged in two lines on each side of the center line of the vessel; eight of these are 20 feet long by 18 feet wide, while four of them are 22½ feet long by the same width. They extend vertically from the bottom of the vessel to the main deck, a distance of approximately 26 feet, and they have a combined capacity of 28,000 cubic feet of material. Each of these hoppers is provided at the bottom with a central discharge valve, opening through the floor of the vessel. The valve is controlled by a hydraulic cylinder, the plunger of which is 12 inches in diameter by 36 inches stroke.

The method of dumping is ingenious and very effective. The discharge opening is circular and about 4



Length, 300 feet; **Beam,** 52 feet 6 inches; **Molded Depth,** 25 feet; **Speed,** 8 knots per hour; **Capacity,** 28,000 cubic feet.

HYDRAULIC SELF-PROPELLED DREDGE "THOMAS," FOR CUTTING NEW 40-FOOT CHANNEL, NEW YORK HARBOR.

feet in diameter. A circular tube of the same size fits down over the edge of the aperture, and prevents the escape of the sand through the opening during the process of pumping. To discharge the load from the twelve tanks these tubes are all simultaneously lifted by the hydraulic cylinders which are located immediately above them and the sand runs out through the bottom. To facilitate its exit, powerful jets of water are thrown into the mass of sand, a powerful pump being carried on the dredge for this purpose.

Between the hoppers is a rectangular well, in which is hinged a length of suction pipe, 4 ft. 6 in. in diameter. This suction pipe which is hinged by a ball-and-socket joint in trunnions, one in each wall of the well, is raised and lowered by means of 1⅜-inch steel cables, operated by a hydraulic lifting gear. Sand and water are drawn up through the pipe by means of a centrifugal dredging pump of 48-inch suction and delivery. The pump is driven by double, tandem, compound engines, one of which is located on each side of the pump. The engines have 17-inch high-pressure and 30-inch low-pressure cylinders, the common stroke being 36 inches.

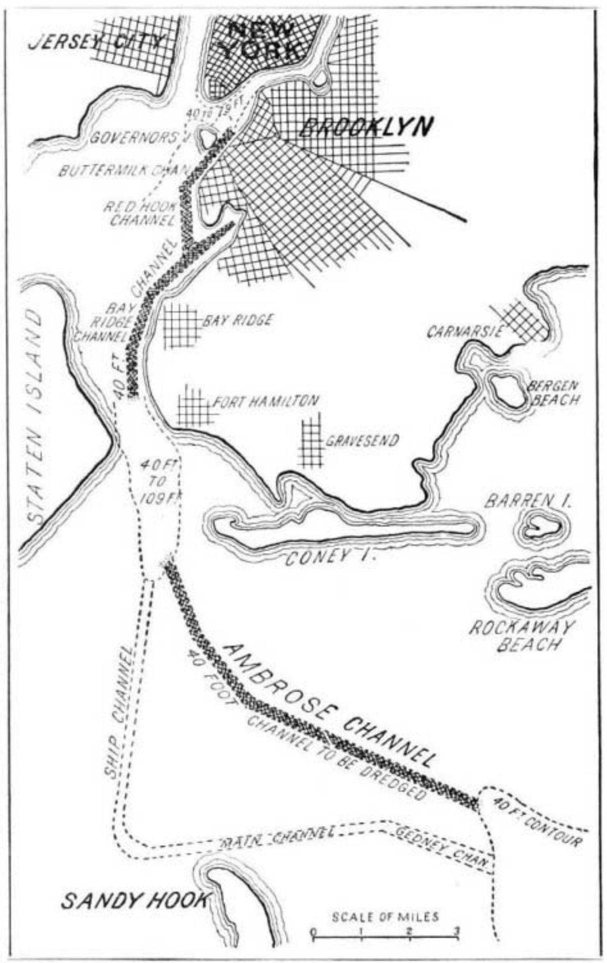
In operating the dredges the sand and water are drawn up through the pump and carried by lines of piping laid along the deck through which it is discharged into the various hoppers, care being taken in loading the hoppers to trim the vessel on an even keel. The sand and mud sink to the bottom of the hopper and the surplus water flows out through the discharge ports in the side of the vessel. When the hoppers are full, the suction pipe is drawn up and the vessel proceeds under her own steam out to sea, where the hydraulic valves are raised allowing the mud, sand, etc., to pass out through the bottom of the hull.

Drainage of Lake Copais.

An interesting piece of engineering work which has been recently carried out in Greece has been the drainage of Lake Copaïs. The lake has practically disappeared, and a large surface of arable land has been thus secured. This sheet of water presented many remarkable features; it was situated near the center of the plain of Bœotia at about 300 feet above the sea level, and was the largest of the lakes of Greece. Toward the north and east it was bordered by high limestone rocks. It received all the waters of Bœotia, the Hereynus, Cephisus and Melas; it was very deep at the foot of the ancient Copæ, but, on the contrary, was partly filled up by alluvium from the slopes of Helicon. At low water it covered a surface of 60 square miles, and its volume reached at times more than 800,000,000 cubic yards, and at some periods its level at the village of Copæ was more than 22 feet above that of the Melas. It had no apparent connection with the sea or with the smaller lakes, the water being carried off by evaporation and by twenty or more subterranean passages which communicated with the canal of Eubœa; these latter were purely natural fissures resulting from earthquakes. The evaporation from the surface was, however, considerable, owing to the high temperature of the region, which in summer reached a mean of 21 deg. to 28 deg. C. and sometimes even 35 deg. When the level of the lake fell at the end of spring a temporary vegetation appeared, which was very abundant, and showed that the soil would be productive if the lake were dried up. Some unsuccessful attempts in this direction were made in ancient times, but it was only in 1880 that the government of Greece made arrangements with a French company, with a capital of $3,000,000, to put into execution the drainage of the lake; for this M. Sauvage had made the projects as far back as 1848. The general plan consisted in making all the waters converge toward the northeast so as to draw them off by a tunnel into the bay of Larymna, but it was also possible to take advantage of the fact that there were two lakes toward the east at a lower level, and it was the latter arrangement which was carried out. It was decided to dig a belt canal around the southern end of the lake which traversed some parts of it and finally ended at the estuary of Karditza; from this point a tunnel took the water to Lake Likeri, the ancient Hylicus, and from there another canal led it to Lake Paralimin, passing by the village of Moriki; a tunnel then brought it to the canal of Eubœa (or Atalanti), near Skroponeri. This work was not, however, finished by the original company; it exhausted its capital, and sold the concession to an English company capitalized at $16,000,000. The company received for the work 16,000 acres of the reclaimed land, and had the use of the rest of the territory, deducting 3,000 acres with which the government indemnified the persons who claimed property rights or possession in certain parts of the lake. The amount of land obtained by the drainage of the lake reaches more than 48,000 acres. The peasants of the surrounding district have already put 15,000 acres in cultivation. The company rents the ground for a payment of 20 per cent of the gross product, at least for certain crops, such as wheat, barley, corn, etc. The cultivator has the right to pasture his stock on the ground reserved for this purpose; he also undergoes a fine if he does not cultivate all the territory he rents. The ground is very fertile, and produces cotton, melons, colza, beet, etc., with success.

Artificial Fossilization of Wood.

M. G. Arth presented to the Académie des Sciences an account of a singular transformation of wood into a substance resembling a fossil combustible. A piece of guaiac wood in a perfectly healthy state had been placed at the bottom of a bronze casting to serve as the pivot of a horizontal turbine of the Jonval type, having a force of 12 horse power and turning at 112 revolutions per minute. The whole of the movable system weighed about 800 pounds; the end of the shaft which rests upon the wood is of steel. Without being immersed in water, the pivot is always damp, as it is placed below the level of the outlet orifices. After six months of running, the apparatus was dismounted. The wood was found perfectly intact in the lower part, but the upper part upon which the steel shaft rested was transformed into a black and brittle substance, breaking easily into small pieces; the brilliant and irregular fractures presented all the appearance of the mineral combustibles. After drying in vacuo, analysis gave 3.9 per cent ash, 4.86 hydrogen, and 69.76 carbon. The organic matter in its original state gave 5.05 hydrogen, 72.59 carbon, and nitrogen and oxygen



MAP OF NEW YORK HARBOR, SHOWING THE NEW 40-FOOT CHANNELS.

22.36 per cent. The relation between the quantity of oxygen and nitrogen and that of hydrogen is 4.42; in woods this relation is about 7; in lignites it is about 5, and in dry coal from 4 to 3. Thus by its composition, as well as by its properties, the black product is to be placed between the lignites proper and coal rich in oxygen; by its calorific power it approaches the latter. It is interesting to remark the short time necessary for this transformation, which was evidently due to the influence of pressure and a moderate elevation of temperature (due to the friction), in presence of moisture; that is to say, under the action of the agents which are commonly made to explain the progressive transformation of wood into ligneous matter and to coal. It is thus shown that under favorable circumstances the time necessary to realize these changes is much less than generally supposed, and the duration of the long geological periods usually considered in such cases is not essential.

Architectural Volumes.

We wish to acquaint our readers with the fact that bound volumes of our BUILDING EDITION for 1900 are now ready for delivery. These volumes are invaluable to those wishing to consult plans of houses of a wide range of cost and architecture; numerous perspectives and floor plans are given in each issue. A feature of this edition during 1900 was the numerous cuts of beautifully furnished and decorated interiors.

Correspondence.

The Parsons Steam Turbine.

To the Editor of the SCIENTIFIC AMERICAN:

In answer to your kind request that I should contribute an article on Steam Turbines in your valued and influential columns, it has given me much pleasure to compile a short statement of the present state of the steam turbine industry so far as it relates to the Parsons steam turbine, manufactured by the following firms: Messrs. C. A. Parsons & Company, Heaton Works, Newcastle-on-Tyne; the Parsons Marine Steam Turbine Company, Limited, Wallsend-on-Tyne; the Westinghouse Machine Company, of Pittsburg, Pa., U. S. A.; Messrs. Brown, Boveri & Company, of Baden, Switzerland, and a German company now in course of amalgamation.

Messrs. C. A. Parsons commenced the manufacture in the year 1884, and have gradually improved and increased the size of the steam turbines manufactured by them. At the present time the aggregate horse power of turbines at work for electrical purposes exceeds 140,000 horse power. The largest size plants yet constructed are two of 1,000 kilowatts output for the municipality of Elberfeld, in Germany. The consumption of steam of these plants when tested by a deputation of experts from Germany, W. H. Lindley, Prof. Schroter, and Prof. Weber, showed the following results:

"At the overload of 1,200 kilowatts, and with a steam pressure of 130 pounds at the engine, and 10 deg. C. of superheat, the engine driving its own air pumps, the consumption of steam was found to be at the rate of 18.8 pounds per kilowatt hour. To compare this figure with those obtained with ordinary piston engines of the highest recorded efficiencies, and assuming the highest record with which I am acquainted of the ratio of electrical output to the power indicated in the steam engine, namely, 85 per cent, the figure of 18.8 pounds per kilowatt in the turbine plant is equivalent to a consumption of 11.9 pounds per indicated horse power, a result surpassing the records of the best steam engines in the production of electricity from steam under the conditions named."

I have also pleasure in sending you an official translation of the report of these gentlemen.

So early as 1892 the steam consumption of the turbine had been lowered to 27 pounds per kilowatt hour, or 16 pounds per indicated horse power, as testified by Prof. Ewing, F.R.S., of Cambridge, England; and in the following year its application to marine propulsion was undertaken by the second named company above, and led first to the construction of the yacht "Turbinia," of 34½ knots speed, completed in 1896, and later to that of H. M. S. "Cobra," of 400 tons displacement and 35 knots speed, and H. M. S. "Viper," of 370 tons displacement and 36.58 knots mean speed on a one-hour trial under English Admiralty conditions of weights and measurements. During the trials these vessels have shown a coal consumption per indicated horse power within the guarantees, they have suffered no breakdown or hitch directly or indirectly connected with the turbines, during their official trials, and the "Viper" has exceeded her contract speed by more than 5 knots.

On November 1, 1896, the United States and Canadian patents for land purposes only were acquired by the Westinghouse Machine Company, of Pittsburg, but up to the present time I am only aware that five plants of 120 to 300 kilowatts capacity have been put to work, and one of 1,500 kilowatts capacity is under construction. This should be contrasted with English output of over 130,000 horse power during the last ten years for electrical purposes only.

Last August Messrs. Brown, Boveri & Company, of Baden, undertook, in conjunction with ourselves, the manufacture of steam turbines for electrical purposes on the Continent, and they have at present an order for a 4,000 horse power turbo-alternator for Frankfort-on-Main besides quite a number of smaller plants.

I have had my attention directed to an article by Rear Admiral George W. Melville, Engineer-in-Chief of the United States navy, in your issue of November 24, and as I have the honor and pleasure of his acquaintance by correspondence, and know his invariable courtesy, I venture to hope that he will pardon me when I say that the "Viper" and the "Cobra" are not "racing machines," but formidable torpedo-boat destroyers, of the usual scantlings of the English 30-knot destroyers, strengthened specially for the higher rates of speed to which they have attained; that they can outstrip by many knots any other destroyers in the world in smooth or heavy weather, and that their complete absence of vibration at all speeds permits of an accurate sighting of guns and torpedoes, impossible with similar vessels fitted with reciprocating engines.

I may perhaps further explain that though the first marine steam turbines have been fitted in very fast vessels for the obvious reason of facilitating the development of a new system, yet steam turbines are