45-caliber, 8-inch, breech-loading rifles and fourteen 50-caliber, 6-inch, breech-loading rifles; and a secondary battery of eighteen 14-pounders, twelve 3-pounders, four 1-pounder automatic guns, four 1-pounder single-shot guns, two 3-inch field guns, two machine guns, and a half a dozen small caliber pieces for boat service. There will be two submerged torpedo-tubes, to be placed on the broadsides pretty well forward. The 8-inch guns are to be mounted in two balanced elliptical turrets on the main deck forward and aft of the superstructure. These turrets will be generally 6 inches thick with slanting faces ½ inch thicker. The turrets are to be controlled electrically, and are to fire through arcs of 270 degrees. The rate of ammunition supply is one complete round of powder and projectile to each electric hoist every fifty seconds.

The four 6-inch guns mounted on the main deck are to be placed in sponsons at the four main corners of the superstructure, and are to fire through arcs of 145 degrees—the forward ones from dead ahead aft, and the after ones from dead astern forward. These guns are protected by 5-inch armor. The ten other 6-inch guns, five on each broadside, are to be placed amidships on the gun deck—the forward ones firing dead ahead, while all the other guns on each side will have arcs of fire of 110 degrees, and will be arranged to house within the side line. These guns will be separated by 2¼-inch splinter bulkheads. The ammunition hoists will be run by electricity, and are to supply each 6-inch gun with three complete rounds every minute. The 14-pounders will be mounted on the gun deck and up in the superstructure, two forward and three aft of the 6-inch battery on each side, and four on each broadside between the 6-inch guns up in the superstructure. The 3-pounders are to be mounted on the superstructure deck and on the bridges, while most of the 1-pounders are to fill the military tops. Each 14-pounder is to be supplied six rounds a minute, while the 3-pounders are to have ten.

The firing stations for the torpedoes will be sheltered from the reach of 6-pounders and lighter pieces, and are to be located above the torpedo tubes. The conning-tower, located at the fore end of the superstructure, will be of steel 9 inches thick, and the signal tower, located at the after end of the superstructure, will be of steel five inches thick. The pilot-house will be of bronze. All magazines are to be carefully insulated, and certain of them are to be chilled by the refrigerating plant. All are also to be easily susceptible of instant flooding.

Because of the extensive application of electricity, the ships will carry pretty large generating plants, having a total output from the seven units of 6,250 amperes at 80 volts—power enough to run all the ammunition hoists, work the turrets, drive some of the ventilating fans, run the machine shop, and furnish power for the steam laundry which is to do the major share of the officers' and crew's washing. Owing to the high freeboard of the ships and to the fact that it is carried uniformly from bow to stern, very excellent accommodations will be provided for the officers and enlisted men, of which the complement will consist of: 1 flag officer, 1 commanding officer, 1 chief of staff, 20 ward-room officers, 12 junior officers, 10 warrant officers, and 777 enlisted men, a total of 822 persons.

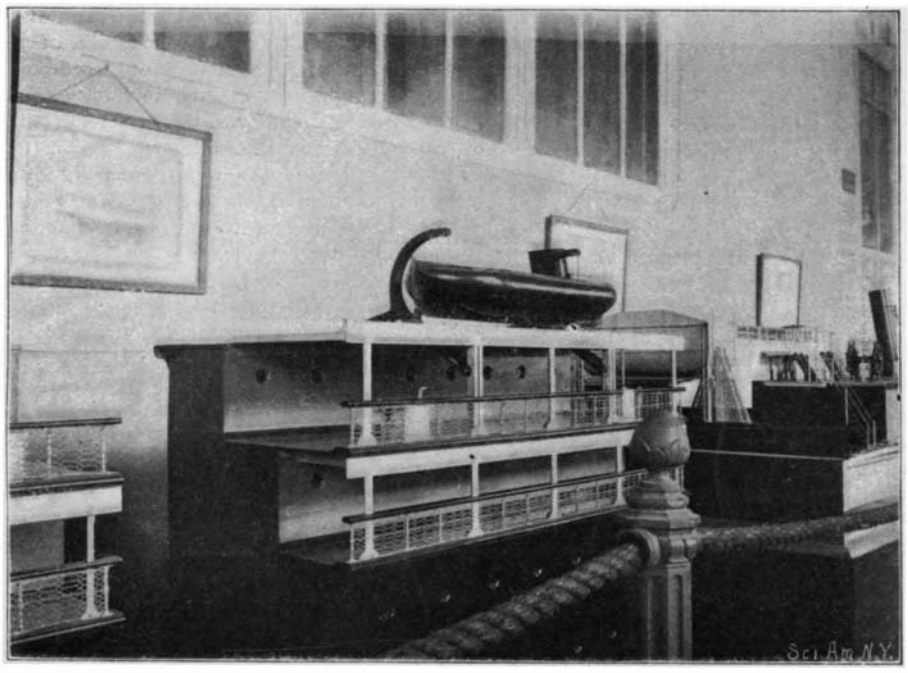
The ships will have twin screws, driven each by its own triple expansion engine of the four-cylinder type. The high-pressure cylinders will be 36 inches in diameter, the intermediate-pressure cylinders will be 59½ inches in diameter, and the two low-pressure cylinders of each engine will be 69 inches in diameter. They will have a common stroke of 45 inches, and the engines will make about 133 revolutions when developing the maximum indicated horse power of 23,000. Steam will be supplied by 30 boilers of the straight-tube water-tube type placed in 8 water-tight compartments. They will have a combined grate surface of at least 1,590 square feet and a total heating surface of quite 68,000 square feet. The four funnels will rise 100 feet above the grate bars. The normal reserve of fresh water will be 150 tons—just half of that carried on trial, and, excepting coal, the trial displacement will call for two-thirds of all other stores.

The ships will carry ammunition enough to put up a good long fight; 500 rounds being allowed the 8-inch guns, 2,800 rounds for the 6-inch guns, 4,500 rounds for the 14-pounders, 6,000 rounds for the 3-pounders, and a pretty liberal supply for the rest. Provision is to be made for closing many of the water-tight doors automatically, i. e., from a single controlling station, and every care has been taken to minimize the consequences of accident or injury. Three years is the maximum time limit for construction, and the maximum limit of cost is $4,000,000 in the case of the ships of 1899 and $4,250,000 in the case of the ships provided for during the present year.

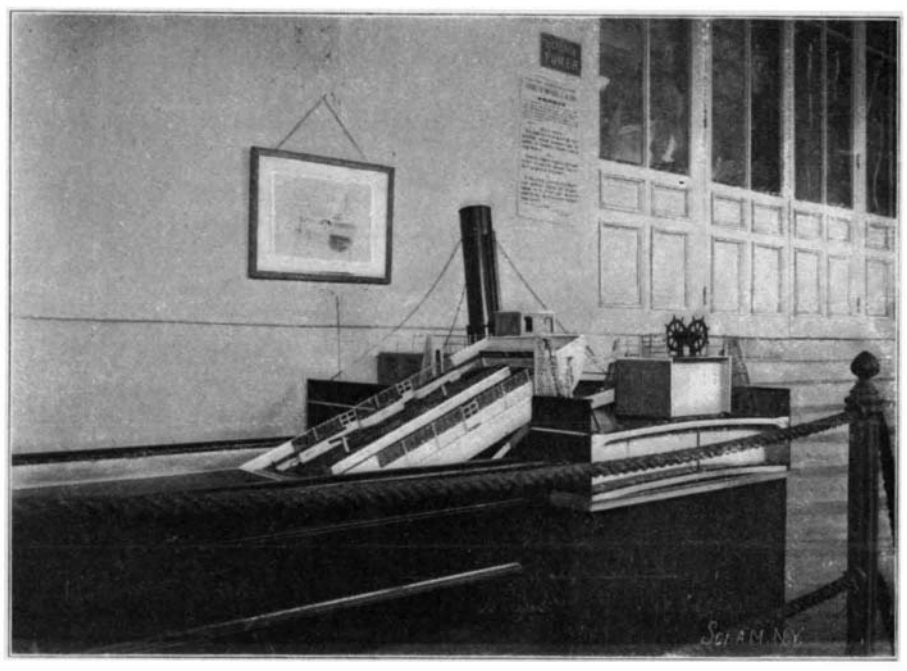
We have ample reason to be proud of these latest products of our naval designers; and in either peace or war they are bound to command a wholesome respect.

THE POLLAK PRIZE FOR LIFE-SAVING DEVICES.

The competition for the Pollak prize offered for the best life-saving devices brought together an extensive exhibit, which was contained in the Navigation building of the Paris Exposition. Mr. and Mrs. Pollak, of Washington, D. C., were among the passengers lost on the ill-fated vessel "Bourgogne," and their heirs decided to found a memorial prize of $20,000 to be awarded for the life-saving devices which, in the opinion of a committee of experts, would be the most efficient in preventing such disasters or in saving the passengers in case of shipwreck. Circulars were issued by the United States government stating the conditions of competition, and the Paris Exposition was selected as the most appropriate place for the assembling of a collection of this kind. The French government and the different foreign commissioners also issued circulars in their respective countries calling for inventions of this nature. As a result, more than four hundred competitors from Europe and America sent models of life-saving devices, or plans and descriptions, and these were seen in the Navigation building, near the Seine. An international committee of naval experts was appointed, including prominent naval officers or constructors from different countries, among whom may be mentioned Lieutenant Sims, late United States naval attaché at Paris; Commander Clavaud, director of the French life-saving society; Captain Siegel, German naval attaché at Paris; Rear-Admiral Naoumoff, chief inspector of the Russian life-saving society; Signor Pasella, naval constructor, professor at the Italian school of naval architecture; M. Couvert, president of the Chamber of Commerce at Havre; Captain Wallenberg, of the



The Roper System of Launching Lifeboats



The Roper Life-Raft in the Act of Launching.

Some of the American Inventions.

Individual Life-Saving Appliances.

COMPETITION FOR THE POLLAK PRIZE OF $20,000 AT THE PARIS EXPOSITION.

Swedish navy; Captain Nepean, director of the English life-saving society, etc.

According to the rules, the jury had the right to award the whole of the prize to one person or divide it among several competitors; the awarding of the prize was not obligatory, and it could be withheld for a future competition. As a result of the examination of the different systems, the jury found that the appliances designed by Mr. Leopold Roper, an experienced English naval architect, came the nearest to a satisfactory solution of the problem; as, however, the final solution had not yet been reached, and there was still room for considerable improvement, the jury decided not to award the whole of the prize at the present contest. The sum of $2,000 and a gold medal was awarded Mr. Roper, as his system was considered by far the best in the present series. A description of these devices will be useful in showing what lines should be followed by inventors who wish to enter the next competition for the prize. These devices include, first, an improved system of life-boats and davits, and second, a life-raft which the committee think is the most valuable.

The system of life-boats will be readily understood by referring to the figures, which represent the working models shown in the section. The first of these shows the boat suspended from the davits in its normal position. The davits are of steel channel and are light and strong: they are pivoted below the deck and carry in the rear a pivotal support which is attached at the level of the deck to a guide-piece which slides back and forth in a hollow deck beam by means of a large screw. This screw is operated by a winch at the side, worked by one man. When the winch is turned, the davits rise, being pushed up by the rear arms. The boat is then ready to be lowered. This is done by a second winch in a corresponding position on the other side, which unwinds the steel rope which supports the boat, and the boat may thus be lowered to either of the decks and to the water in a very short time by the man in charge. The use of a single steel rope is a great improvement over the ordinary block and tackle; when not in use it is for the most part inside the davit, and consequently well protected from the weather, and there is no complicated arrangement of ropes to become tangled up when the boat is released. As both ends are let go at the same time, there is no danger of tipping up the boat and throwing out the occupants, as often happens. The advantages of such a system over the ordinary davit with block and tackle are at once apparent. The boats themselves were also recommended by the committee. They are built of steel and are lighter and stronger than the present wooden ones, besides not being subject to warping or leaking when exposed to the weather. They are made with double bottom and a series of air-tight compartments, and are one-fifth lighter than other boats of the same size. On account of their great buoyancy they may be fully crowded with passengers without danger of sinking. The "Campania," of the Cunard line, has been fitted with twenty boats on this system, and it is of interest to compare the figures with relation to the ordinary boat. On the "Campania" the weight of each boat of the ordinary type is 3½ tons, making a total of 70 tons. Each boat carries 60 passengers, or in all 1,200 persons are taken. The forty davits each weigh 2,600 pounds, or a total of 52 tons, and the weight of boats and davits is 122 tons. To lower all the boats, allowing 10 men for each, requires 290 men. By Roper's system, each boat weighs 2½ tons, or 50 tons total; the boats carry 110 persons each, providing for 2,200 passengers. The 40 davits weigh each 1,800 pounds, making 36 tons, or for the whole system, 86 tons. Two men are required to lower the boats, making only 40 men. It will be seen that 2,200 persons are provided for, against 1,200, and the system weighs 86 tons against 122 tons; the greatest advantage is in the small number of men necessary, or 40 against 200 by the old system. For these reasons the committee consider that this system of life-boats is a great advance upon the present system and recommend its adoption; it is, however, the life-raft designed by Roper which is considered to be a step in the right direction toward solving the problem.

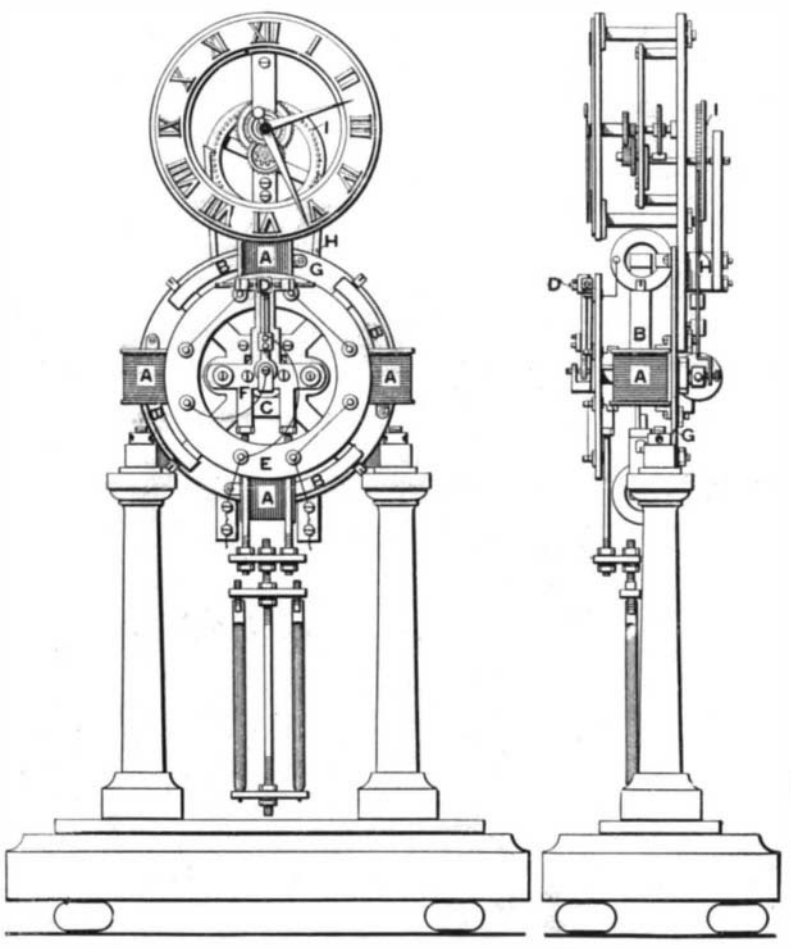
Our second engraving shows the appearance of this raft, which is large enough to carry 600 persons. It is built of steel, with double bottom, and divided into compartments forming air chambers; in some of these supplies of water, provisions, etc., are carried. The raft is supported normally above the deck and serves the purpose of the captain's bridge, it thus does not take away any extra room, and costs but little more than the ordinary form of bridge, this being estimated at $2,000. The raft is supported on each side by a heavy angle-piece, serving as a guide, in which it may slide back and forth by sets of rollers placed at intervals along the bottoms and sides. These cross-pieces are supported at each end by solid uprights, which are firmly secured to the deck; the cross-pieces are held in place by a simple clamp device, which may be instantly released by moving a lever. In case of shipwreck the raft is loaded with passengers, and a man at each side releases the clamp, thus lowering the guide-pieces at that end, and the boat rolls out by its own weight to the water's edge. This movement is shown in our engraving, where the oblique position of the guides will be observed, also a second guide-piece in front, which normally forms part of the upright support, but is now lowered, and serves to guide the boat into the water. As will be seen, the whole arrangement is one of great simplicity and not likely to get out of order, and can be operated by a few men. In the compartments may be placed provisions for six days, besides sails and tackle, etc. The buoyancy of the raft is amply sufficient to keep it afloat even if some of the compartments should become damaged. It may be remarked that the raft may be utilized under ordinary circumstances for landing troops, horses, etc., and can give good services in this way. This system of life-rafts has been tested practically upon H. M. S. "Polyphemus," which was provided with two of these rafts, of practically the same design as shown in the present model; the trials showed that they fulfilled all that was claimed for them, as each raft contained 200 men with supplies, etc., and the launching was carried out in about 45 seconds.

The committee are decidedly in favor of life-saving en masse, and for this reason have approved Mr. Roper's life-raft as the only device in the present competition which answers to this idea in a practical manner. Most of the inventions, outside of individual life preservers, seem to have been made by persons who had but little practical knowledge of the conditions to be met with. It should be observed that all appliances which require skill in putting together at the moment of shipwreck are almost valueless, as there is generally not sufficient time to manipulate such devices, and the crew of a transatlantic liner, composed as it is of untrained men, many of whom may have been taken on board at the moment of starting, cannot be depended upon for any great service in this connection; devices must be looked for which take only a few men to operate for the saving of a great number of passengers, such as the large life-raft. The type designed by Roper is, however, somewhat large, as a heavy raft for 600 persons might cause some trouble in getting started; by using a small-sized raft and increasing the number, a more satisfactory result would, no doubt, be obtained. The committee do not favor the system of water-tight compartments for vessels, on account of the cost and diminution of the capacity of the vessel; in a severe collision, such as that of the "Bourgogne," the system would not have availed much. Another point that should not be overlooked is that a vessel sinks end first, and accordingly many of the detachable deck-houses and other similar devices would fail to work. As it was not to be supposed that a first competition would be entirely successful, it has been decided to hold a second in the autumn of 1901, and a circular to that effect will be issued probably before the end of this year; it may be held at some point on the English Channel, as this will give a favorable opportunity to try some of the devices in actual practice.

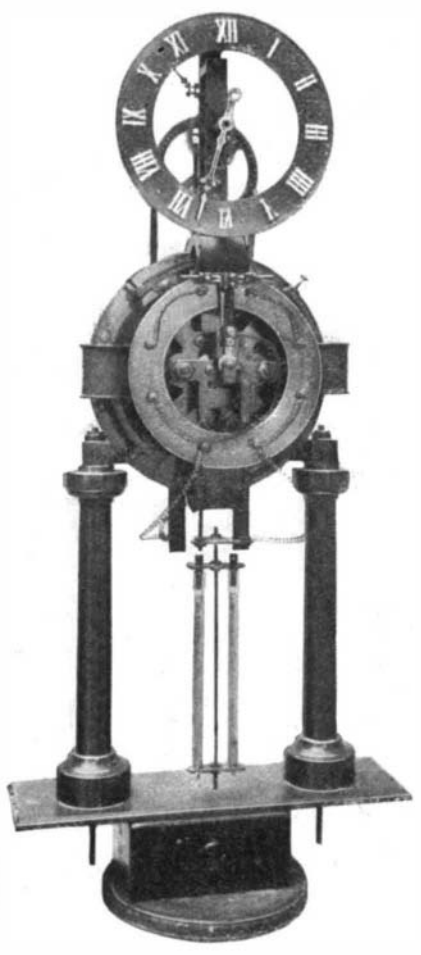
Out of the great number of devices a few have been selected for illustration as showing the general character of the exhibit.

One of the views shows some of the American inventions. To the right are two systems of improved davits and life-boats, and in the center is a model of a "marine brake," consisting of a large plate which is pivoted against the side of the vessel and may be swung out at will, thus slowing up the vessel by the resistance-surface it offers. Of the two larger models below, that to the left shows a type of inclosed life boat for a great number of persons, built of copper, and the second model represents a method of lessening the effect of collisions by surrounding the vessel with a series of rubber buffers. On the wall are several rubber garments which are inflated with air, etc. A great part of the exhibit is made up of individual life-saving devices, which are inflated or made of cork, air cylinders, etc. One view shows a number of these devices. The figure on the left has garments which may be inflated, also a rubber air belt, and next it is a vest made of cork and chamois skin. The two figures in the center carry a kind of long life-belt made of a number of sections of impervious material stuffed with a mixture of lamp-black and cork, and near it is a belt made up of semi-cylindrical air-chambers of waterproofed leather.

Two English systems of water-tight doors for the compartments of vessels are shown. The door seen on the left is normally held open by a catch which is released at will by an electro-magnet or a hydraulic cylinder and the door swings shut and is locked automatically. In the second system the doors slide into place, forming a water-tight joint, and all the doors of the vessel are controlled from a central point. Either hydraulic pressure or electric motors are used for the closing. The motor on the left pushes the door into place by means of a long screw, which is turned by gearing and works in a nut on the door. On the right is a hydraulic system for accomplishing the same movement; above and below are the cylinders whose pistons act upon the door, and it is closed or opened by sending the pressure into the forward or rear pipe. Both systems are worked from a central point either by a series of valves or electric switches.



FRONT AND SIDE ELEVATIONS OF ELECTRIC CLOCK.



ELECTRIC CLOCK RUN BY EARTH PLATES.

ELECTRIC CLOCK RUN BY EARTH PLATES.

Our occasional contributor Mr. N. Monroe Hopkins has prepared with a great deal of care an article on a new electric clock of his devising, which is well-nigh perpetual in its action, besides being accurate and practically noiseless.

The general appearance of this clock is shown in the perspective view, and much of the detail is given in the outline side and front elevations. The design and its carrying out are so novel and attractive that we have given in the current SUPPLEMENT the author's article in full, with many additional illustrations, the whole being sufficiently explicit to enable a careful workman to make it. The clock shown in the perspective view was mounted on a suitable base and inclosed in glass.

The back plate, *G*, which supports the entire mechanism, is secured to the caps of the pillars, and has, at its center, the knife-edge bearing of the pendulum. To this back plate are secured four magnetic spools, *A*,