of ample dimensions worked by direct gearing on the main shaft. It is found by this means that ample cooling water can be maintained from a very moderate original supply of fresh water, and the objectionable features of having salt-water circulation are entirely obviated. Unquestionably this will be an important factor in all salt-water installations of this kind, and will greatly add to the endurance and protection of the outfit. Where the circumstances make a keel condenser in any degree objectionable, a regular tube condenser (more properly a cooler) can be adopted with circulating pump for it, and secure ample provision for the work.

In the boat inspected containing this motor, an independent installation of a small 4-horse-power "Standard" motor was made for the purpose of driving a dynamo for lighting the vessel and charging storage battery, a bilge pump for constant use, an air compressor for pumping up the compressed-air tanks whenever necessary, and a small magneto for sparking. This auxiliary is not necessary to use except when particularly desired, as, when the main engines are in operation, the air supply is kept up in the tanks by attached pumps, and it is easy, of course, to attach bilge pumps to the main shaft, so as to permit disuse of the auxiliary engine, except at night.—Journal of the American Society of Naval Engineers.

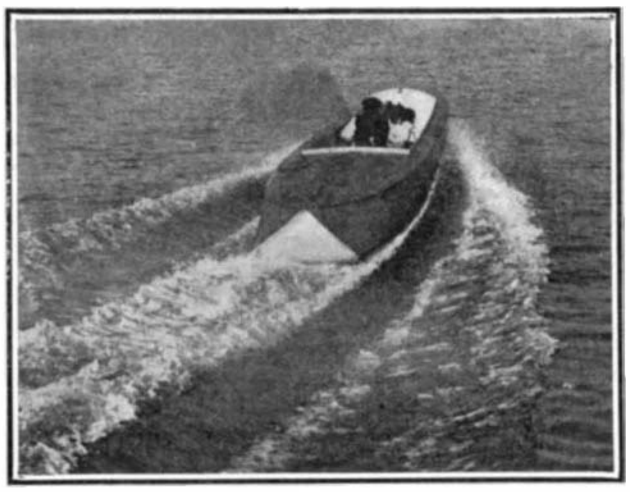
A HIGH-SPEED MOTOR BOAT THAT CAN BE BUILT AT HOME.

The illustrations shown herewith depict the Brooks Boat Company's "No. 13," as viewed from the front, rear, and side when traveling at high speed through the water. When the fact is considered that this boat was claimed to be going 28 miles an hour when the photographs were taken, one can readily see that the model of hull used is a good one, and one that throws but little spray when compared, for instance, with the "Standard," shown at the bottom of page 168. Fitted with a 60-horse-power, six-cylinder Sterling engine, "No. 13" is claimed to have made a measured mile in 2 minutes 8 seconds last summer, which would be at the rate of 28.12 miles an hour. As the photographs show, this boat looks every inch a racer, and appears from the shape of the hull to be capable of attaining the speed claimed. It is 39 feet 7 inches in length by 5 feet beam, with a depth of hull at the bow, amidship, and at the stern of 31, 29, and 19½ inches, respectively. The draft depends upon the size of propeller used, as the hull is made flat at the stern, so that it glides nearly on the surface of the water.

The builder of the above-described speed boat is one of the oldest boatbuilding concerns in this country. This company not only builds boats, but also makes a specialty of furnishing frames complete, with all the necessary material for putting them together and with patterns for cutting the planking. When supplied with all this material and instructions, which can be had at relatively small cost, the amateur can build himself a boat during leisure hours, knowing that when it is completed, his craft will not be an experiment either with regard to appearance or speed.

Besides the racer shown, the Brooks Company builds, or supplies frames for, several smaller speed craft, among which are a 30-foot racing boat claimed to make 16¼ miles an hour with an engine of 10 horse-power, and a 22-foot speed launch, claiming also 8½ miles an hour with a 2-horse-power motor, and which should therefore make as high as 12 miles an hour with 6 to 8 horse-power. Still another interesting model is a stern-paddlewheel boat, which can be built in varying sizes from 25 to 40 feet in length. This boat can be built as an open or closed launch or as a boat for freighting purposes on shallow lakes or streams. Equipped with a 7 to 12 horse-power motor, it will attain a speed of from 6 to 9 miles an hour.

Bow View, Showing Wave Formation.



Stern View, Showing Wake.

The Brooks "No. 13" Making 28 Miles an Hour.

A RACING MOTOR BOAT FOR AMATEUR BUILDERS.

Cupro-nickel, says the Brass World, is used for two purposes: In the manufacture of bullet jackets and in the production of five-cent pieces. Bullet jackets consist of 80 per cent of copper and 20 per cent of nickel. The five-cent pieces made by the United States government are composed of 75 per cent of copper and 25 per cent of nickel.

INFLUENCE OF THE AUTOMOBILE ON LAUNCH DEVELOPMENT.

(*Concluded from page 167.*)

tools—have been utilized in the production of engines of phenomenal lightness, up to 300 horse-power or higher, and especially designed for launch installation. At the same time every improvement in the automobile world in the line of carbureters, ignition devices, lubricators, etc., has been transferred to the marine engine.

In this country, under somewhat different conditions of manufacture, the builder has had on the one hand his old, heavy, slowly-turning engine, and, on the other, the French automobile and auto-marine engines, of wonderful refinement and lightness. The result is seen in several magnificent machines in the larger sizes, purely of the marine type, with the skeleton framework of the steam torpedo-boat engine, light and powerful to an extent not dreamed of five years ago, with all the latest advances in gas-engine practice and electrical science making them as reliable and practically as flexible and tractable as the steam engine. Every development of automobile engineering in the line of better materials, finer tools, and improved methods has gone to further the perfection of the marine engine.

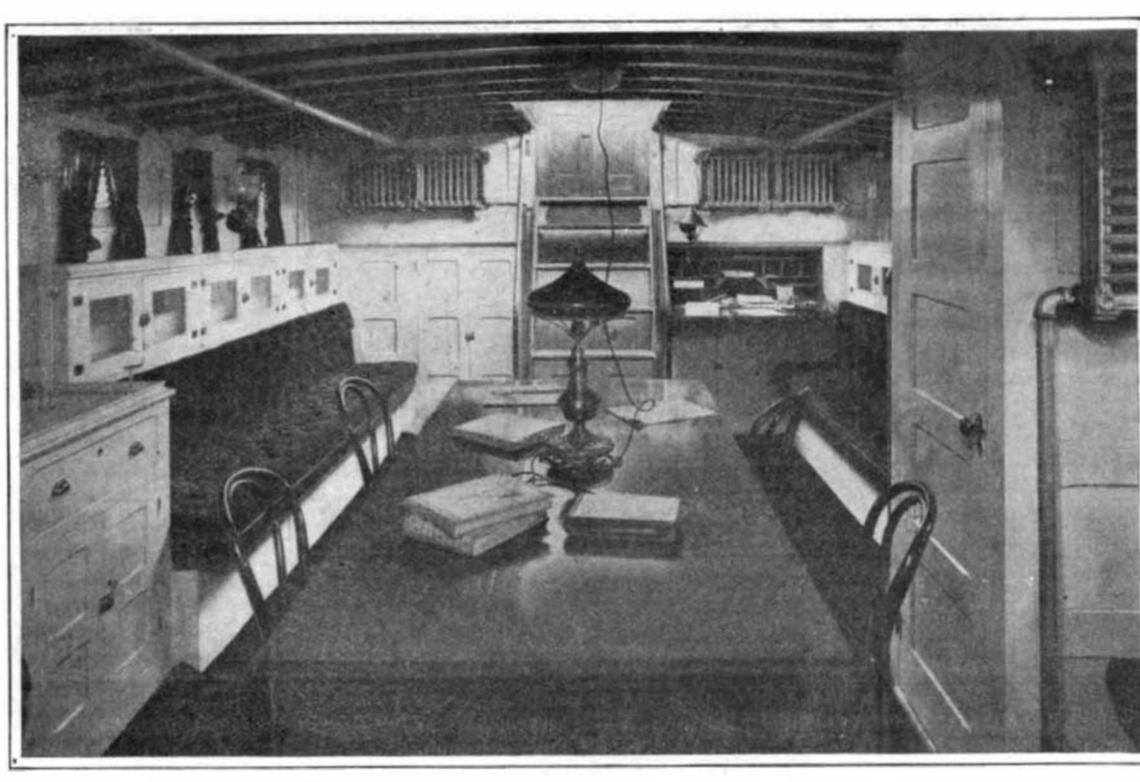
But the full measure of advance is not to be gaged solely by such costly machines as the double-acting, six-cylinder engine of 500 horse-power, started and reversed by compressed air. The improvement begins with the smallest and cheapest of the two-cycle engines, where better materials, improved design, standard tools of greater accuracy, and more scientific carbureters and ignition devices, have raised the standard and decreased the relative cost. Throughout the whole range of heavy engines, still in demand for much of the yacht work and in fishing and working vessels, there has been a general improvement along the same lines. Next to these stands a new class of launch engines of varying sizes from 20 to 80 horse-power, mostly of high speed as compared with the old type, but far lighter, more compact, practically as strong and durable, and superior alike in reliability and economy.

With the improvement of the engine and the multiplication of types and sizes has come a reconstruction of the entire power pleasure fleet on new lines. Limited no longer to a few sizes of engine of a single type, the yachtsman and his designer have been free to plan a great variety of new craft. For day use there are launches of comparatively high speed of from 20 to 80 feet; for ordinary pleasure running there are comfortable and convenient craft of good speed, easily handled by one person and safe in any ordinary weather. Where cruising is the main object, the reduction in size and weight of engine has brought about a corresponding change in the refinement of the hull, which is no longer a homely box from which a speed of but six or seven miles per hour is expected, but is as handsome and graceful as a sailing yacht, with double the accommodation on the same length, and with a speed of at least a dozen miles. Still another new type is the rough-water cruiser, from 30 feet upward, including the 40-footers that raced around Cape Cod in 1905 and 1906 and the 40 to 60-footers that will race to Bermuda this year. While for this special work the old type of heavy engine still takes precedence of all others, the development of this most useful and interesting class may be traced back directly to the autoboat racing of two and three years ago—a reaction and a protest it is true, against the extreme racing type, but nevertheless owing its origin to it.

CANOVETTI'S AIR-RESISTANCE EXPERIMENTS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

In view of the great activity which we find at present in the line of aeroplanes and airships of different forms, the study of the resistance which the air offers to moving bodies becomes one of considerable importance. This question is also of interest in the design of high-speed trains or automobiles and in another field, in the design of projectiles for artillery. Newton was the first who formulated a series of laws for air resistance, supposing that it is produced directly by the inertia of the molecule of air as acted upon by the moving body. But this hypothesis is far from being in accord with what happens in reality, and the laws which result from it



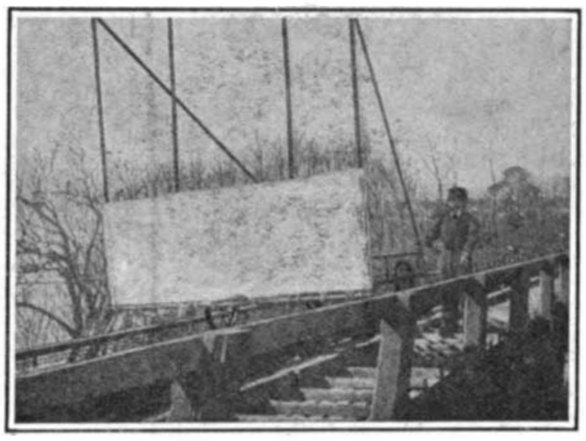
Cabin of the U. S. Coast Defense Inspection Boat "Norka," Which is Noteworthy for Its Roominess and Comfortableness.

A TYPICAL MOTOR-BOAT INTERIOR.

are only good within certain limits, and then approximately. Following him, Euler brought out another theory which comes nearer the practical conditions but without corresponding with them completely. On account of its great elasticity, the air gives rise to phenomena which are not to be foreseen by theory. It acts differently according to the speed of the moving body. Up to a speed of 800 feet per second the velocity follows a certain law, and after that it departs considerably from this law. It is difficult to establish any sure data of this value of air resistance for various shapes of bodies, and in spite of the experiments which have been made hitherto in this direction, we may say that the question is far from being completely solved.

An important contribution to this subject is the recent work of the eminent Italian engineer Canovetti. The experimental work which Signor Canovetti has been carrying out of late concerning the question of air resistance to bodies moving at a high speed is of great interest. The first experiments which Canovetti undertook were made at Brescia in 1897 and from the commencement they proved highly successful. To carry out the tests, he used a steel cable of small diameter which was stretched from the top of the Castle of Brescia, a structure of considerable height, some 260 feet, down to the ground at an easy slope of about ten degrees. The wire was tightly stretched so as to give a nearly straight path, and upon it was made to run a two-wheeled carriage, transporting the body upon which the experiments for air resistance were to be made. The bodies were hung below the carriage, and were variously shaped. For instance, one or two circular disks were formed of a metallic hoop with canvas stretched upon it. Where a pair of disks were used, these were placed one behind the other and at different distances. The researches were carried out with special reference to the forms of the bodies and the speeds which would have a direct application in aerial navigation, either for aeroplanes or elongated balloon bodies such as are used for airships.

Since the first experiments were made, Canovetti desired to carry on another series of researches, but on a larger scale. This he had an opportunity of doing, for the Como Brunate inclined plane, which runs up the mountain slope, was put out of working order by a series of repairs which had to be made, so that Canovetti found that he could make use of the inclined tracks for carrying out his new experiments, and thus means were at hand for making these tests upon a much larger scale both as to distance and size of the apparatus than before. In this work he received aid from the Accademia dei Lincei which enabled him to carry it out in a very thorough manner. To this end he had built a four-wheeled carriage frame of light and strong steel tubing, so as to run upon the rails of the track. Mounted at the front end of the carriage is a large square frame of bamboo upon which is stretched a cloth covering having a total surface of ten



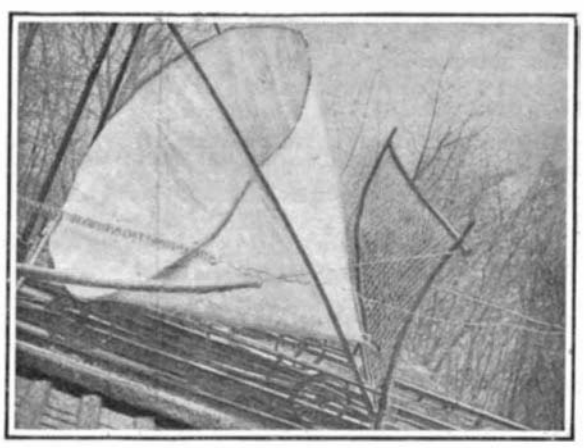
Canovetti's Car on Track With Air-Resistance Frame Using Small Amount of Canvas.

square yards. In the center of the carriage are placed two ballast carriers in the shape of steel cylinders which can be loaded with small lead weights to the extent of forty pounds for each cylinder or a maximum of eighty pounds for the carriage. The total weight of the latter is about 160 pounds. The apparatus thus constructed is taken to the top of the incline and allowed to run down the slope by its own weight. At the bottom of its course the carriage is stopped by a metallic network which is stretched upon a properly designed frame and is rendered elastic by a system of springs and counterweights so that the carriage is stopped without too much of a shock. Starting with the square frame a number of other frames having different forms are used, such as a flat round disk, a conical form, and others. When using the square frame and varying its surface from ten to two square yards, and at the same time varying the weight on the carriage, the latter was found to take different and increasing velocities each time, and the speed of travel was measured and registered very accurately by means of an electric device. A series of contacts are placed along the track, spaced about eighty feet apart, and the contacts are connected with the registering station at the foot of the slope. Here are placed a set of apparatus which have been specially designed for this purpose and upon which is observed the exact course of the carriage at any given moment. The registering instrument consists of a double Morse register, and the paper strip which is unrolled at a regular rate contains two sets of punctures. The first series of dots are made at regular intervals by means of a clock, while the second set lying alongside the former are formed by a needle-point on the armature of an electro-magnet through which current is sent from the contacts lying along the track, and when the car passes over a contact a dot is formed on the paper, thus giving an exact record of its passage, and the time can be measured by comparing with the set of chronometer dots. Upon the data which are thus obtained Sig. Canovetti makes the necessary calculations for finding the air resistance and the laws which govern the latter.

After the experiments were made with different forms of flat planes, a new series of data were obtained by using a cone-shaped frame covered with canvas. First the cone was placed with the pointed end in front, and next the point was placed in the rear, in order to show the effect of the air resistance upon the body of an airship. These experiments have a close analogy to the researches which are made upon various forms of hulls of vessels in a naval testing basin. Another series of tests which are likely to be of great value are those which Sig. Canovetti is carrying out with the frame disposed as we find it in an aeroplane, in a flat or slightly inclined position, and this may throw some light upon the different conditions of balance and resistance which enter into this question.

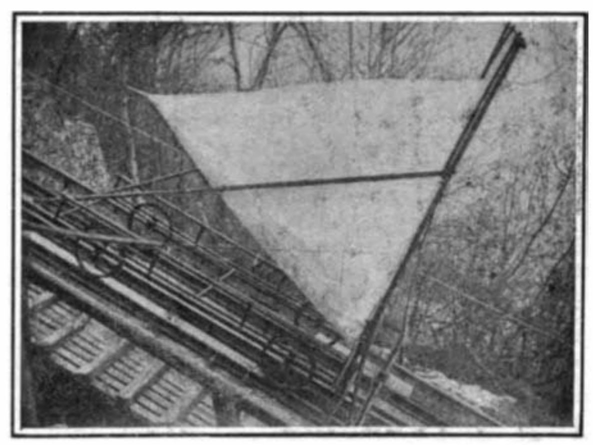
Spring Frame or Buffer for Stopping the Car at the End of Its Course.

Frame stretched with wire net and held by coiled spring.



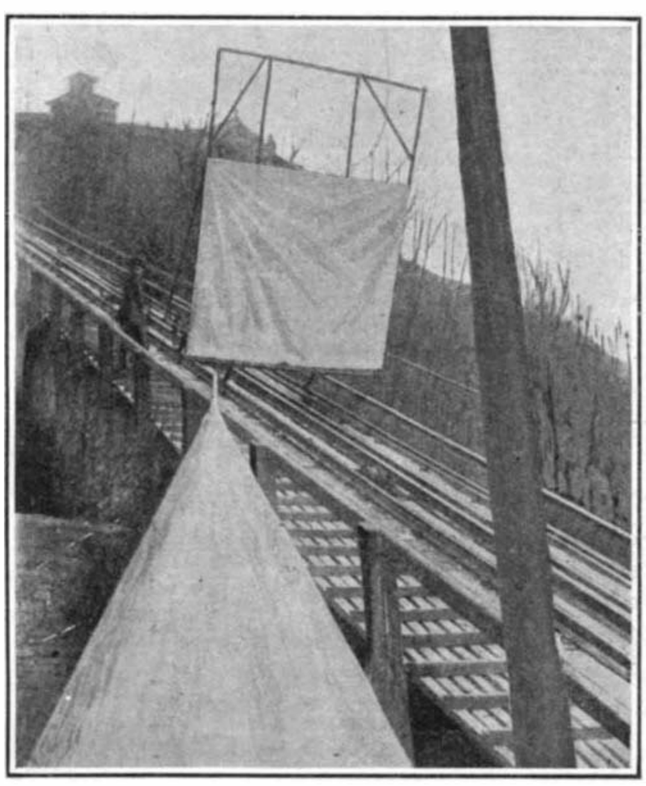
Car Running Backward.

Canovetti's car using a conical air-resistance piece (canvas-covered bag) coming to a stop on the spring mattress. Cone is small end foremost and bamboo frame toward rear.



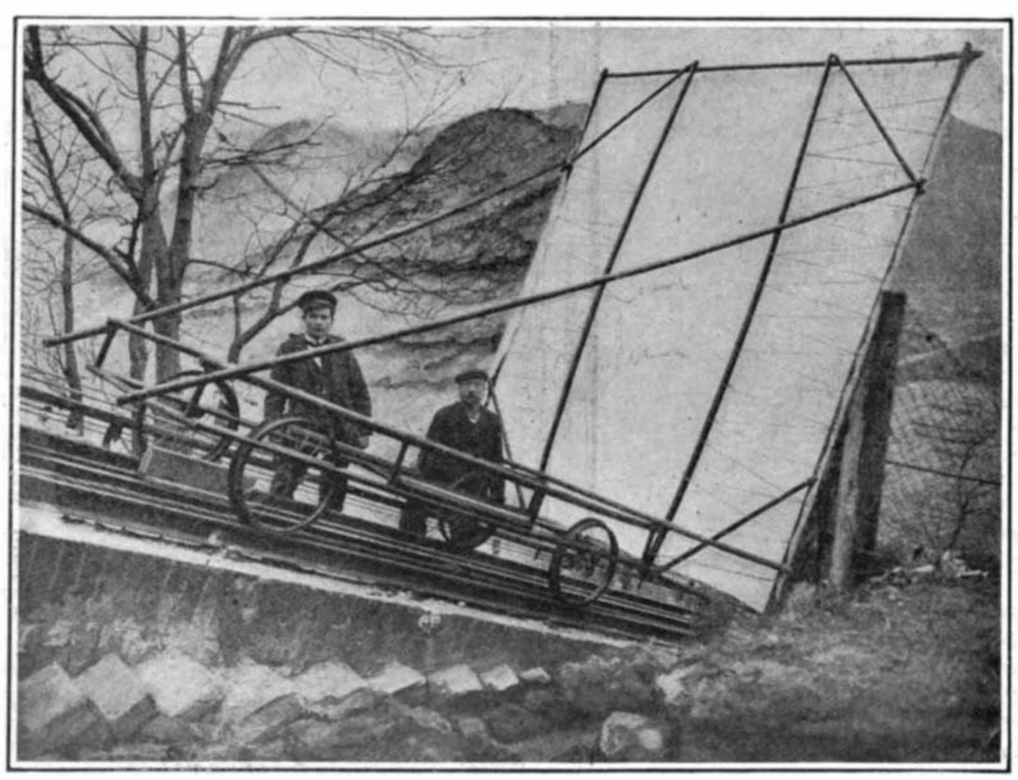
Same But Running Forward.

Car having same conical bag now placed against the bamboo frame, with the large end foremost.



Canovetti's Car on Down Grade to Test the Air Resistance.

The experimental bamboo frame is partly covered with canvas. In front is a separate conical canvas frame or bag for other tests.



Canovetti's Experimental Car Used on Inclined Track, Running on Rails for Air-Resistance Tests.

On the bamboo frame in front is stretched more or less canvas for different air resistances. Other shapes are used as seen in the illustrations, especially a conical shape, useful for gathering airship data.

CANOVETTI'S AIR-RESISTANCE EXPERIMENTS.