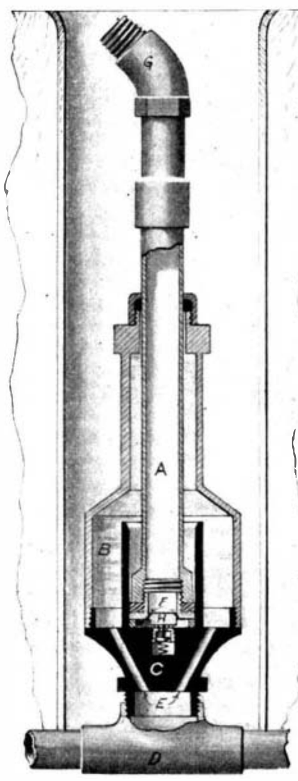
NON-FREEZING HYDRANT.

A hydrant embodying a number of important improvements is described in a patent recently granted to Mr. Charles L. Burkhart, of Dayton, Wash. The hydrant is provided with a tubular piston, which may be raised to permit the water to flow, and when lowered will stop this flow, at the same time opening a valve to drain out the water in the piston, thus rendering the hydrant non-freezing. The entire device is situated in a casing which is sunk into the ground. The tubular piston, which is marked *A* in our illustration, projects from the hydrant proper. The hydrant proper consists of two sections, *B* and *C*, which are screwed together and form a chamber. Section *B* has formed on its upper end a nut, above which is a packing fitted snugly against the piston, *A*. The section, *C*, is connected with the water-supply pipe, *D*. Two channels, *E*, lead up through the section, *C*, to the hydrant chamber. Projecting upward from the section, *C*, is a cylinder formed thereon, into which the lower end or head of the piston, *A*, rests when the hydrant is not in use. The piston head is provided with a rubber gasket, which snugly fits against the walls of this cylinder. The gasket is held in place by a cap piece, *H*. When in its lowest position the cap piece depresses the stem of a valve in section *C*, opening the valve and permitting all water in the piston to be drained out through an outlet channel. With the parts in the position illustrated, the pressure of the water in the hydrant chamber acts on the piston to hold the same in its lowest position. If it is desired to use the hydrant, the piston is raised until the piston head clears the top of the cylinder. The drainage valve then closes, and the water passes up through the openings in the cap piece, *H*, and out through the tubular piston. A hose may be connected to the elbow, *G*, and since the piston is revoluble, it will follow the movement of the hose, preventing kinking of the hose and consequent interruption in the flow of water. Since the piston must be lowered in order to cut off the flow of water, it normally assumes a position which will not interfere with a lawn mower. If it be desired to remove the hydrant from connection with the water supply without injuring the casing, it is simply necessary to remove the elbow, *G*, and slip a suitable tool down over the piston to an engagement with the nut on the upper portion of the section, *B*, and upon turning this the hydrant will be unscrewed from the coupling *D*.



NON-FREEZING HYDRANT.

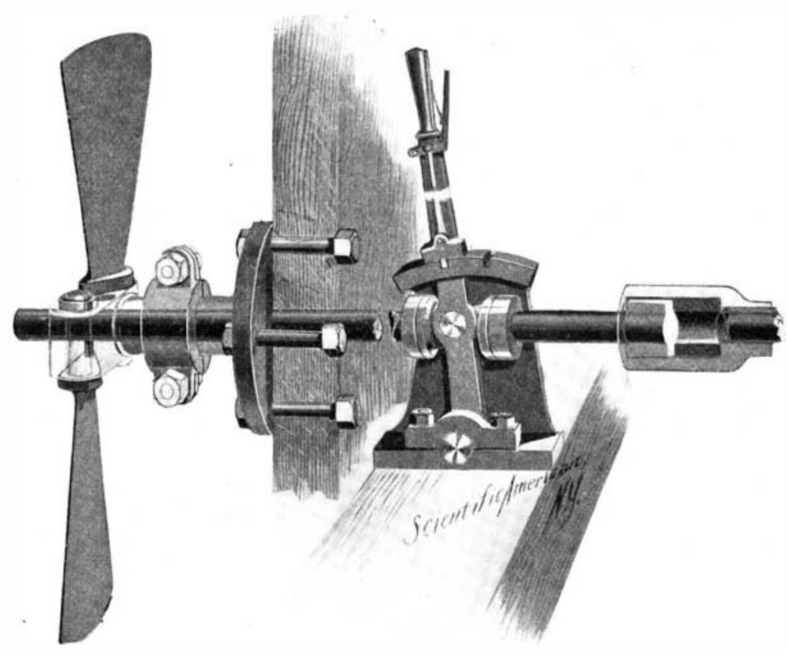
A few weeks ago the last train over the "baby gage"—a 22-inch railroad—was run from Longfellow to Metcalf, Ariz. Acording to the Copper Era, a new 36-inch narrow-gage road takes the place of the old. The "baby gage" was built in the early seventies. It was the first railroad ever built in Arizona. The engine was hauled overland from Sargent, Kans., then the nearest railroad station, to Clifton and set up by Dad Arbuckle, who is still in the employ of the company. At first the road was built and operated only to the Longfellow mine, but was afterward extended to Metcalf. The old "baby gage" was considered quite an engineering feat in its time, and justly, too, because it was built at a distance of more than one thousand miles from the nearest railroad points.

REVERSIBLE SCREW-PROPELLER.

The accompanying engraving illustrates a screw-propeller of a construction which enables it to be reversed by a sliding movement of the propeller shaft. It does not require the use of a hollow or tubular shaft usually employed, and therefore requires the use of only one stuffing box and other features incident to the two shafts. Further, it enables several reversible propellers to be mounted in tandem on the same shaft, thus securing great efficiency and at the same time preserving the advantage of reversible propellers.

The propeller shaft is connected at its inner end to the engine shaft by a coupling which allows longitudinal sliding movement. At its opposite end the propeller shaft passes through a box secured to the sternpost of the vessel. The propeller blades are carried on a hub mounted on the outer end of the propeller shaft. This hub is held against sliding movement with the shaft by a coupling which connects it with the box on the sternpost. This coupling, however, is of such design as to permit free rotary motion of the hub. Each blade of the propeller is provided with a crank-shaped base which is rockably mounted at one end on the hub, and at the other is held in place by a pin driven into the proper shaft and extending through slots formed in opposite sides of the hub. At a convenient point in the vessel a hand lever is mounted, which is suitably connected to the propeller shaft and may be actuated to slide the same longitudinally. Our illustration shows this shaft in its outer position. By drawing the shaft inwardly the propeller blades will be reversed, their crank-shaped bases, by reason of their connection with the pin on the propeller shaft, being swung on the pivot pins, which secure them to the hub.

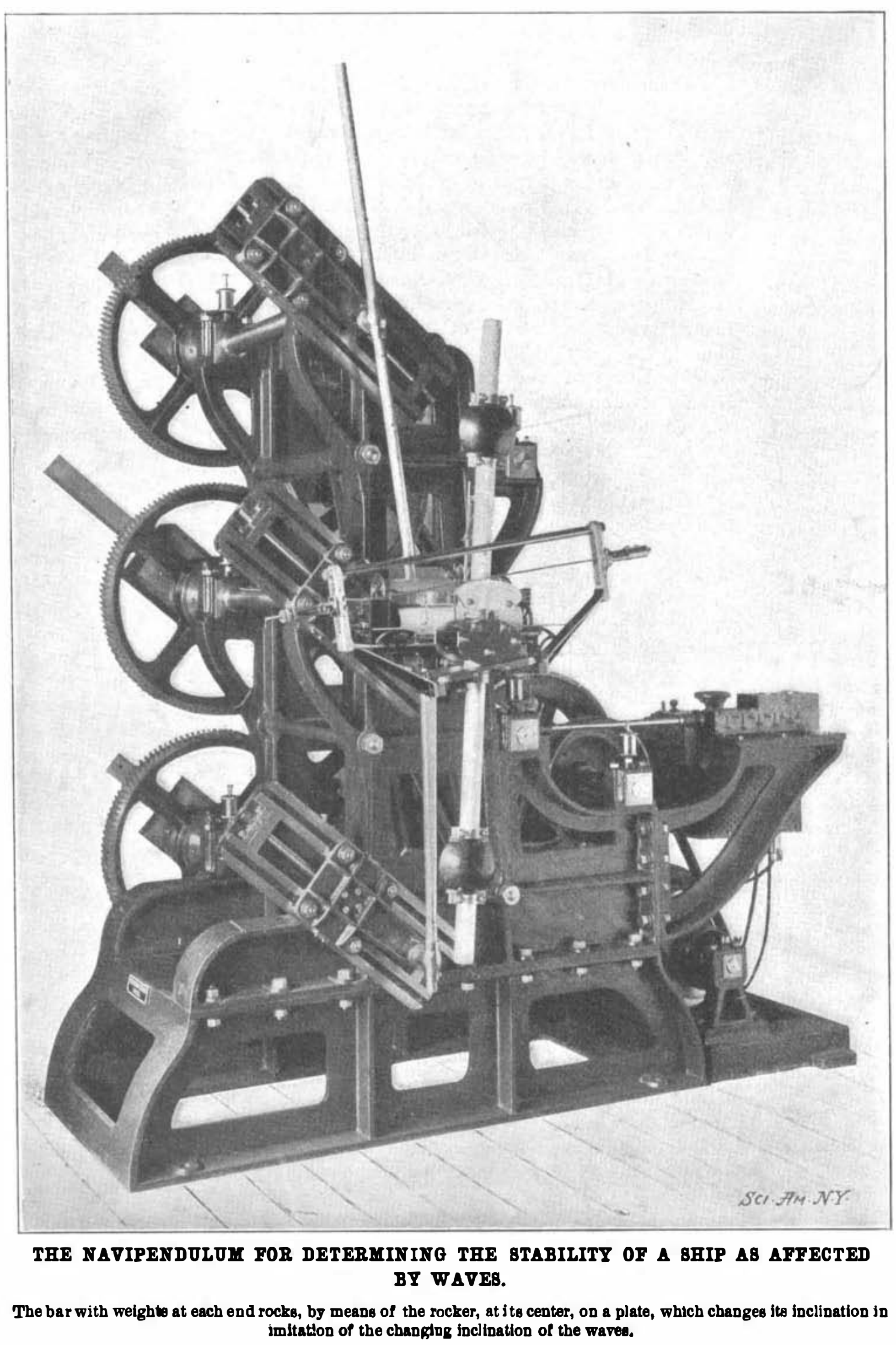
This invention will be found applicable particularly to small vessels, although of course it may be used on larger craft if desired. A patent on the device has recently been secured by Mr. Samuel Irwin, of Lindsay, Ontario, Canada.



REVERSIBLE SCREW-PROPELLER.

THE NAVIPENDULUM METHOD OF EXPERIMENT.

The movements of a ship in a body of still water are not unlike those of a pendulum, the ship, if it be moved from the perpendicular, beginning to oscillate around the vertical and coming to a state of rest after having gone through a series of oscillations of gradually decreasing amplitude. We present an illustration of an invention by Capt. Russo, of the Royal Italian Navy, which was designed to enable us to solve the problem of the rolling of ships. It will be seen that the apparatus contains a kind of pendulum which is composed of a heavy rod and two weights, one near each end. The pendulum rests and rocks through a central block upon a plate. The rocking motion of the pendulum is analogous to that of a rocking-chair or a small rocking-horse, to which the rolling motion of a ship may be roughly compared. In constructing a navipendulum, it is necessary to know certain data regarding the ship to be experimented upon, such as the displacement, form of hull, distribution of weights, metacentric height, the curve of stability, the period of oscillation, the amount of still-water oscillation, etc. All of these elements are involved, so that the instrument, if properly constructed, becomes an exact representative of the ship itself in everything that affects its rolling in still water. If the working of the navipendulum were confined, however, to still-water experiments, it would have but small practical value, as the beautiful tank experiments of the late Mr. Froude have given us all data on this subject. But the usefulness of the navipendulum begins where the tank leaves off, namely, in solving the important problem of the rolling of a ship on waves. After comparing the rolling of the ship in still water to the motion of a rocking-chair on a fixed plane, it is only necessary, in carrying the parallel further, to suppose that the sustaining plane, instead of remaining at rest, be made to oscillate, inclining and displacing itself from one side to the other in a forward and aft direction, and also in a vertical direction. The rocking-chair in this case, while following the plane of the various displacements, will, of course, have a more complicated movement than when the plane is at rest; it will incline from the vertical by angles of variable amplitude to the right and to the left. The oscillatory motion of the chair will, in such a case, be similar to the rolling of ships on waves, since it happens that the element on which the ship is supported continually changes in trim and position to the position of

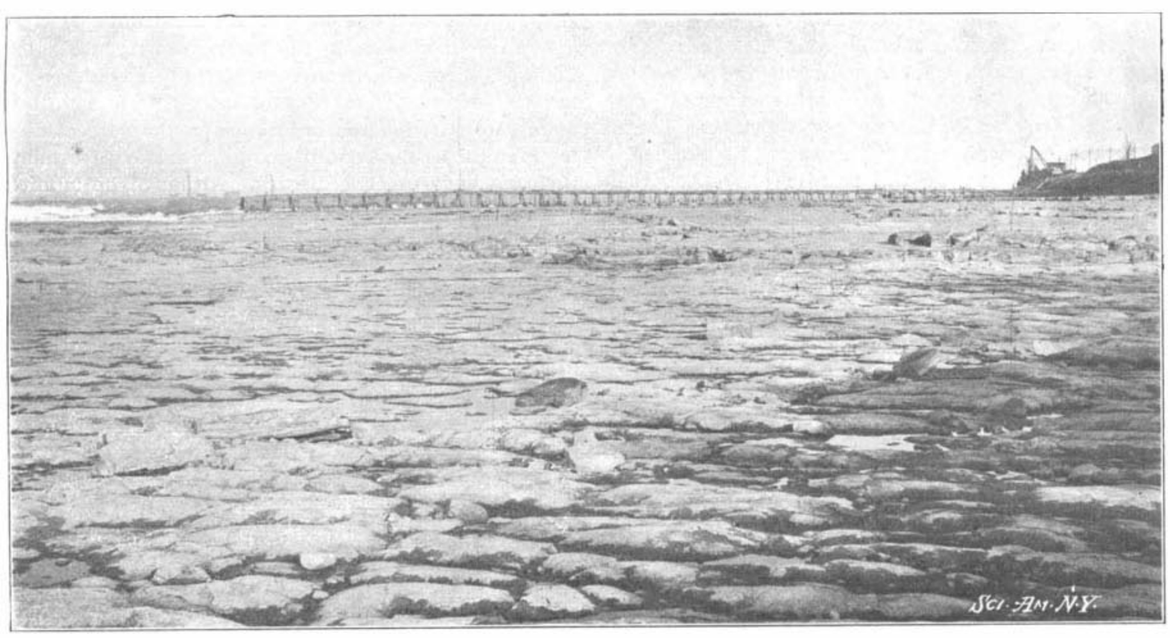


THE NAVIPENDULUM FOR DETERMINING THE STABILITY OF A SHIP AS AFFECTED BY WAVES.

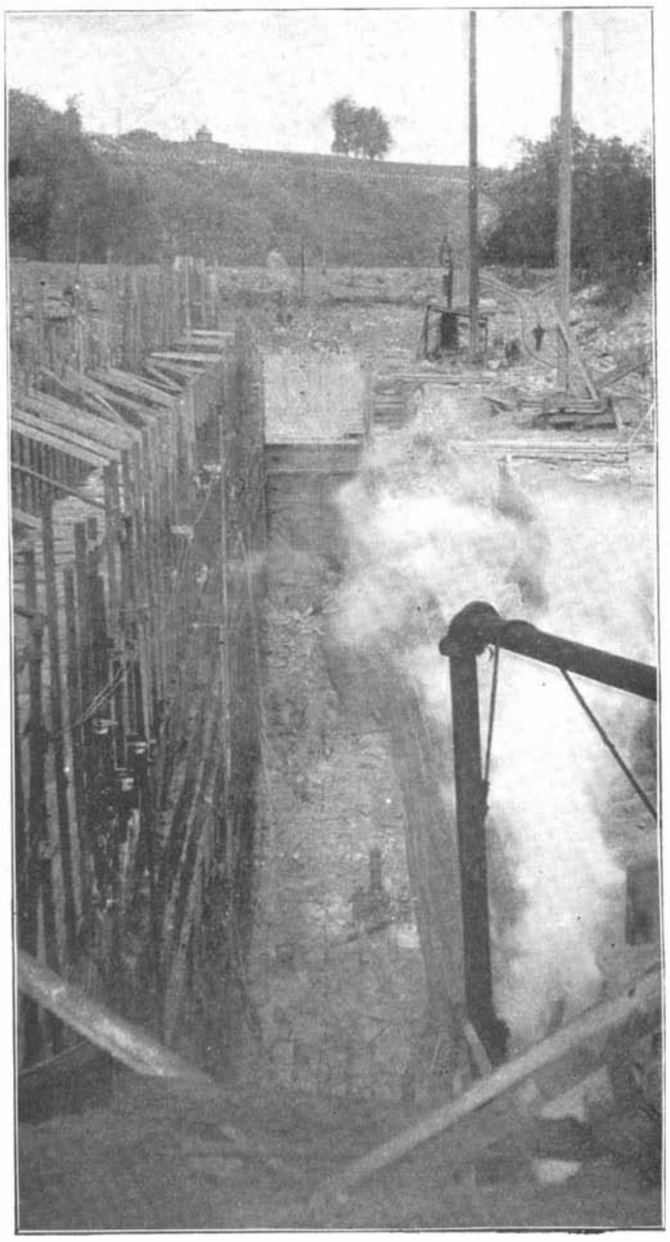
The bar with weights at each end rocks, by means of the rocker, at its center, on a plate, which changes its inclination in imitation of the changing inclination of the waves.

successive waves. While the above is but a rough comparison, the scientific process followed in Capt. Russo's method has led to the construction of an apparatus, in which it is claimed that a perfect similitude is established between the case of the ship in the waves of the sea and that of the navipendulum carried by the apparatus which we herewith illustrate. The whole object of the various axles, gears, electric motor, etc., is to give to the plate on which the navipendulum rolls a complex motion of a special nature, which is determined on the basis of the length, height and period of the wave constructed in the experiment. The navipendulum enables the naval architect to ascertain in the designing of a ship, the degree of steadiness which she will actually possess. Its importance in this respect may be judged from the fact that many ships have been found after construction to be wanting in a proper margin of stability. With the navipendulum to guide him the naval architect would never make any mistake on this question of stability. The apparatus described has been officially adopted by the Italian Admiralty, who have provided their experimental works at Spezia with an instrument of this kind.

OUTER END OF BIG WING DAM ABOVE THE DUFFERIN ISLANDS.



A LARGE SECTION OF BED OF NIAGARA RIVER ABOVE THE HORSESHOE FALL LAID BARE BY CONSTRUCTION OF DAM.



WHEELPIT OF THE CANADIAN NIAGARA POWER COMPANY.

THE NEW PLANT OF THE CANADIAN NIAGARA FALLS COMPANY.

BY ORRIN E. DUNLAP.

The Canadian Niagara Power Company is making good progress with its work on the Canadian side at Niagara Falls, and the time is fast approaching when this installation that is destined to command much attention will be completed. This company is practically the Niagara Falls Power Company, and the plan it has adopted for the development of power on the Canadian side is very similar to that so successfully established on the New York side, where a tunnel 7,436½ feet long and two wheelpits, one 424 feet long and the other 463 feet long, have been built.

On the Canadian side the scene of the power development is in Victoria Free Park, a section of territory purchased by the government for park purposes, in order that the beauty of the falls of Niagara might be preserved from vandalism and the works of man. Promoters of the industrial interests of the locality have, however, found that the park is an ideal site for a great power development, and the ideas thus developed are now being carried out in their fullest detail. The Canadian Niagara Power Company will develop power by means of a wheelpit and tunnel tailrace. The length of the wheelpit when completed will be 480 feet, but a section 266 feet in length is now being built. This pit will be 21 feet wide and 170 feet deep. It has reached a depth of about 115 feet at present. The method of construction, and the rock through which it is being sunk, are almost identical with that of the two pits on the New York side.

When completed the wheelpit will be lined with brick from top to bottom. The first section now building will afford a development of 50,000 horse power through the installation of five units of 10,000 horse power each. The contract for three of these has been awarded to Messrs. Escher, Wyss & Co., of Zurich, Switzerland, none of the shops in the Dominion of Canada having facilities for their construction. It is understood that they will be somewhat similar to the turbines installed by the Niagara Falls Power Company in wheelpit No. 2, but each of just twice the output capacity. The turbines just ordered are to be delivered within a year, and the first power from the installation is expected to be ready for delivery early in the spring of 1904.

The generators to be installed in the power station of the Canadian Niagara Power Company will also be of 10,000 horse power, or of twice the capacity of the generators in the two stations of the Niagara Falls Power Company. They will be wound for 12,000 volts, three-phase. The frequency will be 25 cycles, which will give uniformity with the plants on the New York side and allow of parallel operation. A generator that has an output capacity of 10,000 horse power will occupy but little additional space to a generator of 5,000 horse power, and while saving in space, the Canadian Niagara Power Company also secures a lower cost of generator per horse power and a lower cost of turbines per horse power. The speed of the generators will be 250 revolutions per minute. A feature of the development on the Canadain side is the fact that as the power plant will be located in Victoria Park, all of the power produced must, under the agreement with the commissioners, be transmitted beyond the park boundaries for use. Under these circumstances the voltage of 12,000 is expected to result in economy, and for long-distance transmission the voltage will be increased to 40,000 or 60,000. The power plants on the New York side will be connected with the Canadian plant by means of three cables strung across the upper steel arch bridge.

In connection with the development on the Canadian side the Canadian Niagara Power Company is constructing a large forebay. This will extend the full length of the wheelpit, but at a point where it will be bridged it will narrow down to 250 feet, passing which point it will again broaden out to 400 feet or more. The forebay will carry an average depth of 18 feet of water. From the north end of the wheelpit a canal 16 feet wide will be built for 500 feet to the river, affording facilities for an ice run. The flow in this canal will be regulated by gates. The bridge that will span the forebay will be of the stone arch type, built in five arches. It will have a width of 60 feet and will carry the tracks of the Niagara Falls Park and River Railway as well as a boulevard driveway. When finished the bridge will be one of the prettiest in the Niagara region.

The tunnel that will connect the wheelpit with the lower river will discharge very close to the foot of the Horseshoe Fall. It is 2,200 feet long, not a third of the length of the tunnel on the New York side. However, it is 25 feet high, which is four feet higher than the New York tunnel, and its width will be 18 feet. The tunnel has been driven, and the contractor, Anthony C. Douglass, is now removing the bottom bench, having taken out about 1,200 feet of it, or more than half. Owing to the great scarcity of brick, in lining this tunnel concrete is being used from the spring line down, but the concrete lining will have a facing of vitrified brick. This application of concrete will do away with 3,000,000 brick, but 1,250,000 brick will be used in forming the arch. Owing to the closeness of the portal to the Horseshoe, the masonry to be built there will be massive. As it is located at a point where ice gathers in immense quantities in the winter time, it will be subjected to great stress. This work will not be begun until next spring, owing to the nearness of the winter season. At the portal about 60 carloads of granite from Quebec and 200 carloads from Queenston will be used. In timbering the tunnel over 2,000,000 feet of lumber was used.

A SECOND GREAT POWER PROJECT.

The Ontario Power Company is also working on its project for the development of power in Victoria Park. This company's plan is to develop power on somewhat the same principle as that in use by the