A PENDULUM PROPELLER.

We have been favored by Mr. H. C. Vogt, M. Inst. Danish C. E., of Copenhagen, with photographs and an account of his new system of propelling and steering vessels, a system which is both new and ingenious. If an inventor should try to imitate artificially the movements of a man's leg, the impossibility of providing for the innumerable motions would soon be evident, but if any one of the motions of the leg be singled out, it is possible to obtain even better results by art than by nature. Mr. Vogt says that if from the animals capable only of moving on land, we turn our attention to aquatic animals or fishes, the examples for imitation become less complex, because in water, even the weight of the fish and the art of balancing is so simplified that the action of the tail or propeller is almost limited to propulsion and steering. In this case there is consequently something to imitate. The art of nature is concentrated in single lines of action which can be partly imitated. Anyone who has watched with what ease a dolphin passes an Atlantic liner, running at a speed of 22 knots, will readily see that the tail of some swimming animals must possess sufficient area to act on the water, and to avoid losing power. This area is bound to oscillate in accordance with the law of harmonic motion. When these propellers of nature oscillate, they communicate lateral as well as sternward velocity to the water, but a subsequent stroke always takes up a good deal of lateral energy given to the water by a previous stroke, whereas with real propellers this corresponding lateral energy is dispelled. From these and other deductions which Mr. Vogt has made both experimentally and mathematically, he has been able to construct an apparatus for propelling, steering, and maneuvering navigable vessels. The device is one by which propelling, steering and maneuvering are all effected by means of a rudder whose head is formed as a shaft and mounted in a tube fixed perpendicularly, or approximately so, to an oscillatory driving shaft. It is connected at its upper end through a spring or springs to a steering and maneuvering device, so that the oscillation of the driving shaft and the consequent pressure of the water on the oscillating rudder causes it to execute movements similar to those of the tail of a fish, and compounded of oscillations about the axis of the driving shaft and oscillations about the common axis of the tube and the rudder-head, while the mean position of the oscillating rudder in relation to the tube can, by means of the steering and maneuvering device, be fixed or varied, as required in order to fix or change the direction of motion of the vessel. The apparatus is adapted for use in a steam vessel of ordinary construction and to be mounted therein with the rudder in a position under the stern similar to that ordinarily occupied by a screw propeller. The upper end of the rudder-head, formed as a shaft, is connected by a universal joint having its center in the axis of the driving shaft, with a steering and maneuvering shaft whose upper end is connected to springs tending to prevent the rotation of the steering and maneuvering shaft about its own axis in both directions, so as to be put under stress by the pressure of the water on the rudder-blade when it is oscillated and thereby to limit such oscillation. The rudder-blade is preferably laminated so as to impart to it elasticity, which has been found to increase its efficiency.

The rudder-head, instead of extending upward beyond the oscillating driving shaft and having a spring or springs secured to its upper oscillating end, terminates at the driving shaft and is connected with a vertical shaft having a stationary axis, by means of a universal joint, whose center is in the axis of the driving shaft. The upper end of the shaft has fixed to it a disk or wheel, *A* (see diagram), which is connected by radial helical steel springs, *C*, with a ring, *B*, which is mounted on and kept down to a support by means of catches. The ring, *B*, can be turned by means of a worm, *D*, driven by bevel wheels, *E*. The connection between the wheel and the ring enables the position of the vertical shaft to be altered as required by turning the ring by means of the worm, the turning power being transmitted by the springs. The oscillation of the tube with the rudder-blade is similar to that of a pendulum, its speed varying gradually from zero when most to one side of the vessel, through a maximum when vertical, to zero when most to the other side of the vessel, and vice versa, so that when the vessel is moving straight ahead, the position of the blade may, under the combined action of the springs and the water, vary gradually from being directly fore and aft when farthest a-port and farthest a-starboard to being most inclined to a directly fore and aft position (in one direction or the other, according to the direction of motion of the tube) when the tube is vertical, so that the springs are then at their greatest tension and have accumulated a certain amount of energy, which returns the blade to its directly fore-and-aft position during the remainder of its semi-oscillation about the axis of the shaft. Experiments indicate that the rudder-blade should not make an angle greater than 45 degrees with a directly fore-and-aft position when the tube is vertical. The amplitude of oscillation of the tube may be 80 degrees. By turning the shaft, by means of the ring, *A*, through angles up to 90 degrees, in one or the other direction, the vessel can be turned to port or to starboard, as desired, since the rudder-blade will be more perpendicular to its direction of motion, and will consequently act more forcibly on the water when moving in one-half oscillation than in the next, while by turning the shaft through 180 degrees the motion of the vessel can be reversed. The desired oscillation can be imparted to the shaft by any suitable means, for example, an arm projecting therefrom may be jointed to the piston rod of an oscillatory steam cylinder. Instead of steel springs such as described, pneumatic cylinders or cushions may be employed.

PENDULUM PROPELLER DRIVING FORWARD, SHOWING SHAFT.

PROPELLER DRIVING ASTERN.

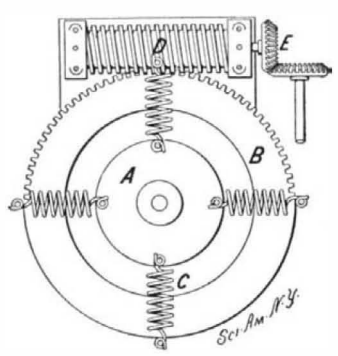
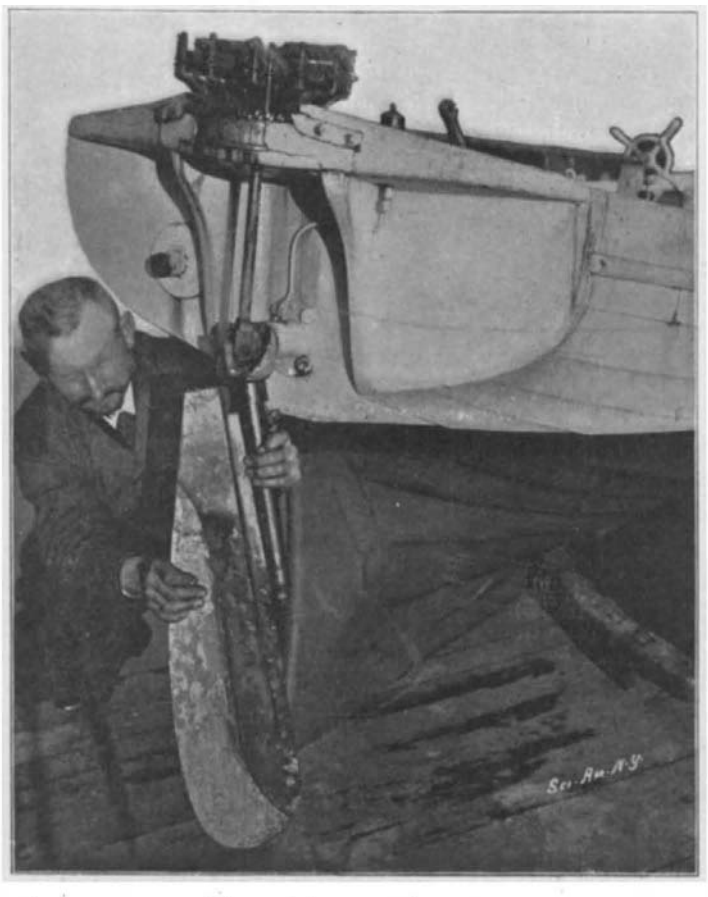


DIAGRAM OF TOP OF STEERING HEAD.

Mr. Vogt has made important experiments, beginning in the autumn of 1900, with a screw boat 20 feet long, 5 feet broad, draft of 2 feet and a displacement of about 1½ tons. The petroleum engine had an indicated effective horse power of 1.7 at 300 revolutions. Power is transmitted to the old propeller shaft by means of bevel gears, so that the revolutions of the engine are reduced from 300 to 120. By means of a crank and connecting rod these revolutions are transmitted to the rocking shaft of the pendulum propeller, making 120 double swings, corresponding to the 300 revolutions of the motor. The experiments showed high efficiency and it was found that the driving thrust of the pendulum propeller was greater than the screw propeller, and that the maneuvering ability was greater than attainable by twin screws and helm together, on account of the greater length between the propeller and the center of turning of the ship. The Russians have decided to see if the pendulum propeller is better for the purpose of ramming than the screw-propeller, and their government has ordered a launch furnished with a pendulum propeller, but it is not believed that the conditions are favorable, because the engine power is great in proportion to the size of the boat. The illustrations which we have reproduced, showing the propeller in various positions, were especially made for the Scientific American by lifting the boat with a crane, and it is only fair to state that the boat is an old one, originally fitted with a propeller. Mr. Vogt has bought the hull of an old Danish gunboat of 100 tons displacement. A pendulum propeller 7 feet long making two double swings per second, corresponding with two revolutions of the engine per second, will be provided. This will give the vessel a speed of 7.3 knots and require 40 effective horse power. This would give the ship the same speed as 50 or 53 horse power with screw propellers, but a 50 horse power screw engine might weigh less. Mr. Vogt considers that a steam turbine in connection with proper gear might solve the difficulty of weights, and until this difficulty with the engine is solved, the pendulum propeller will be limited to sailing ships. Mr. Vogt thinks if some clever American could solve the problem of the engine, the propeller itself would be very much superior to the screw propeller in every respect.



VOGT'S PENDULUM PROPELLER, SHOWING BALL-AND-SOCKET JOINT AND STEERING MECHANISM.

Irrigation Society's Protest.—The Executive Committee of the southern California section of the National Irrigation Association has formulated a telegram of protest which has been sent to President Roosevelt. The telegram calls the President's attention to a report sent out from Washington that he would recommend to Congress action for the reclamation of the arid lands which will have the effect of intrusting to the States, instead of the agents of the Federal Government, the systematic development of the plans for irrigation works. The committee represents that such a policy would be a serious error and a death blow to the National irrigation movement, and to an era of home building on the public domain.

The telegram also calls the President's attention to his letter of November 16, 1900, to the National Irrigation Congress at Chicago, which it is said "crystallized the sentiment dominating that convention, that the reclamation of the arid lands must be kept absolutely within the control of the national government."

Electric pickling of iron, according to a recent patent, is accomplished by using an electrolyte consisting of acid and alkaline, or alkaline-earthy salts. An example of such an electrolyte consists of 1,000 pounds of common water, 100 pounds of hydrochloric acid, 5 pounds of sulphuric, 5 pounds of hydrofluoric, and 15 pounds of caustic soda or potash. A bath lined with lead is used, and the iron or steel to be cleaned forms the cathode, the anode consisting of platinum, lead or carbon.