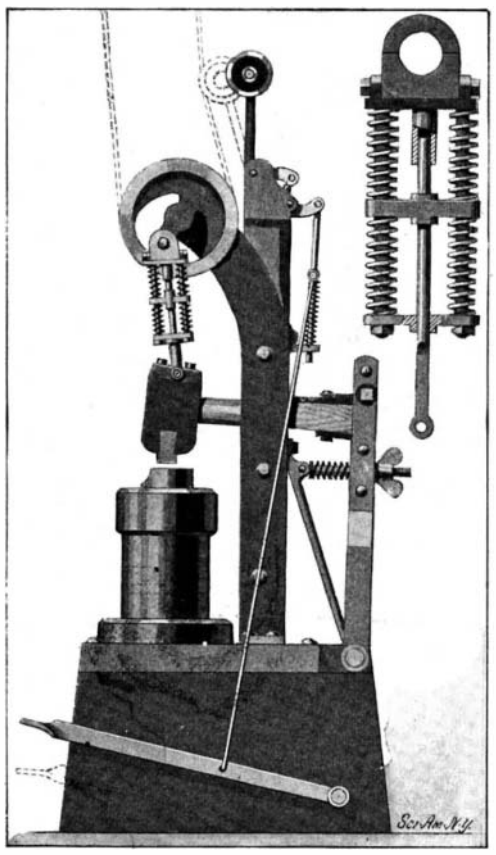
AN ADJUSTABLE POWER-HAMMER.

The inventions which have recently been patented in the United States include an adjustable power-hammer devised by Mr. Abel Sack, of Ashton, Neb.

The handle of the hammer, as our illustration shows, is hung on centers carried by a link, the lower end of which is fulcrumed on the base. By means of a screw-rod surrounded by a spring which presses on the link and on an inclined brace extending from the base to a central upright, the link is caused to swing forward or backward so as to shift the hammer and its die according to the nature of the work in hand.

The hammer-head is pivotally connected by a yielding pitman with the wrist-pin of two counterbalanced crank-wheels driven by a belt. Our smaller illustration shows that the pitman consists of a head from which a tubular portion depends, designed to receive the upper end of a shank pivoted to the hammer. The shank carries a cross-head through which guide-rods extend. Springs are coiled around the guide-rods, and press against the cross-head on opposite sides. The pitman yields in the direction of its length; for an upward pressure of the hammer on the pitman causes the cross-head to press the springs.



SIDE ELEVATION AND DETAIL OF POWER-HAMMER.

By hanging the hammer on a link pressed outward by a spring, and by connecting the hammer with a yielding pitman to the crank-wheels, it is evident that the desired blow to be given can be struck with any pressure. Objects of any kind can be readily fashioned by this trip-hammer, owing to the yielding pitman and to the transverse adjustability of the hammer relatively to the anvil.

In order to tighten or loosen the belts and simultaneously to actuate and stop the hammer, tightening pulleys are employed which are operated by a treadle through the medium of a system of levers and links. When the hammer is idle the belts run loosely around the crank-wheels. By pressing the treadle the tightening-pulleys are thrown forward against the belts to tighten them. When the pressure on the treadle is released, a spring automatically withdraws the tightening-pulleys from the belts.

The hammer delivers a drawing stroke, since it is supported so that it can move longitudinally.

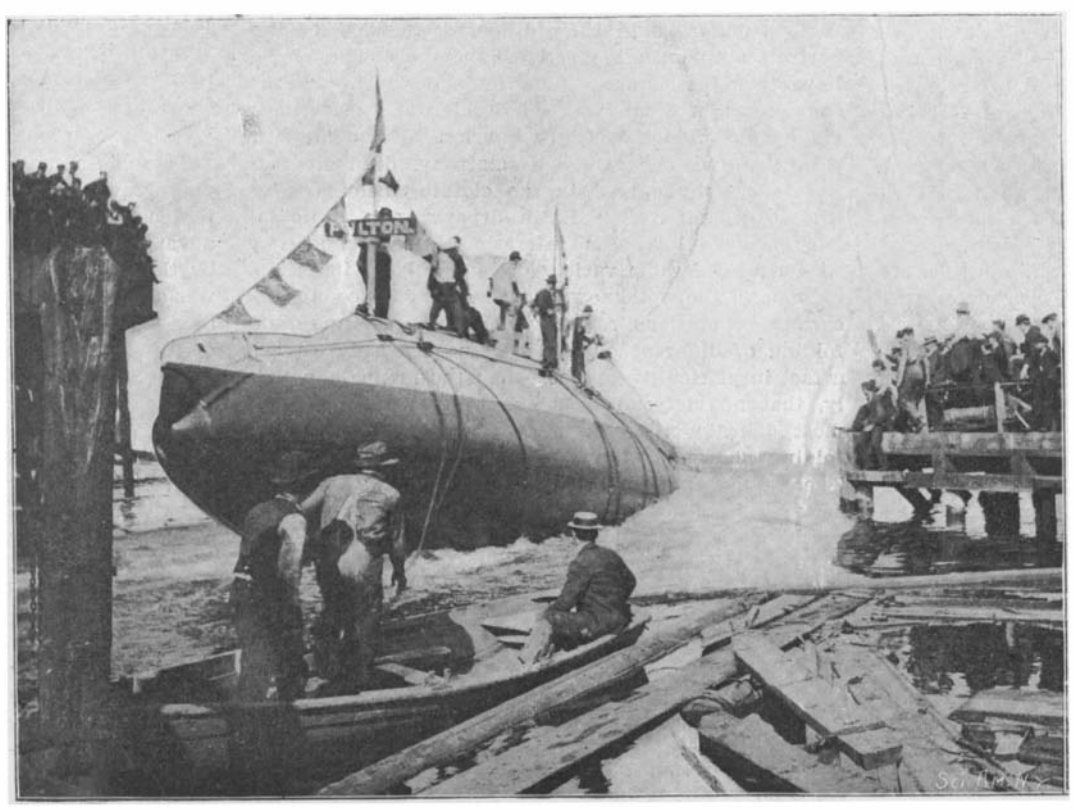
LAUNCH OF THE SUBMARINE TORPEDO BOAT "FULTON."

The launch of the submarine torpedo boat which is herewith illustrated affords practical evidence of the fact that the possibilities of submarine warfare are being fully recognized and tested by the great naval powers of the world. It is to the French navy that we owe the present awakening of interest in this subject, and their elaborate course of experiments in the Mediterranean are fresh in the public mind. Antedating these French experiments were those of the British government with the "Nordenfeldt;" but for the past decade and a half the English navy have done practically nothing in this direction. It is but just to say that the present interest in the question of submarine warfare is largely due to the indomitable energy and confidence of Mr. Holland, the inventor of the type of submarine recently adopted by both the British and American navies.

At present there are six boats of the Holland type under construction for the United States navy. Four of these, the "Adder," "Moccasin," "Tortoise" and "Shark," are under construction by Lewis Nixon at Elizabethport, N. J., and two, the "Grampus" and "Pike," are being built at the Union Iron Works, San Francisco. The vessel shown in our illustration, which was launched on June 13 at the Nixon shipyard, is identical with these vessels in every particular. She was built for the Holland company to be used as an experimental vessel, and in a few weeks' time she will make a series of trial runs in Peconic Bay. In these trials every part of the equipment and motive power is to be subjected to thorough test, and the experience thus gained will be incorporated in the six boats which are now in frame and plated at the two yards where they are under construction. The vessels are similar in general design to the "Holland," which has been illustrated at different times in the SCIENTIFIC AMERICAN. The length over all is 63.33 feet, the diameter 11.75 feet, and the displacement when submerged 120 tons. The vessel is driven by a single screw, and motive power is furnished by four-cylinder Otto gasoline engines of 160 indicated horse power, and by electrical motors of 70 horse power. The gasoline engine will be used for propulsion on the surface, and also for charging the batteries, which will be drawn upon by the 70-horse power motor when the vessel is submerged. When the gas engines are charging the batteries, the electric motor is used as a dynamo. The armament consists of a torpedo tube, which is provided with five Whitehead torpedoes. The conning tower is 21 inches in diameter and is protected by 4 inches of armor. The speed is to be about 7 knots an hour.

There are separate engines for operating the vertical rudder, and the two horizontal diving rudders. These engines are worked by air at a pressure of 50 pounds, supplied from six storage flasks which carry air at a pressure of 2,000 pounds to the square inch. The necessary reduction of pressure is secured by means of a reducing valve.

In recent government trials between Annapolis and the Norfolk Navy Yard, the "Holland" (the precursor of the improved boats, of which the "Fulton" is the first) ran a total distance of 145 miles. The trip was a surface run, and the actual speed, after corrections, was 5 2-3 knots. The temperature did not rise above 60° F. For surface propulsion the ventilation arrangements were good, and under submarine conditions, although the commanding officer detected an odor from the gas, the crew appeared to suffer no discomfort. The report states "the behavior of the boat and of all mechanisms was excellent" with a few minor exceptions.

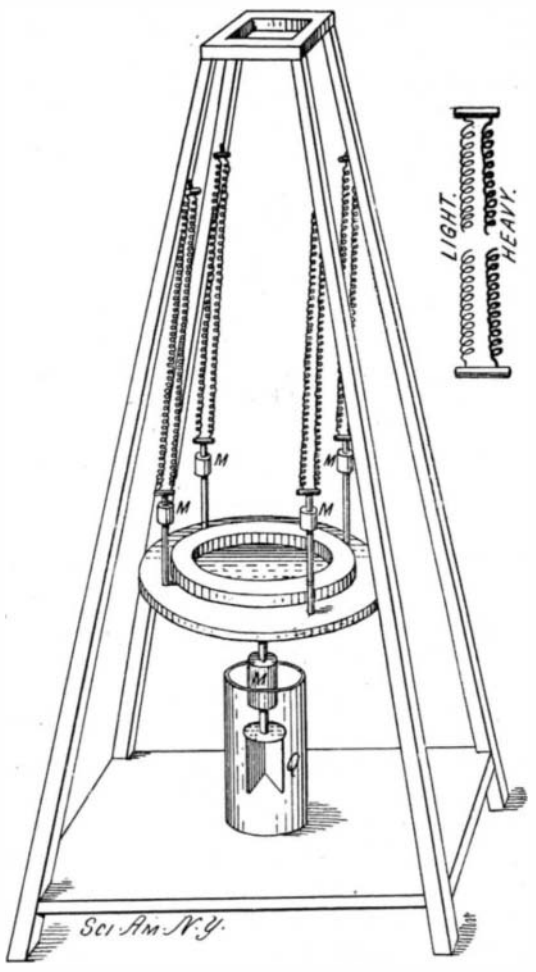


LAUNCH OF THE SUBMARINE BOAT "FULTON."

THE FORM OF MERCURY BATH—EXPERIMENTS AT THE OBSERVATORY OF PARIS.

BY J. GUENAIRE.

The mercury bath is an indispensable adjunct to the telescope used to observe the passage of a star at the meridian of observation. As the angles are counted from the vertical, it is essential that the latter should be accurately determined; this is carried out by the use of the mercury bath. The telescope is directed perpendicularly over the bath, and in consequence two images of the cross hairs near the eye piece are formed. One of these is formed directly and the other by reflection from the mercury; if the telescope is exactly vertical the two images coincide.



MERCURY BATH, HAMY SYSTEM

It is then observed whether the zero of the graduated circle at the side of the telescope corresponds with the zero of the vernier, or if not, what correction is to be added or subtracted. At the Observatory of Paris the question of mercury baths has been carefully studied of late, owing to the fact that the Observatory is located in the center of the city and the surface of the mercury is troubled by the vibrations of the soil. Among the different forms of mercury baths in use may be mentioned, first, the bath formed of a material which is wet by the mercury; it has certain advantages, the reflected image being fixed, but diffused. This want of sharpness may come from vibrations which are very rapid, but of small amplitude. Second, grooved baths; in these the vessel has grooves on the bottom 0.12 inch wide by 0.12 inch deep. This form was studied by Leverrier in 1869, and its introduction was considered as improving notably the observations of the vertical, and was thought to have entirely suppressed the influence of vibrations. In fact, the image is improved, but to a degree quite insufficient for permitting the observation of the nadir during the day. Third, floating baths; a floating bath with a thin layer of mercury, proposed by P. Gautier, was tried with success at Paris and Melbourne, but it was afterward shown by Perigaud that its advantages had been wrongly attributed to the floating, and his experiments show that it is the thickness of the mercury which comes into play. The images are sharper as the layer is thinner. It is on this principle that are established the baths which are at present in use at the Paris Observatory for meridian observations. Fourth, suspended baths; this type of bath appears to have been proposed by Seguin and Mauvais in 1852. After placing the bath upon rubber plates or cushions they found that the best results were obtained by suspending it from rubber bands, and concluded that elasticity by traction is preferable. At Melbourne, Mr. Ellery, in 1888, found that the rubber band system overcame the large trepida-

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