always locked, and will not act until the torpedo is clear of the vessel discharging it. The torpedo is always ready for practice, and requires no readjustment or preparation, except oiling the bearings after every second discharge. A depth register takes the place of the firing pin in practice shooting, and records an exact curve of the immersion during the run.

Any system of discharge may be employed which permits of a motion of the torpedo about its longitudinal axis, such motion being the gyroscopic resultant of a vessel's movements, or of pointing, and the energy of the flywheel. This is accomplished by allowing a slight rolling motion to the discharge tube, or to the torpedo support within it, which automatically returns to normal position when the motion ceases. The roll in these circumstances is small. If the torpedo be launched when rolled, the steering rudders at once operate to right it, without deflection.

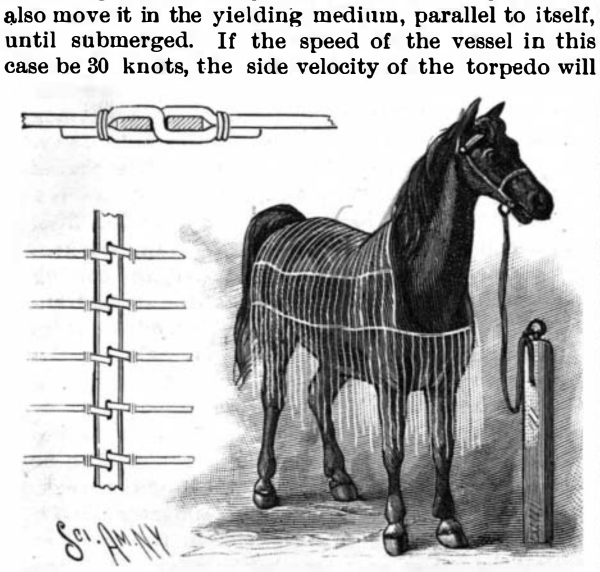
The Howell torpedo, by its gyroscopic principle, is the only torpedo entirely automatic in maintaining its direction. It has no ballast, but, after launching, automatically takes the depth for which set, and directs itself in a vertical plane. Its course in a horizontal plane is straight, and independent of the action of deflecting forces. It steers itself automatically, though not in the generally accepted sense of boat steering. Ordinarily, a boat is steered on a course by using a rudder to return to such course when forced off it by any agency; but the torpedo when acted on by similar exterior forces, simply rolls to the right or left, instead of changing course to the right or left, and this rolling causes the regulator to give a series of impulses to vertical rudders, which produces a resultant motion of the torpedo opposite to that given by the exterior deflecting force. The result is that the torpedo, having been rolled by a deflecting force, is rolled back to normal position by the automatic action of the rudders, there having been no change in the original direction or course. This directive force was practically tested with a small 30 in. model having a 15 lb. flywheel, by a board of U. S. ordnance officers, who attempted to turn it in the water, the propellers being detached, and the wheel revolving 9,000 turns per minute, and they reported as follows:

"On taking hold of rear end of torpedo and pulling at right angles to length, it moved parallel to itself, rolling at the same time, but no deflection could be produced." This force is at its maximum at the moment of launching, when a torpedo is subjected to the strongest deflecting influences, and may be explained as follows to those who are not familiar with the principles of the gyroscope: Viewed from the right hand side of the torpedo, the wheel revolves, as shown by arrows, *a*, *b*—Figs. 3 and 4. A force acting on the point of the torpedo, tending to deflect it to the left, would act on the flywheel as a force at A and B tending to slue the latter; but the force at A acting on the particles moving in the direction, *a*, would have a resultant in the direction, A^1, and the force at B acting on the particles moving in the direction, *b*, would have a resultant, B^1; hence the torpedo can only roll to left instead of being deflected. The vertical rudders thereupon acting to turn the tail of the torpedo to the left and its point to the right produce a resultant, C, until the wheel—and torpedo—are rolled back to their normal vertical position, and without deflection from the torpedo's course. The amount of the roll depends upon the relation of the deflecting force to the energy of the wheel. In the 8 ft. torpedo the radius of gyration of the flywheel is 5·4 in.; therefore, at 10,000 revolutions per minute, the average speed of the particles is 470 ft. per second, and the energy is 167 foot tons. If the torpedo be discharged, point first, into a wave from the broadside of a vessel moving at high speed, the deflecting force will operate to roll the torpedo, and also move it in the yielding medium, parallel to itself, until submerged. If the speed of the vessel in this case be 30 knots, the side velocity of the torpedo will be $50\frac{7}{10}$ ft. per second when striking the water. Therefore, this deflecting force being insignificant compared with the flywheel energy, the resultant roll will be small. The directive force and propelling power are stored in a steel flywheel by giving it a high velocity of rotation, the source of power being external to the torpedo. The stored power is then transmitted directly from the flywheel to the propellers, and does not require to be worked off through an engine, as in other systems of propulsion. At 10,000 revolutions of its flywheel per minute, the energy in the 8 ft. torpedo is 375,000 foot pounds—167 foot tons; at 12,000 revolutions it is 550,000 foot pounds—245 foot tons; the elastic limit of the wheel is not reached under 14,500 turns per minute, when the stored energy would be 778,800 foot pounds—347 foot tons. The force is imparted by means of a motor actuated by either steam, electricity, compressed air, etc., as may be most convenient for the required service, and can be so imparted in thirty seconds, and thereafter sustained for any length of time, and until the instant of launching through tube or from a protected port. By taking a longer period to apply the force, as when preparing the vessel for action, or to charge upon the enemy, a motor of less power can be employed; in a small vessel the motor can be operated by stored force. It takes one minute to charge the 8 ft. torpedo with 375,000 foot pounds of energy, using a motor of 12 horse power, and five minutes for the same transmission of force with a motor of two horse power. After attaining 10,000 revolutions per minute, and detaching the motor, the flywheel of the 8 ft. torpedo, geared to its shafts and propellers, continues to revolve for one hour in the air.

As the energy in the flywheel increases as the square of the revolutions, while the resistance to propulsion varies as the square of the velocity, the speed of the torpedo should increase in direct proportion to the number of revolutions made. It is found that the increase is in somewhat greater proportion with the higher speeds—speeds above 18 knots being more easily attainable in wholly submerged bodies. With the wheel spun to 6,400 revolutions—an energy of 150,470 foot pounds—the mean speed of the 8 foot torpedo is 18 knots for the first 200 yards of a total range of 500 yards. With 8,400 revolutions the mean speed is 24 knots for the first 200 yards of a total range of 800 yards—an increase of one-third speed with less than one-third added revolutions. This wheel is now run at 10,000 revolutions, and two-fifths of the entire energy are expended in giving relatively higher speeds before the revolutions are reduced to 8,400, when, as noted, the mean speed becomes 24 knots for the following 200 yards; and three-fifths of the energy expended before the revolutions are reduced to 6,400. The twin screws of the 8 foot torpedoes are $5\frac{3}{4}$ inches diameter, $7\frac{1}{2}$ inches pitch, and are geared down—3 to 5—to the flywheels by bevels, making 6,000 turns per minute when the flywheel makes 10,000. The speed is greatest at the start, and gradually decreases during the run of a thousand yards. It was at first intended to equalize the speed, and an attachment was designed to give a uniform thrust of the propellers for 600 yards. It is, however, found preferable to develop a very high speed for 300 yards, and a high average for a greater distance, retaining the long range. The mean speed for each 100 yards is easily determinable, and will be marked upon a sight. Furthermore, for bow fire, the initial speed is now so great that the danger experienced in fast vessels of overrunning their own torpedoes would be avoided.—*The Engineer.*

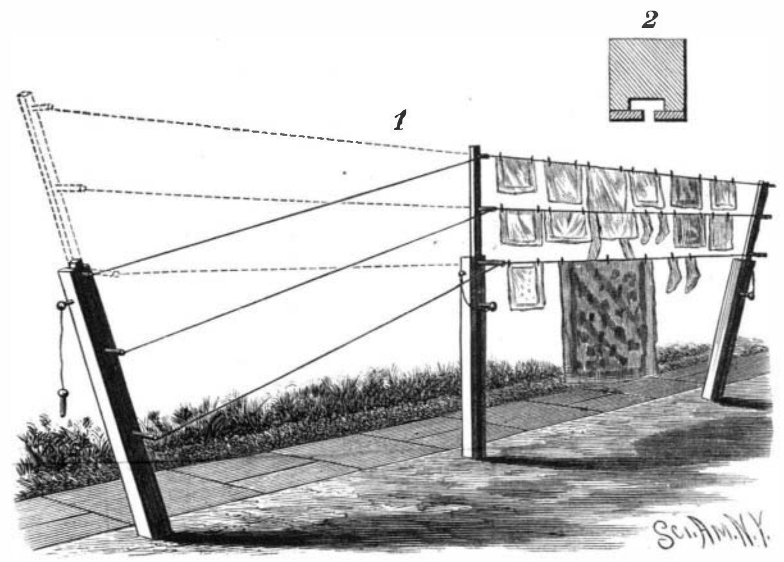
AN IMPROVED FLY NET.

A fly net in which the transverse straps are more securely held than by the ordinary fastenings, the net being more solid and durable, and adapted to lie snugly upon the horse, is illustrated herewith, and has been patented by Messrs. Vinton A. and Frank S. Weaver, of Moundsville, West Va. The longitudinal straps or bars of the net are made with perforations, either round or oblong, to receive through them the engaging ends of the transverse straps or lashes, arranged in pairs. The two transverse straps of each pair have their ends continued sufficiently beyond the edge of the longitudinal strap to allow of their projecting end portions being secured each to the body of the other by wire clips or other suitable fastenings. Each strap is thus secured by two clips or fastenings instead of one, thereby giving the straps a more solid hold, although no increased number of clips is used.



WEAVER'S FLY NET.

AN IMPROVED CLOTHES DRIER.



COX'S CLOTHES DRIER.

A device for supporting lines for drying clothes, whereby the lines may be readily raised or lowered as desired, and which will afford a large amount of drying room in a small space, is illustrated herewith, and has been patented by Mr. George Cox, of No. 123 South Sixth Street, Reading, Pa. The posts are preferably arranged three in a row, the two outer ones inclined away from the central vertical one, and all arranged adjacent to suitable walks. The posts are provided in one face with a guideway, as shown in section in Fig. 2, in which sliding bars are adapted to move up and down, the bars having pegs projecting through the slots to which the lines are secured. The pegs are of different lengths, so that the clothes on the upper lines may fall clear of those below. In hanging clothes, the sliding bars are all lowered, the bars being raised as the top lines are filled, and when all are hung the lines will be held straight, as shown in the dotted lines, the bars being held in their uppermost position by a pin inserted under them in each post. The incline of the end posts is such that the end of each line is raised practically in a line tangent to the arc of a circle struck from the center of its peg in the vertical bar, so that the line is kept nearly taut in any position, except when the vertical bar is down.

AN IMPROVED BRIDLE FOR BROOMS OR BRUSHES.

A simple and cheap bridle for effectually retaining a broom head in its proper place between the rows of broom corn is illustrated herewith, and has been patented by Mr. Robert E. Copson, of Omaha, Neb. It consists of a single piece of wire bent to form a loop, and with an upwardly projecting arm having an eye, the illustration showing the bridle open, closed, and as applied to the broom. In the eye is inserted a wire nail which is driven into the inner end of the handle. It is claimed that only one row of stitching will be needed when this bridle is used, that the broom corn can be worn down to the bridle, and that the broom will not get loose on the handle.

COPSON'S BROOM OR BRUSH BRIDLE.

The Huckleberry and Blueberry.

They are the only ones of the popular berries, says a contemporary, that have not been improved by cultivation. Middle-aged men can recall the time when the strawberry and blackberry were rather poor, commonplace fruit, but they have been cultivated, grown from seed, and the result is the toothsome berries which now adorn our tables. But the huckleberry we eat now is the same which tickled the palates of our great-grandfathers. Word has gone forth to improve this berry, to grow it in gardens from seed, and select the variety which gives the best result. It is not generally known, but nearly all our edible plants and fruits were originally weeds, or of so inferior kind as to be scarcely fit for human uses. But for countless generations man has been improving his environment, but more especially the grains and fruit upon which he now lives. The human palate itself must have been greatly improved in sensibility, owing to the difference between what fruits and vegetables were and what they are. There are those who think that this process is to go on, and that other weeds will be turned into useful plants, and that by scientific methods the quantity of food will be at length so great that no human being will ever die of starvation.

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