fic Ocean, belonged to one widely distributed species, excepting one other kind obtained off the coasts of Japan. The hammer-headed shark (*Zygæna malleus*) was taken by us only with a net on the coasts.

The sharks were often seen attended by one or more pilot fish (*Naucrates sp.*), as well as bearing the "suckers" attached to them.

I often watched with astonishment from the deck this curious association of three so widely different fish as it glided round the ship like a single compound organism. The sharks, as a rule, were not by any means so easily caught as I had expected. Frequently they were shy and would not take a bait near the ship, though they never failed to bite if it was floated some distance astern by means of a wooden float. It is always worth while for naturalists to take what sharks they can at sea, since their stomachs may contain rare cuttle fish which may not be procured by any other means.

The sharks caught were always suspended over the screw well of the ship. It was amusing, on the first occasion on which one was got on board, sprawling and lashing about on the deck, to see two spaniels belonging to officers on board, put their bristles up and growl, ready to fly at the fish. The dogs would probably have lost their heads in its mouth if not driven back. Sometimes the sharks were bold enough and would bite at a bit of pork hung over the ship's side on the regulation shark hook, which is supplied to ships in the navy, and which is an iron crook as thick as one's little finger, and mounted on a heavy chain.

No shark was hooked during the voyage which was large enough to require such a hook. Nearly all the sharks caught and seen were very small, from five to seven feet in length. The largest obtained was, I think, one netted at San Jago, Cape Verde Island, which was four feet in length. Large sharks seem scarce. I was disappointed, and had expected to meet with much larger ones on so long a voyage. The largest shark known seems to be *Carcharodon rondelettii*, of Australia. There are in the British Museum the jaws of a specimen of this species which was thirty-six feet and a half in length (Gunther's "Catalogue of Fishes.") The Challenger dredged in the Pacific Ocean in deep water numerous teeth of what must be an immensely large species of this genus.

The great basking shark (*Selache maxima*), a harmless beast with very minute teeth, ranging from the Arctic seas to the coast of Portugal, has been known to attain a length of more than thirty feet. Sharks occasionally seize the patent logs, which, being of bright brass and constantly towed, twirling behind ships, no doubt appear to them like spinning baits intended for their use.

The pilot fish often mistakes a ship for a large shark, and swims for days just before the bows, which it takes for the shark's snout. After a time the fish becomes wiser and departs, no doubt thinking it has got hold of a very stupid shark, and hungrily wondering why its large companion does not seize some food and drop it some morsels. The "suckers" often make the same mistake and cling to a ship for days when they have lost their shark. I fancy that porpoises and whales, when they accompany a ship for several days, think they are attending a large whale. A humpback whale followed the Challenger for several days in the South Pacific.

RECENT MECHANICAL INVENTIONS.

Messrs. Michael Furst and William Chadwick, of Brooklyn, N. Y., have patented an improved machine for spinning hemp yarn. The improvement relates more particularly to the condenser of hemp spinning machinery, and to devices for rubbing the sliver and polishing the yarn.

An improved lathe dog, provided with a movable or adjustable arm or carrier to adapt it to hold objects at points more or less remote from the center, has been patented by Mr. B. F. Cloud, of Philadelphia, Pa.

Mr. J. D. Russell, of Lebanon, Mo., has patented an improvement in tire tighteners, which is operated by means of a cam and lifting bar, so as to expand the felly and make room for leather washers at the end of the spoke.

An improvement in bench vises has been patented by Mr. Thomas Gremmit, of Rockford, Ill. It is constructed so that it may be readily adjusted for different kinds of work, and for holding work of different shapes.

A Life Saving Bow.

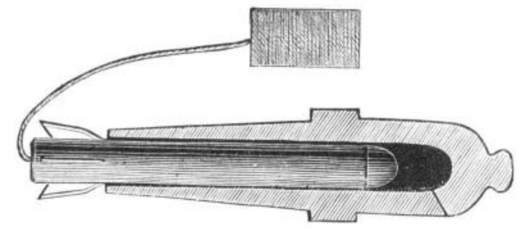
Seeing that wrecks very frequently occur within two or three hundred yards of shore, a correspondent suggests that an efficient aid to the life saving service in such cases might be found in a bow light enough to be carried in the hand and strong enough to throw an arrow with a light line to a ship in distress, or from a ship to the shore. A cord 3-16 of an inch in diameter would suffice to haul off a line strong enough to carry a cable, and much valuable time might thus be saved. To drag a heavy gun a mile or two along a sandy beach, with other heavy apparatus, involves more labor and loss of time than can well be afforded by the short crews of our life saving stations, especially when the wreck is near the shore and in danger of breaking up.

A bow carrying a light life line might be useful also at bathing stations, as at Long Branch, where accidents happen very near the shore. The cost would be small, and there would be no expense attending the practice required to make the beach attendants familiar with the use of the bow and line.

A NEW WINGED PROJECTILE.

The accompanying cut represents a new winged projectile designed by Mr. E. S. Hunt, of Boston. The Massachusetts Humane Society have recently adopted it, and have such faith in its efficiency that they have presented a gun and projectile to the Royal National Life Boat Institution, England, hoping that the authorities will consider its merits.

Two smooth bore brass guns, mere toys to look at, weighing 56 lb. and 69 lb. respectively, each 24 in. long, were used to fire the projectile, the charge of powder varying from 3½ oz. to 4½ oz. The projectile, the novel feature of the invention, weighed, when filled ready for firing, 12¼ lb. In form it is an elongated shell carrying a line tightly coiled within, which it pays out without the smallest risk of breaking as it travels through the air. It is placed in the gun, as it were, the wrong or heavy shot end first, and on leaving the muzzle, at once reverses, the front end becoming the



HUNT'S WINGED PROJECTILE.

rear end, the projectile, after this reversal, maintaining, in consequence of the four wings, and on the principle of the arrow, an accurate and distant range.

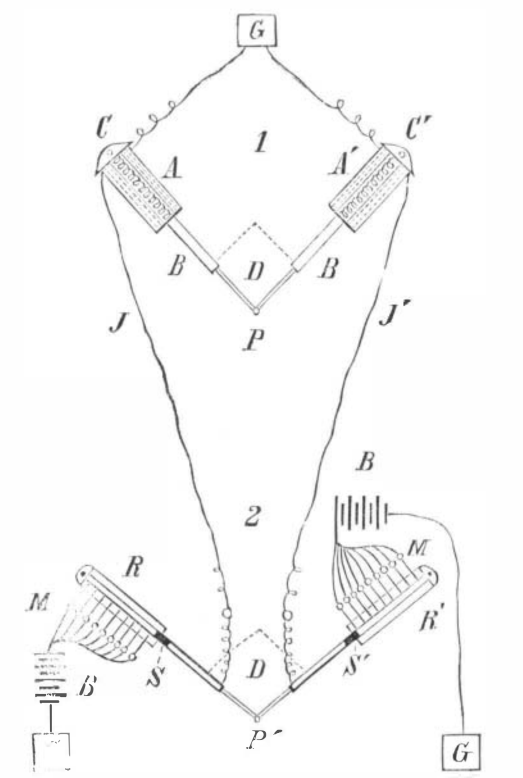
In construction the projectile is a tin tube 20 in. long, 3¼ in. in diameter, having fixed or hinged wings at one end, and a leaden shot weighing 6 lb. at the other. Within the tube is a compact coil of line 17½ in. long, and the diameter of the tube. This line is from 200 to 400 yards in length, with a breaking strain of from 250 lb. to 400 lb. The shot is attached to the second or shore coil lying alongside the gun, so arranged that on the shock of the discharge the line runs out freely from both coils.

During a recent trial at Mr. Hunt's range, 22½°, an elevation which has been found by continued practice best suited to throw the line over any wreck with the smallest strain to it and the projectile, the distances obtained and measured on the official range course were 389, 448, and 507 yards, the deviation of the shot and line from the target being 4⅔, 9, and 8 yards respectively. Three shots fired at 30° and 35° elevation, traversing a line of flight some 400 ft. in the air, ranged 478, 489, and 386 yards, with deviations of the shot and line from the target of 2, 6, and 6 yards respectively.

THE WRITING TELEGRAPH.

Prof. A. E. Dolbear, Tufts College, Mass., communicates the following description of his writing telegraph to the *New England Journal of Education:*

When a current of electricity is sent through a hollow coil



PROF. DOLBEAR'S WRITING TELEGRAPH.

of wire the latter is made a magnet, and will attract into it a short rod of iron. If the helix be held vertical, the rod of iron may be supported in the air without touching anything, through the strength of the attraction. If the iron rod be placed end to end of the coil, it will be attracted into it with a force proportional to the strength of the current of electricity in the coil. I have utilized this in making a galvanometer, the iron rod or core being supported by a spiral spring; the distance the core is drawn into the spiral is the measure in weight of the strength of the electrical current. This same device is also employed in the receiving instrument of the writing telegraph (see 1 in the diagram).

Let *a* be a hollow coil of wire, and *b* the core of soft iron held in place by a spiral spring within the helix. At *p* is a marker attached by a light rod to the end of *b*, so that any movement made by *b* toward *c*, the bottom of the helix, would cause *p* to make a straight line in the same direction. Now let a current of electricity enter the helix by the wire, *l*, and at once *b* will move into the coil a certain distance; a stronger current would make it to move still further in, and a weaker one would allow the spring to push it back again; the marker then would make a straight line. At *a'* and *b'* is another fixture, precisely like the one described; they are at right angles to each other, and their common junction is at *p*, so that any motion made at *b'* will make *p* record the direction. When these two act conjointly, the place that *p* will have will depend solely upon the distance each of the cores, *b* and *b'*, is drawn into its helix, and when the helices can turn upon pivots at *c* and *c'* it is plain that the point, *p*, may take any position inside the space indicated by the dotted lines; that is, any kind of a figure may be drawn by *p* inside those limits. This instrument is called the receiver.

The transmitter (see 2 in diagram) is a separate instrument, and unlike the receiver. At *r* is a narrow strip of wood having a groove in it, in which *s* may slide. On one side of the groove are a series of wire terminals of the battery, B. The end, *s*, of the slide is metallic, and it is in connection with the wire, *l*; and when it is thrust a little way into the groove it touches one of the wire terminals of the battery and permits a current of electricity to flow into the wire, *l*, and so through helix, *a*, drawing *b* in and causing *p* to make a short mark. If *s* is thrust into *r* still further, a stronger current is thrown on the line, *l*, and so on the further it is down the groove. At *p'* is a marker corresponding to the marker in the receiver, so it will be understood that *p* will duplicate the motion of *p'*. In like manner as in the receiver, there is a second part in the transmitter, at right angles to the first, and its slide, *s'*, is in connection with the marker, *p'*, and with the terminals of the battery, B', so a current over the line, *l'*, will move *b'* in the receiver. The other terminals of the batteries, G and G', are in the earth. It is evident that *p'* may be at any point within the limits of movement of *r* and *r'*, and also that any new position will vary the current on one or both lines, *l* and *l'*; hence any movement of *p'* will be duplicated by *p*. For writing a strip of paper moved by clockwork under the point, *p*, will give a facsimile of what is written at *p'*. A profile or portrait, or indeed any kind of marking whatever, at *p'*, will be duplicated by the receiver. The arrangement for varying the current from the battery, B, consists of a series of coils of wire having different resistances, as shown at *m m*.

The main part of this invention was made by me some years ago, and it is alluded to in the book on "The Telephone and Phonograph," by George B. Prescott (p. 261). A device quite similar to this has lately been invented and described by Mr. Cowper, of England. His receiver, however, consists of two electro-magnets at right angles to each other, and the varying current acts so as to twist a light needle very much as in a common galvanometer. This transmitter is identical with mine. My instrument was made and shown to a good many persons when Cowper's was first made public here.

The Regeneration of the Eye.

Galignani's Messenger reports some curious experiments lately undertaken by M. Philipeaux, to discover whether on completely emptying the eyes of young rabbits and guinea-pigs, the vitreous humor would be reorganized, and whether even the crystalline would be reproduced. With this view, he has been conducting his operations, always, of course, taking care not to touch the crystalline capsule, for experience has shown that in order that an organ shall regenerate, a portion of it must be left in its place. It seems that a month after the mutilation was effected, the experimentalist was able to state that the eyes, which had been emptied, were filled afresh, and that the crystalline was reconstituted. He operated on 24 animals, and in each case the mutilated eye revived. This would seem to show that the optic organ has the same capabilities as the bones; the organic process repairs an evil and reconstructs, more or less completely, that portion which has been struck off from the whole. How far similar results are obtainable with the human eye does not appear. If the same regenerating power is found to be general, a decided improvement may be possible in the treatment of certain injuries and diseases of the eye.

Close Work.

A very pretty piece of engineering was successfully completed early in May in connection with the Baltimore Water Works Tunnel, by the resident engineer, Mr. O. C. Swann. It was the union of two headings between shafts 3 and 4, the most of which was done by Thos. McCabe, contractor. Shaft No. 3 was 276 feet deep, and shaft No. 4, 300 feet, being the two deepest on the whole tunnel. The distance apart was 2,100 feet. The center line was so exact, says the Baltimore *Gazette*, that it struck a plumb line. In the level there was no apparent difference whatever, and measurement varied only one inch between the surface and the tunnel measurement. The entire tunnel, to be 6¾ miles in length, will be finished in about a year. The tunnel commences at the Great Gunpowder river and runs perfectly straight, with an internal diameter of 12 feet, to Lake Montebello, the receiving reservoir. There are 15 shafts along the length of it, varying from 2,000 to 3,000 feet apart and from 50 to 300 feet deep.