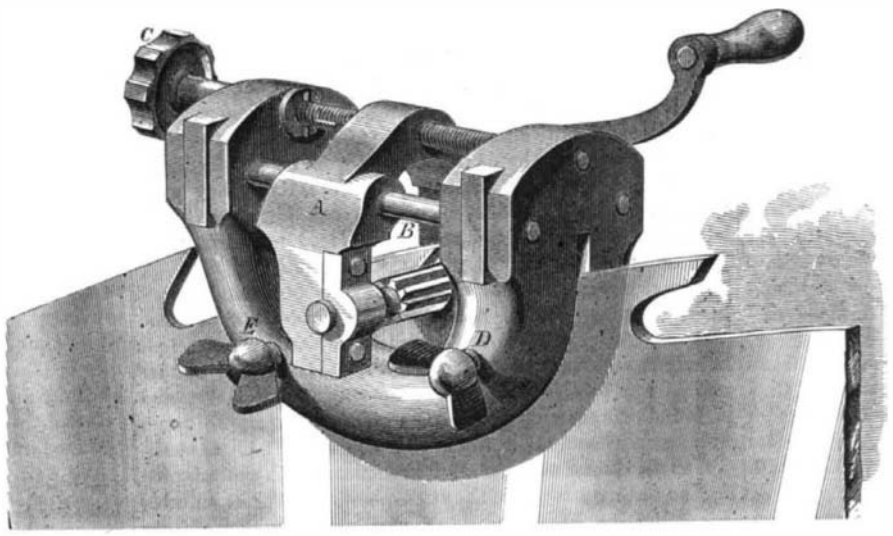
IMPROVED SAW GUMMER.

The inventor of the device illustrated in the annexed engraving states that, after an experience of eighteen years in using various kinds of saw gummers, as the result of such experience, he has produced the present machine, which he believes to be the best yet invented. It is a very strong apparatus, as will be seen from the heavy semicircular iron frame with which it is provided, the ends of which are cast solid. The cutter is journaled in the carriage, A, which slides on guides, B, and is fed to its work by the hand wheel, C. The cutter is rotated by the crank shown. The thumbscrews, D and E, hold the gummer upon the saw.

It is stated that any gullet can be started without filing or without danger of breaking the cutter by slacking the thumbscrew, E, on the lower part of the frame, until the circle of the cutter is formed.

The same is done to direct the cutter toward the center of the saw and to make a large gullet, the feed screw being operated during the turning of the crank. The screw, D, then holds the gummer upon the blade, and at the same time serves as a center about which the instrument works. There are no boxes liable to get out of order, and the bearings can be easily Babbitted. Finally, the inventor claims that the saving in cutters alone will soon cause the device to pay for itself.

For further particulars address Mr. Walter B. Noyes, Three Rivers, P. Q., Canada.



NOYES' IMPROVED SAW GUMMER.

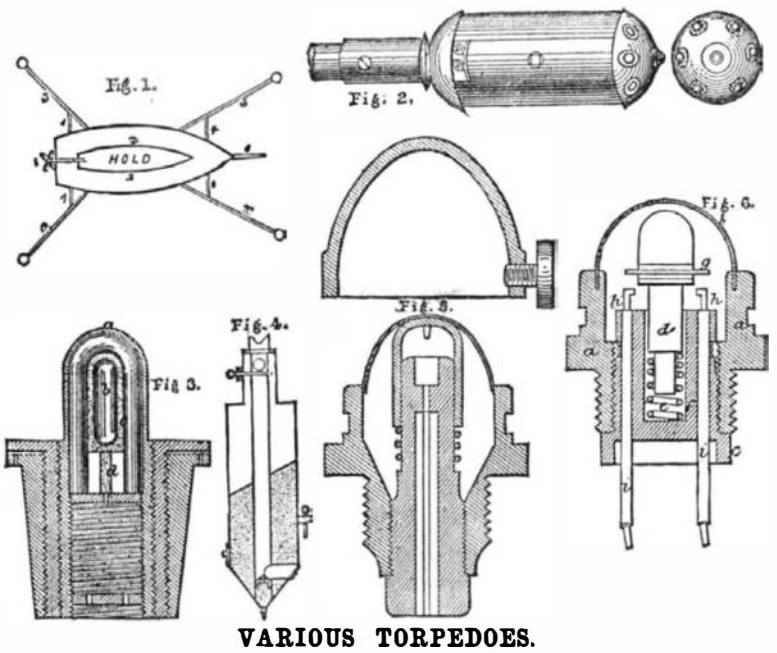
SPAR TORPEDO WARFARE.

Mr. A. Sedgwick Woolley, Associate and Secretary of the Institution of Naval Architects, England, recently read before that society an able *resumé* of the torpedo system of attacking the enemy's vessels, by means of boats specially constructed for this submarine warfare, which carry their deadly bombs on the ends of spars, extending usually from the bows of the boat. We give a condensed abstract of the paper, illustrated by a series of engravings selected from the pages of *Engineering*:

Spar torpedo launches are being so generally adopted at present into the service of all foreign nations that a short sketch of the origin and history of this form of submarine warfare may be interesting, before discussing the merits and demerits of the plans now in vogue.

The first idea of an offensive attack by means of a boat, specially constructed to carry a torpedo, seems to have originated with Captain David Bushnell, of Connecticut, about the year 1775, but it had little in common with the boats now used for the same purpose. This boat, an account of which was read by the inventor before the American Philosophical Society, in 1798, was only intended to accommodate one person, who sat in a watertight chamber capable of containing sufficient air to support him for thirty minutes, and who could cause the vessel to descend and ascend at will, by letting the water into a chamber below him, or expelling it therefrom by means of two brass force pumps, at the same time letting fall about 200 lbs. of the lead, by which the vessel was ballasted, at the bottom. An attempt was made with this boat to blow up the English 64-gun ship Eagle, during the campaign of 1776; but the operator, from some reason or other, was unable to fix in the screw, and had to desist from the attempt.

The next step in the same direction was made by the celebrated Fulton, who proposed a similar diving boat to the French Government about the year 1801, and made several successful experiments in the harbor of Brest, blowing up a small vessel by means of a torpedo, which he placed under her bottom. In this boat Fulton seems to have employed a screw, operated by a crank, as a means of propulsion. The French Government, however, would not adopt his invention, and Fulton forthwith withdrew to England, in 1804, where, under the assumed name of Francis, he obtained the support of Mr. Pitt. A commission was appointed to examine into and report upon his invention, which they at once pronounced to be impracticable. Fulton then returned to America, where he also gained the ear of the minister, and had a commission appointed; but he met with great opposition, and was so unfortunate in his experiments that he gave up the attempt to introduce a system of torpedo warfare in order to turn his attention to steam navigation, which he may be said to have introduced into that country. It may be remarked, however, that, during the course of his torpedo experiments, he developed the first notion of the torpedo steam launches of to day. This idea, which never got beyond the state of a model, consisted of a vessel of 300 tuns, shown in Fig. 1, with sides 6 feet thick, designed to be cannon-proof, and musket-proof decks six inches thick. She was to be propelled by a scull wheel, and was intended to carry two torpedoes on each side, fixed on the end of spars 96 feet long, supported by guys from the masthead.



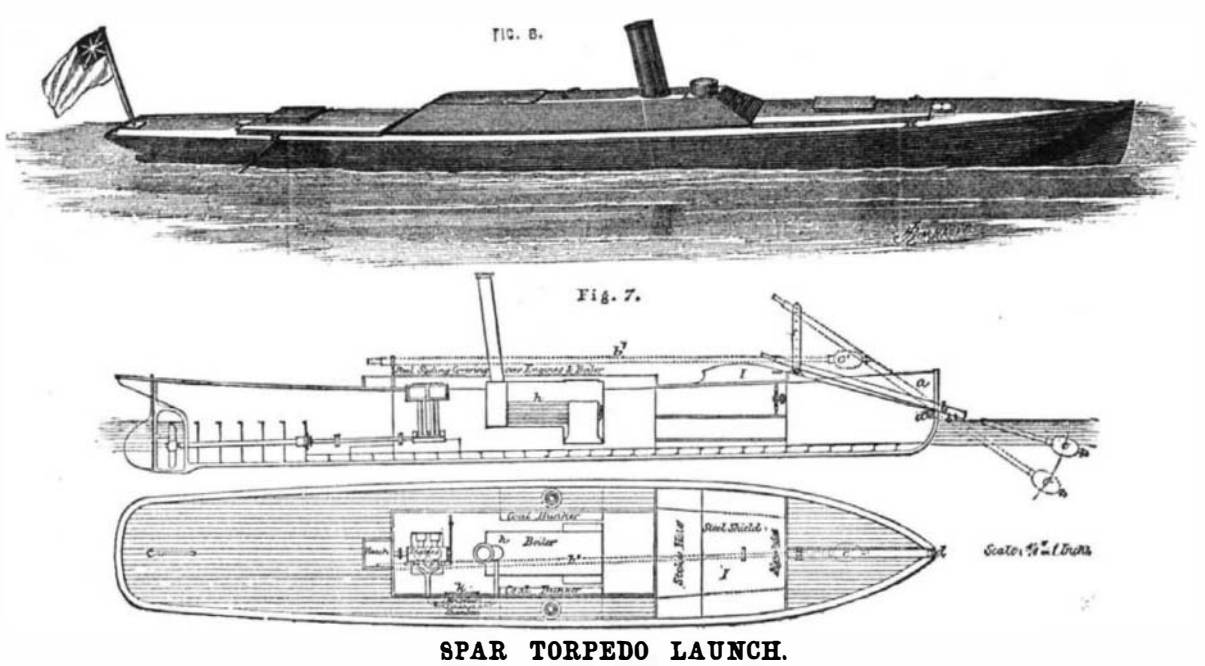
VARIOUS TORPEDOES.

It was not, however, until, during the civil war of America, the Southern States, being overpowered by the force and resources of their adversaries, resorted to a most extensive employment of torpedoes, that the power of this species of attack was developed.

The first of these attacks was made off Charlestown, against the United States war vessel Ironsides, by a cigar-shaped boat under the command of Lieutenant Cassell, with a crew of three men, carrying a torpedo containing 60 lbs. of powder at the end of a spar. Not knowing the action of the explosion, and thinking that their boat would probably be sunk by it, her crew jumped overboard before ramming. The explosion, though severe, failed to effect any hole in the bottom of the Ironsides; the boat was also uninjured, and was found drifting, half full of water, by her engineer, who climbed into her, made up his fires, and steamed back safely to Charlestown. The next attempt was also made off Charlestown, with a plunging boat, against the United States steamer Housatonic, which was sunk by the explosion, the torpedo boat, however, going down as well. This boat had already drowned sixteen men during the trials made with her in Charlestown harbor, the last time going down with a crew of nine persons, and not again appearing till she was fished up and put in order; and a fifth crew of six persons, under a Captain Dixon, undertook the attack on the Housatonic. She was propelled by means of a screw worked by a crank, which required the six men, sitting three and three opposite each other, to turn it.

The confederate ship Albemarle was sunk by a torpedo launch, commanded by Lieutenant Cushing. The launch, however, was also sunk by the explosion; and out of a crew of fourteen persons, only two saved themselves by swimming. Both sides were employed in preparing special spar torpedo boats when the war terminated. Just before the close of it, however, a remarkable attack was made, in the James River, on the merchant vessels which had brought supplies to Grant's army, by the confederate fleet of three ironclad rams and seven gunboats, all armed with torpedoes, fixed on the end of spars, 30 feet or 40 feet long, which projected from their bows, and could be raised or lowered by a tackle. This fleet was stopped by a boom, and two of the ironclads got aground, where they remained all night, under fire from the banks; but although their torpedoes were completely riddled with rifle shot, not one was exploded, as it so happened that the fuses were in no case struck. The Southern States had throughout employed percussion fuses, which were exploded on contact, the shape of their torpedoes being cylindrical with hemispherical ends, into which seven fuses were inserted, as shown in Fig. 2; these fuses (shown in Fig. 3) consisted of a cap of lead, *a*, containing a glass tube, *b*, filled with sulphuric acid, and surrounded with a mixture of chlorate of potash and white sugar, *c*, communicating with a primer, *d*, of mealed powder; on contact, the lead cap being crushed, the glass bottle was broken, and the sulphuric acid ignited the chlorate of potash and sugar, and fired the torpedo. The danger of a torpedo, furnished with these fuses, being exploded by contact with any floating log of wood or boom, before reaching the enemy's ship, and the extreme caution required in handling it, led the Federals to adopt a torpedo made as shown in Fig. 4, which could be detached from the spar, and having an air chamber provided to keep it nearly vertical when so detached, a tube being placed in its center, at the upper end of which an iron ball was kept in position by a pin; this pin was released by means of a rope, leading into the boat, and dropped on to a cone of fulminate.

Captain McEvoy, of the London Ordnance Works, invented the mechanical fuse, A, shown in Fig. 5, provided with the safety cap, B; but being afterwards impressed with the advantage arising from the use of electric communication, he invented, in 1871, the plan shown in Fig. 6. This consists of a metal bushing, *a a*, having its upper end closed by a thin metal dome, *b*, and a metal plug, *c*, screwed into its lower end. A metal spindle, *d*, is supported on a spiral spring, *e*, inserted in a recess, *f*, in the plug, *c*; a thin insulated bridge, *g*, is attached to the spindle, *d*, under which are two terminals, *h h*, of insulated wires, *i i*; one of these wires is connected with the battery, and the other, to which is attached the electric fuse, has either an earth or other connection with the battery. When the torpedo, with this closer attached, is projected against a vessel or other body, and receives a shock sufficient to crush in the thin metal dome, *b*, the spindle, *d*, is forced down until the metal bridge, *g*, is brought into contact with the two terminals, *h h*, thus completing the circuit of the electric fluid, and firing the fuse The wires would, of course, only be connected to the battery just before the action of ramming. It is, however, evident that the thin metal dome might be crushed in through some accident beforehand, and that then, as soon as the wires were connected, the torpedo would be fired at once. To overcome this difficulty, there has been substituted for the metal dome, *b*, one made of india rubber, fixed in a peculiar manner, which would always retain its form and allow the spring, *c*, to keep the circuit uncompleted. The torpedo is shaped as shown in Fig. 7, in order to



SPAR TORPEDO LAUNCH.