

some amusement when it broke from all control, and made an ugly rush into the midst of a group of officials at Woolwich, is now perfected. It is positively stated that this "sea-devil" is so tractable that it will maintain any direction impressed upon it, and, in obedience to its masters, swim for a mile towards any adversary against whom it may be directed. We sincerely hope so, and that it will not again turn round upon its friends. We are just now a little sensitive on the subject of explosives, however, and in accepting this statement it must be understood that we are placing a good deal of confidence in the officers who have been employed in conducting the experiments and improving the invention—and we do not say they do not fully deserve it, but this is almost a new field of enterprise, and our confidence remains to be justified by the results.

In principle there is no doubt that the torpedo-system of warfare is perfect both for offence and defence. For, as Mr. Merrifield remarked in his lecture before the Institution of Naval Architects in March, 1872:—"The work of destroying the floating capacity of a ship is out of all proportion small as compared with the work which it is possible to store in a submarine explosive of large size; and, provided always that this stored work can be applied with certainty and efficiency, there is no alternative to the destruction of the vessel."

As our readers will admit that Mr. Merrifield is no mean authority on a scientific subject, this reduces the problem to one of mere mechanics and seamanship, and there are few mechanical problems, that being intelligibly proposed, would not ultimately be solved by the inventive genius of Englishmen. As for seamanship, in the instance of the "Fish Torpedo," it almost resolves itself into a question of weather. Given a still sea, and a ship at anchor, there is no doubt as it seems, that the mechanical Fish will find its mark. The doubt arises, when we contemplate the possibility of its services being required against a ship in motion, and with a high sea running. In answer to this, it may be said that the Fish will swim at any depth, and at a given depth the water may be comparatively calm. It were more to the purpose, perhaps, to regard the Fish as an efficient weapon for harbor service, or for an attack on ships in position, like the Italian fleet at the action off Lissa. For offensive action in a heavy sea, and more especially to repel the attack of a ram, the palm must still be awarded to the Harvey torpedo, until actual experiments demonstrate that its good qualities are bettered by one or other of its rivals.

What we more particularly wish to observe, is that the experiments against the *Oberon* only touch at one point the mighty problem which grows out of these inventions taken in all their forms, some for one sort of service, some for another. The power of resistance to the shock of a torpedo is an important matter relative to construction; but the ultimate question is one for the tactician rather than the constructor. We can picture to ourselves the possibility of a whole fleet of ironclads being "brought up all standing," in nautical phrase, by submerged torpedoes acting in concert, by being spanned together, for example, somewhat in the fashion of the old chain shot. Skilful and daring men, trained to the work, will not be wanting for any enterprise, however hazardous; and, to meet such attacks, it may be necessary for a fleet to bear down upon its adversary like a convoy of the old times, with its shoal of "devil fish" in attendance,

like the Nereids sporting around their son god Neptune. Even an unarmed ship, being pursued, may be able to drop one or more torpedoes in her wake. Conversely, indeed, the tactical question touches on the problem of construction, as it is obvious that one form of vessel may be better adapted than another to avoid torpedoes, as well as to make use of them. The range of artillery is another element in the whole problem of naval warfare of the future raised by these inventions. If a 25 ton gun will pierce armour a foot thick at the distance of a mile, and the 35 ton gun at more than double that distance, to say nothing of the 38 ton gun now being constructed, what chance would the Fish torpedo have of being discharged successfully against such antagonists? and would it not appear that naval warfare may assume the character of military operations on land, which open with a cannonade from a safe distance before the infantry come into action.

These are only hints of the manifoldness of the important problems which naval officers, no less than engineers and artillerymen, have opened before them. On one point only we will venture an additional remark. The *Broad Arrow* has always insisted emphatically that the naval power of England, and, *a fortiori*, our national security, lies in our power of attack. We are inclined, therefore, to look with less favour than some of our contemporaries on the use of these inventions for exclusively defensive warfare. Our torpedoes should be as active as wasps or hornets, and should be prepared to swim against the enemy under cover of our heavy guns, with the same deadly effect as the charge of our thin red line when the army engages. We do not yet despair of success in the employment of submarine boats for the purpose, each manned with a forlorn hope of gallant fellows, with efficient steering as well as motive power at their command. But the perfection of the offensive torpedo system is the first necessity, and with those of the two natures, invented respectively, by Mr. Whitehead and Mr. Harvey, if the recent accounts be not exaggerated, perfection has been nearly attained. We wait, however, for further and demonstrative proofs that the facts are as stated—unless, indeed, some of the foreign officers who have been taken into the confidence of the authorities will kindly enlighten us on the subject.

NEW GOVERNMENT CAISSONS.

Last Monday a launch took place at Messrs. Westwood, Baillie, and Company's yard at Millwall, of the fifth of six huge caissons which have been ordered by the Government from that firm for use in the Portsmouth Dockyard Extension Works. Several people, chiefly, however, consisting of the workmen and their friends, assembled to witness the launch of the unwieldy hull, and at a quarter to three, the dogshore having been knocked away, the caisson slowly glided broadside towards the river, and sending a huge wave before it, floated, and was subsequently taken in tow by two tugs for conveyance to a place of safety. It will be taken into dry dock to have its cradle removed, and, after receiving fifty additional tons of ballast, will be towed round to Portsmouth by one of the company's tugs, and there received by the Government authorities.

The advantages of these caissons over the more primitive method of a double pair of girders and a swinging bridge lies chiefly in obtaining level road and railways across the

basin or dock entrance, being less watertight, and in being easy of access for repairs. As no description has yet appeared in our columns of the wonderful structures, we will add a few details for the benefit of our readers. The dimensions of the caissons, which are the largest of the kind yet constructed in this country, are—length of roadway deck, 84 feet, breadth of roadway deck, 17 feet; breadth of the caisson, at the widest part 4 feet, and depth of the caisson, 40 feet. They are of the ship form of construction, both longitudinally and amidships, and terminate at both ends, and at the bottom, in an oak keel and stem, which are designed to fit into a groove made in the masonry at the entrance to the basin or dock. The form of these are constructed from lines obtained in the dockyard, and remain perfectly watertight. The pig iron ballast is placed most naturally in the lower division, above which is a water tank. The interior of the caisson is fitted with five decks, two of which are plated and made watertight, one of which is at the water line when the caisson is floating, and the sides ten feet three inches below it, and enclose an air tight chamber. Above and below this compartment are water chambers, which can be opened for the ingress or egress of water. These communicate with one another by wrought iron trunks, and are used for the purpose of conveying water from the upper to the lower tank, and so into the river or basin as the caisson rises on being floated. Above the upper reservoir, immediately under the roadway deck, is another tank, which, when filled with water from the main water supply, sinks the caisson and causes the water to enter through the lower reservoir, and the trunks into the upper reservoir, thus rapidly brings the structure into its bed.

Additional speed in performing the work is available by a sluice gate to fill also the air chamber with water, but this can only be done at an increase of labour, as the water placed in the division can only be taken out by pumping, which must be done before the caisson can be again floated. It will thus be seen that to sink the caisson, the upper tank has only to be filled with water from the dockyard hose, and that to raise it for removal a sluice has only to be opened from the top tank, manoeuvres which are more admirable on account of their simplicity. The floating capacity of the air chamber is equal to nearly 500 tons, and the weight of the caisson when launched, with ballast and its other fittings, was 530 tons. Five caissons of the same description, and nearly of the same size, have already been made for Chatham Dockyard, and for other Government and private establishments. Her Majesty's ships *Valiant*, *Resistance*, and the gunboat *Rocket*, were built for the Government, and a large number of celebrated engineering works—especially gigantic railway bridges, which are referred to elsewhere—also have been, and are being executed in the same yard.—*Broad Arrow*.

Suicides and murders have of late become frequent among the British troops stationed in India. At Ajmere, the other day, a private named Tighe shot a comrade through the head, killing him instantaneously. The two, together with a corporal, were in the barrack room at the time, and after shooting the private, who was a recruit and had just joined, Tighe attempted to murder the corporal. He levelled his piece at him and fired, but missed the man. He was at once secured by his comrades, and is now in confinement awaiting trial.