

well beaten, and half a pint of milk. Butter a mould and pour the mixture into it, tie a cloth tightly over it, and boil it for an hour and a half.

It should not be forgotten that at high tea there should be plenty of nicely-sliced bread-and-butter, and two or three varieties of cake of the simpler and lighter kinds.

We feel quite sure that, as a form of hospitality, high tea might become thoroughly popular. It is

a meal at least as adapted for the requirements and exigencies of rapid London as it is for the quiet moorlands of the North, where it is such an old-established favourite. It should be always a genuine meal, and not a mere ceremony; and yet it is the meal least likely to become the sole "entertainment," or to be anything but a genuine refreshment for that interchange of thought and kindness which should be the true purpose of all social gatherings.



WHAT IS A TORPEDO?

BY LIEUT. FRANCIS I. PALMER, R.N.

UNTIL quite recently, few well-educated people had more than a vague idea of what a torpedo was, and even now so little about it is known to general readers, that we propose to sketch some of the most interesting points of this important branch of modern warfare.

England's naval and with it her commercial prosperity considerably depend on the future development and employment of torpedoes, so the subject should possess more than ordinary interest.

In 1777—one hundred years ago—David Bushnell, an American, was the first to invent and use a submarine explosive machine, which he christened a Torpedo—*Torpedo vulgaris* being the scientific name of the Electric Ray or Skate, a fish which is said to kill its prey as by lightning.

Although records exist to warrant the assertion that explosive submarine infernal machines, *in some form*, were made use of about 2,000 years ago—and again in 1585, when the Dutch besieged Antwerp—the details are so meagre and uninteresting that we had better pass on to a time only one hundred years distant, when the torpedo—as we know it now—first took definite form.

Gun-cotton is the explosive used by the English authorities for torpedo purposes, from its being fairly safe to handle, and from the fact that it cannot be injured by water, thus eminently adapting it for submarine mine service.

Weight for weight, gun-cotton is about four times as powerful as gunpowder.

In 1797, Fulton, another American, revived the subject of torpedo warfare; he also designed a plunging torpedo-boat. After ineffectually trying to get the French to adopt it, he came to England, and the

result of experiments made in this country induced Mr. Pitt, the then Prime Minister, to organise the first extensive torpedo attack. In 1804, Admiral Lord Keith set sail with the Catamaran Expedition, to destroy the French shipping lying off Boulogne. These Catamarans were coffin-shaped watertight boxes, containing a charge of powder to be ignited by clockwork arrangement. The attempt proved a complete failure, through the charges being too light, and being placed too distant from the sides of the enemy's ships.

From England, Fulton returned to America, a country soon to be engaged in war with Great Britain. By this time, the year 1810, he had further matured the art of torpedo warfare, by mooring torpedoes under water, to protect the entrance to a harbour, and by arming boats with explosives, to be carried at the ends of long poles. Both ideas are now used by all maritime Powers.

Although Fulton's experiments were generally successful, the American Government discouraged their further employment after ineffectually attempting to destroy some British ships in the war of 1812—14.

In 1841, Colonel Colt, of revolver fame, a third American, followed Fulton another step, and suggested the ignition of mines by the application of the galvanic battery, an invention which has given to the torpedo the high position it now occupies.

Englishmen, therefore, cannot lay much claim to inventiveness in this somewhat questionable weapon.

As little use was made of the torpedo during the forty years following the American War of 1814, we pass on to our war with Russia in 1854. The Russians employed both mechanical and electrical submarine torpedoes in the Baltic and Black Seas; and the knowledge that these infernal machines were hidden obliged the combined fleets of France and England to manœuvre with great caution. But beyond

a few accidents, and inspiring some amount of fear, the torpedo did little actual damage.

About midsummer, 1862, the Confederates were the first to introduce a regular torpedo service at Charleston, South Carolina; and the Northern officers, though strongly condemning it as a barbarous mode of warfare, were obliged in self-defence to recommend its adoption by the Federal Government. As a matter of fact, some twenty-five Federal war-ships (many drowning their crews) are known to have been destroyed, and nine others more or less injured, by Confederate torpedoes.

Here, for the first time in history, the torpedo took the first place amongst engines of war—doing far more damage than the well-known artillery, the more recent application of the ram, and all other efforts and accidents combined.

Torpedoes are either *defensive* or *stationary*, or *offensive* or *locomotive*. *Pile, frame, ground,* and *buoyant* torpedoes come under the first head. All were used in the American and Franco-German Wars, and are more or less employed in the East.

Pile torpedoes carried a charge of gun-cotton within an elongated iron shell fixed at the head of the pile, which was driven into the bottom at such a depth that the torpedo, although out of sight, was in the best position for exploding on being struck [by the enemy's vessel.

Frame torpedoes consist of three or four heavy timbers parallel to each other and a few feet apart, tied together by cross-timbers. On the head of each timber was a cast-iron torpedo. One end of the frame was fixed in the bed of the river or harbour to be defended, and held by weights so as to present the other end, carrying the torpedoes, to the bottom of the vessel approaching.

There are several varieties of *ground* torpedoes. Those generally employed are made of iron or wooden cylinders securely weighted to the bottom, and fired either by mechanical or electrical agency—that is, on the vessel's coming into contact, or by will. The iron barrel which was exploded by galvanic battery under the hull of the U.S. sloop-of-war *Commodore Jones*, in the James River, contained 2,000 lbs. of powder. The vessel immediately sank, and one-half of the crew were killed.

Buoyant torpedoes are more useful and more largely employed than any other kind. Like the ground torpedo, it can be fired by mechanical or electrical agency, or can be made to combine the two by attaching to it a very ingenious contrivance termed a circuit-closer.

In 1859 the Austrians defended Venice by a large number of buoyant torpedoes contained in wooden cases strengthened by iron hoops. Each case was moored to a triangular frame resting firmly on the bottom. The three chains secured to the case were kept taut by the tendency of the torpedo to rise to the surface, whilst the spread of the triangle prevented their twisting—thus keeping the conducting cable communicating with the galvanic battery free from injury.

Singer's buoyant and mechanical torpedo, with

improvements by Captain McEvoy, was largely used in the late American War.

The machine consisted of a conical iron cylinder, the apex, to which the mooring-chain was secured, being the underneath side. The lower part contained the powder, the upper the air-chamber to give great buoyancy. A loose metal top covered the torpedo, and was attached to a copper friction-tube fitted into the lower end by a chain, so arranged that when the torpedo is inclined by a vessel's striking, the heavy cover slides off, and throwing its weight on the rasp, draws it out, and explodes the tube and charge.

The newest kind of buoyant torpedo dependent on electricity has an apparatus called a circuit-closer attached, by which the mine can at a moment's notice be rendered harmless to a friendly vessel, and be picked up with perfect safety.

Locomotive or *offensive* torpedoes are essentially a naval arm, and to them the term *torpedo* is very properly applicable, whilst the term *submarine mine* more truly expresses those that are stationary. They may be divided into five classes.

Ships or boats might carry outrigger spar-torpedoes. The Confederates employed such boats, which they called "Davids," in the defence of Charleston. They were cigar-shaped vessels, only about one-fourth of them being above water, and that portion not unlike the back of a whale. A copper torpedo fitted with eight sensitive fuzes, to explode on contact with the enemy's side, was carried on a spar-end, which by means of a topping-lift could be lowered some eight feet beneath the surface. In this position the torpedo was sixteen feet from the boat.

The Federal war-ship *Housatonic*, of thirteen guns, was destroyed by such a torpedo-boat in Charleston Harbour. The officer in charge of the deck at the time reported that he discovered something in the water about 100 yards distant, moving towards the ship. It had the appearance of a plank, and the time from which it was first seen until it was close alongside was about two minutes. The "David" which made the attack also sank herself, and drowned her crew of nine men, by running over her own explosion, and possibly into the hole which her torpedo made in the *Housatonic's* side.

Messrs. Thornycroft of Chiswick, and Messrs. Yarrow of Poplar, are the largest and most scientific builders of steam torpedo-launches in this country, and, as may be expected, have introduced many astonishing improvements. Their boats are more like the ordinary steam launch than the American "Davids," exposing very much more of their hull—a difference requisite to give ample internal working-room, a high rate of speed, and a fair certainty of working their spar-torpedoes in rough seas such as they are intended to encounter. The speed of these boats varies, according to their size, from fifteen to twenty-five miles an hour.

Captain Harvey's *towing* torpedo comes next. Although it has never been used in any war, it is supposed to be a most efficacious weapon. It consists of an elongated wooden case, to hold 76 lbs. of gun-cotton,

carrying two projecting levers outside on the top, which work a firing-bolt and ignite the charge. When slung from the after yard-arm of a vessel in motion, instead of towing immediately astern, it diverges from her path to an angle of about 45° , thus allowing the vessel carrying it room to pass alongside or across the bow of the enemy, near enough to bring the torpedo in contact with some portion of her submerged hull.

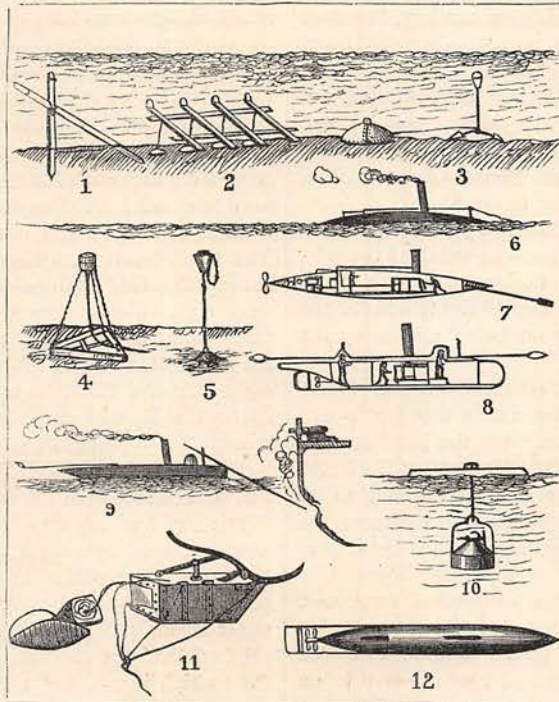
Thirdly come *drifting* torpedoes. Captain McEvoy's torpedo is the best example. It is usual to suspend it from a log of timber or drift-wood, which floats on the surface, carrying the torpedo some ten feet beneath. So long as the apparatus continues to drift, all goes well; but as soon as the motion of the torpedo is interrupted by fouling a vessel at anchor or the piers of a bridge, the current running past acts on the rudder-blade, when a given number of revolutions releases a hammer, and causes explosion.

Fourthly, there are *locomotive machines*, with all the appliances and machinery for working contained within themselves, represented by the Whitehead or fish torpedo. Lord Charles Beresford a short time ago drew public attention in the House of Commons to the power of this torpedo, "which could do all but speak, and which threatened to change the character of naval warfare."

Its construction is kept as secret as possible. The Whitehead torpedo is in reality an explosive submarine cigar-shaped cylinder, worked without the aid of electricity. The large size is nineteen feet long by sixteen inches in diameter. The bow portion contains a bursting-charge of 360 lbs. of gun-cotton (equivalent to about 1,000 lbs. of gunpowder), together with the fuze and detonating apparatus, arranged to explode on striking. The central portion carries the engines to drive the twin screws by which it is propelled; whilst the stern chamber holds the compressed air, reduced to a pressure of about 1,000 lbs. to the square inch, the air being employed for driving the engine. The engine, although weighing only 35 lbs., is capable of exerting a force of something like 40 horse-power. The torpedo is steered in a horizontal direction by an automatic pendulum working fore and aft. This fitment, and another for making the detonating material

harmless in the event of the torpedo failing to strike the object attacked, is kept secret. Direction is given to the torpedo by means of an iron impulse-tube built into the vessel, where it can be discharged at a considerable depth beneath the surface of the water. The torpedo is passed into this tube on rollers, and eventually expelled from the ship by a piston. On its way out a tripper catches against a stud in the tube, and sets in motion the propelling power. Aim is taken by laying the ship herself on for the enemy—a line of sights parallel to the axis of the torpedo being fitted on one of the decks for that purpose. The speed of this torpedo on first leaving the vessel is about twenty-six miles an hour, with a proportionately reduced speed as the distance of travel increases—till about three-quarters of a mile is reached, when the motive-power is expended.

There are only two known attempts at using this weapon with intent to destroy: the first made by H.M.S. *Shah*, about midsummer last, when she unsuccessfully tried to sink the Peruvian rebel ironclad *Huascar*; the second, quite recently—the night of the 26th of December last, when Russian steam launches fired some Whitehead fish torpedoes against the Turkish fleet at anchor off Batoum. The vessels were most injudiciously lying unprotected, and unsurrounded by floating spars and a circle of



1. Pile Torpedoes. 2. Frame Torpedoes. 3. Ground Torpedo. 4. Venice Torpedo. 5. Buoyant Torpedo. 6. American "David." 7. Section of ditto. 8. Modern Spar-Torpedo Launch. 9. Ditto attacking Ship. 10. Drifting Torpedo. 11. Towing Torpedo. 12. Whitehead or Fish Torpedo.

hanging nets. Two of the expended Whiteheads—most perfect machines of the newest kind (it is not known how many were fired)—were picked up at daylight. Both had failed in the attack, although one bore unmistakable evidence that it had struck its mark and crushed in its head against the side of one of the ironclads. Providentially for the Turks, it only partly fulfilled its mission, failing to explode on contact, through an imperfection in the firing apparatus.

The last locomotive torpedo is a boat propelled by steam or other agency, with *no crew on board*, and steered by electricity. General Ballard, an engineer officer, many years ago designed and used such a boat, and drew attention to its value, particularly for harbour defence purposes; and there can be little doubt that this powerful arm of defence and offence will shortly occupy a prominent place in torpedo

warfare. By furnishing the torpedo-boat with three or four wires, you can start and stop the vessel at pleasure, place and explode countermines, force the entrance to a harbour, and do anything, in fact, with her that steam and electricity can do, so long as your motive-power on board lasts.

For some time past the authorities have been searching for antidotes against torpedo attacks of all kinds. The electric light carried at a vessel's topmast-head, to illuminate the sea around her at night-time, probably stands first. Then there is the "crinoline" of wire netting hanging from wooden booms, which stand out at right angles to the vessel's side and encircle her, and catch such nasty missiles as the fish torpedo, causing them to explode harmlessly away from the vessel's side. Then come Gatling guns, throwing a perfect hailstorm of large bullets; and lastly, many means of dragging and destroying the enemy's fixed or defensive mines. But of all these last, probably no method is more effective than that of employing torpedoes to destroy torpedoes—*countermining*, as it is termed. This is executed in the dark, under cover of the ship's guns, when the boat advances to the supposed site of the torpedoes, and sinks another, firing it by her boat electric battery, when sufficiently

removed from the force of the explosion; 150 lbs. of gun-cotton so exploded would probably destroy one-half of the torpedoes within a radius of 200 yards, thus opening out a passage for the attacking ship.

The torpedo has, for some reasons difficult to explain, played an insignificant part in the Russo-Turkish War—probably chiefly due to the want of torpedo material, rather than the deficiency of objects to be attacked.

Another war with Russia will find her very differently armed, for she has recently ordered 142 of the most powerful torpedo-boats known, 100 of which are to be delivered at Odessa in the Black Sea within a few short months.

A last and most important item in the application of the torpedo is a sufficiency of well-trained officers and men. Strenuous endeavours are being made by all the Great Powers to be perfect in this respect.

England has the *Vernon* torpedo-ship at Portsmouth, the Royal Naval College at Greenwich, and the School of Military Engineering at Chatham.

May England fully recognise the importance of this detestable yet fashionable mode of warfare, and it will be hereafter recorded in history that the torpedo has spent itself in vain upon our maritime supremacy.

IN A MEADOW.

HOW may a grateful
mortal speak his
thanks

For such a day as this?

The rillet plays

Between a Paradise of lilled
banks;

Cool, sheltered by a mil-
lion moving sprays.

The early sweets of life,
that long had been

Forgotten in the dark-
ened days of pain,

Come back to give old
charms to each new
scene,

And withered hopes, like
trees, grow green again.



Midmost the leafage of the
bending lane,

Half hid in shade, half
shining in the sun,

Rumbles the heavy, rock-
ing farmer's wain;

And after it barefooted
children run

To cheer the waggoner,
and reach the hay

Plucked by the hedges;
and old women sit

To knit in silence and to
nod away

The hours on cottage-
steps with noon-light
lit.

GUY ROSLYN.