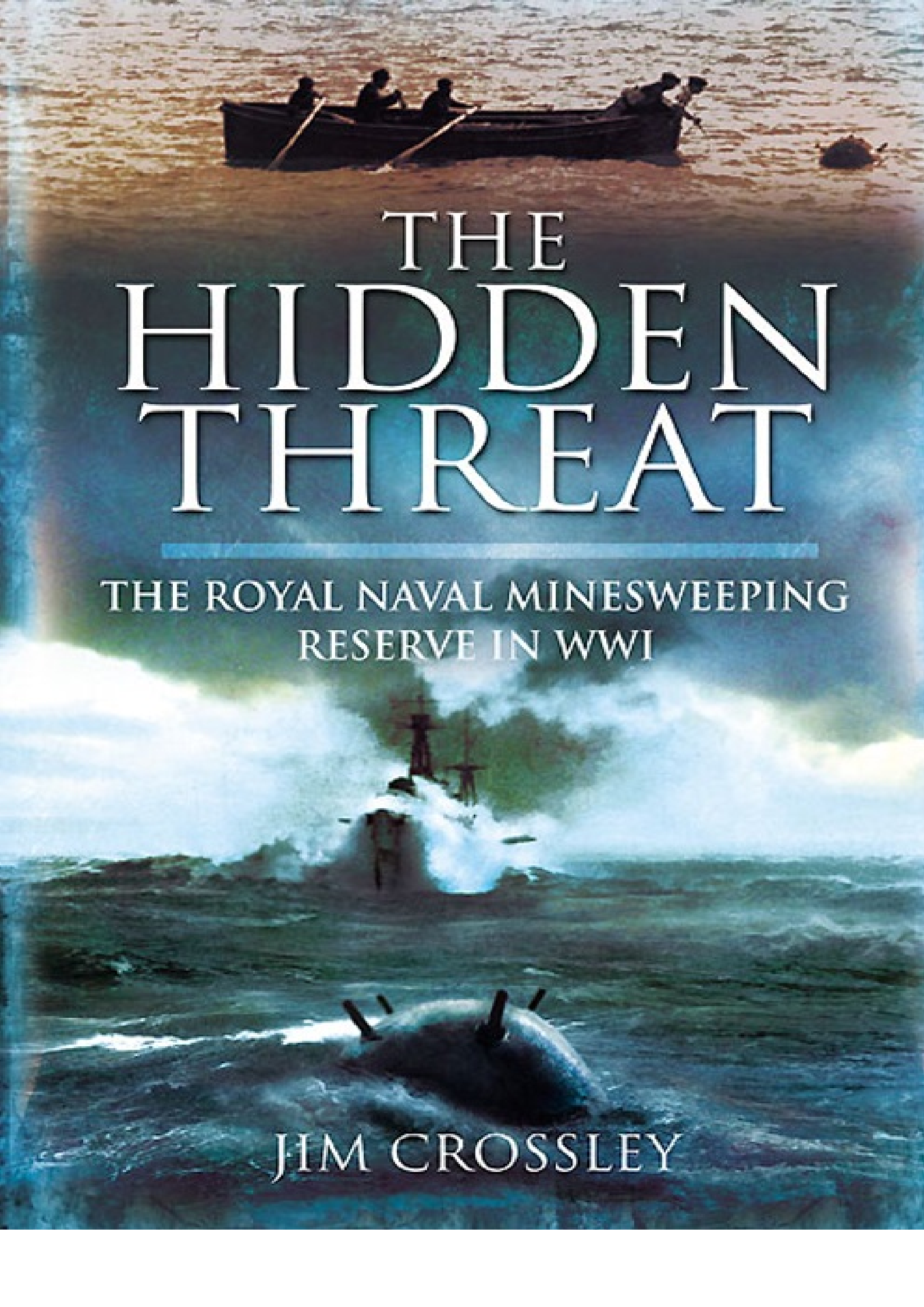
THE
HIDDEN
THREAT
THE ROYAL NAVAL MINESWEEPING
RESERVE IN WWI
JIM CROSSLEY

Dedicated to the brave men who kept the sea lanes open,
and saved the Allied cause between 1914 and 1919.

The Hidden Threat

The Story of Mines and Minesweeping by the Royal Navy in World War I

BY

Jim Crossley

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Contents

List of Figures

Charts

The Minesweepers

by Rudyard Kipling

Dawn off the Foreland-the young flood making
Jumbled and short and steep – black in the hollows and bright where it's breaking
Awkward water to sweep.
'Mines reported in the fairway. Warn all shipping and detain
Sent up *Unity*, *Claribel*, *Assyrian*, *Stormcock* and *Golden Gain*.'

Noon off the Foreland-the first ebb making
Lumpy and strong in the bight.
Boom after boom, and the golf hut shaking
And the jackdaws wild with fright.
'Mines located in the fairway,
Boats now working up the chain.
Sweepers *Unity*, *Claribel*, *Assyrian*, *Stormcock* and *Golden Gain*.'

Dusk off the Foreland-the last light going
And the traffic crowding through
And five damned trawlers with their syreens blowing
Heading the whole review!
'Sweep completed in the fairway.
No more mines remain.
Send back *Unity*, *Claribel*, *Assyrian*, *Stormcock* and *Golden Gain*.'

Introduction

On 26 October 1914 the Second Battle Squadron of the Royal Navy (2BS) put to sea f exercises, they were to fire their main armament at targets towed by two tugs, *Plover* a *Flying Condor,* and they were escorted by the light cruiser *Liverpool*. 2BS consisted of fi ships, its strength would normally have been eight but three of them were in dock for various reason They were all 'super dreadnought' battleships with names redolent of the great days of the Royal Nav – *King George V, Audacious, Centurion, Monarch* and *Thunderer*. The nation expected from them performance to equal that of the heroic age of the British maritime power in the days of Nelson, Vincent, Hawke and a host of other magnificent figures from previous centuries. These sup dreadnoughts were all products of the 1909 and 1910 building programmes of the Royal Navy. The represented the epitome of contemporary naval technology. They displaced 22,500 to 23,000 tons a were capable of a top speed of about 21 knots. They had the advantage of their German peers in spe and weight of broadside (13.5-inch guns as against 12-inch), but were slightly less heavily armoure The commander of this formidable squadron was Vice Admiral Sir George Warrender Bt KC Warrender was in every respect typical of the admirals of the Royal Navy of the time. He was brave a lion, aristocratic, popular with his subordinates and able to use his considerable personal charm inspire loyalty and devotion among the officers and seamen under his command. Unfortunately, h training and upbringing made him incapable of comprehending the threats or the realities of warfa in the twentieth century. One of his contemporaries, Commodore 'Barge' Goodenough, remarke admiringly on his possession of 'An imperturbability that no circumstances could ruffle' – othe attributed his calm to the fact that he seldom understood the magnitude of the problem.

The terrible dangers faced by the Grand Fleet – as the mighty force under command of Admiral S John Jellicoe was known – had already been brought home pretty comprehensively to its Commande in-Chief. The fleet war anchorage at Scapa Flow had been plagued by the real or imaginary appearan of German submarines since the outbreak of the war. Further south, three old cruisers had bee torpedoed in quick succession by a U-boat on 22 September with the loss of 1,400 lives. Concludi that his ships were unsafe at Scapa, Jellicoe had moved the fleet anchorage, first to Loch Ewe on t west coast of Scotland, then even further away to Loch-na-Keal on the Isle of Mull, which had narrow and easily protected entrance, and to Loch Swilly in the north of Ireland, also easily defende It was incomprehensible to many of his countrymen, who confidently expected an early victory at s on the scale of Trafalgar, that the greatest battle fleet in the world could be driven to take shelter s far away from its base by a handful of primitive submarines. But Jellicoe realized that he was faci an entirely new type of naval warfare. In previous ages big warships were immune to attack by small ones. A nineteenth century sloop, for example, had no chance whatever of sinking a battleship, but th advent of high-explosive torpedoes and mines had turned the established norms on their head. torpedo fired by a 130-ton submarine, or a speeding torpedo boat, a mine laid by a stealthy trawler or disguised railway ferry: in 1914 these represented deadly threats to the mightiest super dreadnough Seeing the threat very clearly, Jellicoe wrote a paper to cover himself in case he was considere lacking in fighting spirit by his superiors. He feared that his enemy might try to feign flight so as lure his big ships onto a trap set by submarines or by a minefield. He knew that all German warshi had facilities for dropping mines over the stern when they were being chased and regarded this as grave danger. He wrote to the Admiralty:

> If for instance the enemy battle fleet were to turn away from our advancing fleet I would assume it was to lead us over mines

submarines and refuse to be drawn. I desire particularly to draw the attention of their Lordships to this point since it may deemed a refusal of battle and might possibly result in failure to bring the enemy to action as soon as it is expected. Such a res would be absolutely repugnant to the feelings of all British naval officers and men, but with new untried methods of warfare, ne tactics must be devised… (These) if not understood properly, may bring odium on me, but so long as I have the confidence of the Lordships, I intend to pursue the proper course to defeat and annihilate the enemy's battle fleet without regard for uninstruct opinion or criticism. The situation is a difficult one: it is quite possible that half of our battle fleet might be disabled by underwa attack before the great guns opened fire at all.

In writing this Jellicoe showed himself to be a thinking admiral who clearly understood the strateg imperative of keeping the battle fleet in being, and superior to its enemy. In the event, he probab over stated the danger from submarines; the boats available in 1914 were not destined to have muc success against fast moving warships, but his fear of mines was certainly justified.

In its new bases, however, the fleet considered itself safe and the normal training regime wa resumed. The sortie by 2BS was part of this training and as the ships were off the north coast Donegal, about nineteen miles from Tory Island, they believed they were outside effective U-bo range. The ships seem to have reverted to almost peacetime procedures. They were not closed up f action and watertight doors, which would have divided the hulls into secure watertight compartment were left open. *Audacious* was the third ship in the column. Completed a year earlier, she wa considered a 'crack ship' and her Captain, Cecil Dampier, was keen to show off her gunnery skills. A 08.45 hours Warrender ordered his column to turn four points to starboard. *Audacious* was a little o of station and answered her helm slowly. Just as she began to swing onto her new course, a massiv explosion detonated on the port side of the hull, aft of the main mast, flooding the port engine roo and sending clouds of steam belching from the after funnel and out through any open hatches. Luckil the steam vented clear of the men in the engine room and no one was hurt. Men stuck bravely to the posts until ordered on deck. The ship listed sharply to port as the watertight doors were belated closed. Following standing instructions, the rest of 2BS steamed on regardless. It was suspected th the explosion must have been caused by a torpedo, and, if so, it was vital to keep moving and get cle of the area as soon as possible. One light cruiser, *Liverpool,* and two destroyers were ordered to star by the stricken battleship, but to keep moving so as to make a difficult target for the suspecte submarine.

But it was not a submarine that had caused the damage. The fast liner *Berlin* (17,000 tons) had bee hurriedly fitted out as an armed merchant cruiser, with 6-inch guns and a complement of 200 dead mines. Both sides made extensive use of armed merchant ships like *Berlin* during the war, often high risk operations. They frequently had much longer ranges than warships and were relatively eas to disguise as neutrals; also, navies probably considered them and their crews more expendable tha warships. *Berlin* had been ordered to mine the mouth of the River Clyde in the hope of laying a tra for some of the transports carrying Canadian troops to Britain. These were expected to arrive late October (actually, unknown to the Germans, they had been diverted to the south coast while en route Captain Pfundheller of *Berlin* had set sail in mid-October. His voyage was covered for the most pa by a welcome blanket of fog, so he was able to avoid detection by British patrols and arrive somewhere near his destination on the 24th. At that time ships had no way of fixing their positio precisely in thick weather, and mines have to be laid accurately and in the correct depth of water they are useless. After vainly trying to find out exactly where he was, Pfundheller decided that that h could hang about so close to the Scottish coast no longer and turned westward, so as to drop his dead cargo in the shipping lanes just north east of Tory Island, where they might catch merchant shippin bound for Britain. Having accomplished his mission, he turned *Berlin* northward to get clear of th dangerous waters so near the British fleet, and to seek unprotected British merchantmen trading wi Russia or Norway. Off northern Norway, *Berlin* encountered a heavy gale that damaged the ship an forced her to enter Trondheim for repair. Here she was identified and, together with her crew, interne

for the rest of the war.

Berlin had not sailed in vain. On the night of 25 October the steamer *Manchester Commerce* struc one of her mines and sank. A few hours later the four-masted sailing ship *Caldaff* suffered the sam fate. No reports of these sinkings were sent to Jellicoe, so no particular warnings of mines we circulated to the Grand Fleet. The absence of such warning, however, does not excuse Warrender carelessness in putting to sea without ordering the ships in his squadron to close their watertig doors.

Audacious still had her starboard engines working and was able to make nine knots under her ow power, so it was decided to try to struggle to Loch Swilly to beach her. However, the water was risin fast and she was clearly going to need help. Small vessels were sent out to her from the fle anchorage and the old battleship *Exmouth* was ordered to raise steam in case a tow was neede (Jellicoe, still thinking that a submarine was responsible, didn't want to risk a dreadnought. *Exmou* was expendable.) At 10.50 hours, about two hours after the original explosion, the remaining engin stopped and Dampier began to send most of the crew away in boats to the attendant small ships. Som 250 volunteers stayed on board to try to save the battleship. Hopes rose when the mighty 45,000-to White Star liner *Olympic* (sister ship to *Titanic)* arrived on the scene after an Atlantic crossing. H appropriately named Captain Haddock signalled that he would do what he could to help. Showin commendable seamanship in deteriorating weather conditions, the collier *Thornhill* and the destroy *Fury* passed lines between the two big ships and the tow commenced. The sea, however, was risin and as she filled with water *Audacious* became impossible to tow, hawsers were constantly breaking she wallowed deeper and deeper in the water. At 19.45 hours, all personnel were evacuated from th stricken dreadnought. At 21.00 hours she suddenly exploded and sank. What caused the explosion wa never determined, but it led to the only casualty of the episode. A large splinter struck and killed petty officer on *Liverpool*, which was still standing by. Amazingly, *Audacious* had been fatal damaged by a fairly small mine, containing only 160 lb of guncotton, intended to sink merchant ship Many much smaller ships survived mines containing over 500 lb of explosive, and Germa dreadnoughts on many occasions managed to carry on operating after striking quite large Allie mines. This indicates how poorly the British battleships were designed as far as underwater protectio is concerned.

Earlier in the afternoon, Jellicoe had been belatedly informed of the loss of *Manchester Commerc* and *Caldaff*, and was able to conclude that a mine, not a torpedo, was responsible for the disasters. H took immediate steps to divert all traffic away from Tory Island and ordered minesweepers to clear passage. Great efforts were made to cover up the news of the disaster, but as there were America passengers on *Olympic* who had photographed the ship sinking, these were of little effec Nevertheless, no official announcement was made until after the war. Secrecy was important as at th stage of the war the Grand Fleet only just outnumbered its opponents, having seventeen effectiv dreadnought battleships against Germany's fifteen, and both sides had just five battle cruisers. If ev Germany had a chance against the Grand Fleet, it was in October 1914.

After the loss of *Audacious*, no naval operation could ignore the danger of mines. The results spea for themselves. During the whole of the 1914–1918 war, *Audacious* was the only dreadnoug battleship lost for any reason either by Britain or by Germany. (Austria lost two, one to a limpet mi and one to a torpedo boat.) Not one was lost to gunfire. Mines caused far more losses to the Roy Navy during the war than either gunfire or torpedoes. This weapon, at which British admirals had bee inclined to sneer, and which the Navy was ill prepared either to use or to combat, became a decisiv factor in the war at sea. This book will endeavour to trace how an insignificant branch of the Roy Navy evolved to deal with the menace to British warships and merchantmen and how the Nav

eventually learnt to use mines itself effectively against its enemies.

It should be mentioned here that mines were extensively used in other theatres of the war, includi the Baltic, the Black Sea and the Mediterranean, but as the Royal Navy was not the main participant laying or sweeping these minefields, they are not covered in this book. The exception is t Dardanelles – a mainly British operation that is covered in some detail.

Origins

The idea of blowing up an enemy ship with some kind of explosive device is as old as gunpowd itself. The first successful attempt was in 1585 by the Dutch, who succeeded in blasting son Spanish ships using 'exploding boats', but these weapons cannot really be classified as 'mine as they lacked one essential ingredient – they did not explode under water. A mine in the proper sens of the term must be a device intended to explode under water, where it can do maximum damage to i victim and where the surrounding water pressure makes the explosion more effective than it would h on the surface. Obviously, the construction of a true mine would have to await developments i engineering and of materials that were not available until the early stages of the industrial revolutio of the eighteenth century.

The deployment of an underwater weapon was first attempted during the American War o Independence. It is significant that this was a situation in which a nation with a very weak naval pow (the American revolutionaries) was attacking one with a strong navy (Britain). For many yea thereafter the mine was regarded as the weapon of a weak power, and this was to lead to seve problems for the British in the future. It is important to point out at this stage that what we would ca 'mines' were in the eighteenth and nineteenth century often called 'torpedoes' and torpedoes we sometimes called 'locomotive mines'. It is easier to understand accounts of warfare at that time if th is kept in mind.

The pioneer of mine warfare was an American called David Bushnell. His first attempt (Septemb 1776) was against the British frigate *Eagle*, flagship of Lord Howe. He had devised a primitiv submarine named the *Turtle*. *Turtle* was an egg-shaped device about six feet from top to botto which accommodated a single occupant, Ezra Lee, a sergeant. Lee had two screws that he turned h hand, one horizontal to give forward movement, and one vertical. There was also a rudder and a wat pump to control ballast weight. Together these must have kept Lee pretty busy. A tiny conning towe projected above the water to enable Lee to see where he was. On the outside of the vessel was magazine containing 150 lb of gunpowder. There was a screw attached to the magazine by a lanyar and this was to be inserted into the enemy vessel, and a thirty-minute clock started; the clock wou then detonate the magazine when *Turtle* had had a chance to get clear. *Turtle* was towed to a conceale point up tide of *Eagle*, which was lying in New York Harbour, close to Governor's Island. At first Le was carried past *Eagle* by the tide, but he managed to get back to her and tried to insert the screw. was impossible, however, to penetrate the copper sheathing around her hull. As daylight approache the sergeant had to abandon his mission and released the magazine, which drifted away harmlessl Lee escaped unhurt.

Bushnell made several more attempts against British shipping. One 'magazine' was launche against a frigate *Cerberus*, but it missed her and struck a small schooner close by causing sever casualties. He then adopted a much more promising tactic, this time drifting kegs of explosive slur below floating buoys down towards ships lying in the Delaware River. Unfortunately for th Americans the river was starting to freeze over at the time of launching, and this had caused th British to move their ships clear of the main stream, and out of the main path of the drifting keg

Also the ice delayed the progress of the kegs down tide so that they arrived in daylight, not in the da as intended. In daylight it was not difficult for the British to fend off any kegs getting near their ship but one boat's crew, attempting to capture a keg, was insufficiently careful and it blew up killing fo men and wounding others. Thus Bushnell's campaign came to an end without conclusive result.

In the French revolutionary wars an American citizen, Robert Fulton, made a number of attempts interest both the French and the British Governments in a device that he had invented, not entire unlike Bushnell's, for getting an explosive charge tethered to the hull of an enemy ship. The vehic for delivering the mine, named *Nautilus*, was a copper-sheathed iron submarine, equipped with a sa for use on the surface and a hand-driven screw for underwater propulsion. Some successful trials we conducted, but both the British and the French considered the device 'dastardly' and did not use The British did, however, attempt to use 'explosive catamarans' proposed by Fulton, against th French fleet off Boulogne in 1804. These were not very successful, and the whole enterprise w considered rather unsporting. No such nice moral judgements were to apply in the savage total wars the next century.

Fulton was not finished. In 1804 he came up with new proposals, including one for a moored mi that consisted of a brass case containing 100 lb of gunpowder with a firing pin on top. This w provided with buoyancy by cork. It had one entirely novel feature, which was a system for locking th firing pin after a pre-determined period so as to render the mine harmless. Thus, it had many of th characteristics of a twentieth century sea mine. It was never used in practice. Yet another Fulto development, made during the Anglo-American war of 1812, was a submersible vessel with a turtl shaped metal shell designed to protrude slightly above the water. This towed a number of 'torpedoe as it proceeded through an enemy anchorage. The 'torpedoes' were released and detonated as the struck enemy ships. One of these devices was captured by the British when it went aground on Lo Island in 1814 and this appears to be the only one ever used in anger. Fulton died in 1815. His care as an armaments manufacturer was not notably successful, although some of his ideas formed th basis of subsequent successful developments. Interestingly, his motive was not money or eve patriotism. He genuinely believed that his devices were so awful that they would make war at sea future inconceivable to intelligent humans. A man of many parts, he was also a notable artist and pioneer of steam-propelled boats.

At this point it is necessary to distinguish between different types of mine that would come into u in the nineteenth and twentieth centuries. These can be divided into the following general categories:

Ground mines

These are mines designed to sit on the seabed, typically to protect a harbour from enemy attack. The are frequently controlled from an observation station on shore and detonated when an enemy ship is the act of entering the harbour.

Drifting mines

These are normally allowed to drift under the influence of tides or currents, in the way that Bushnell kegs were used in the Delaware River. Drifting mines can also be released by a fleet fleeing from superior enemy in the hope of destroying some of his ships. As we shall see, the British became ve concerned about such tactics during the First World War.

Some quite ingenious drifting mines had been designed that creep up rivers on the rising tide a stay still on the ebb.

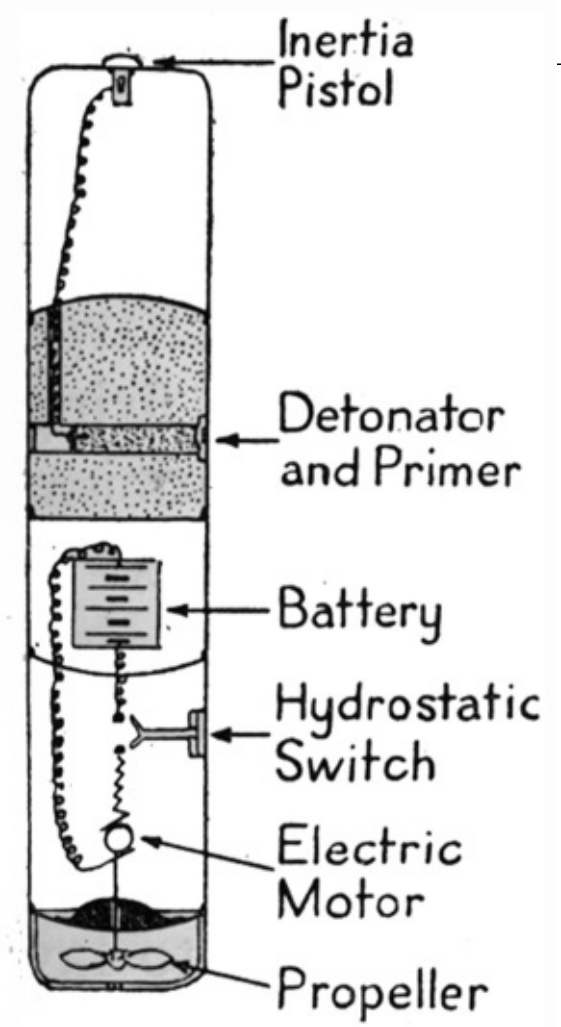

Figure 1: A Leon mine. These were designed to drift free, with depth being maintained by an electric motor and hydrostat. When the battery was exhausted, they sunk to the bottom. In practice they were not much used, although the Royal Navy did sow some in the North Sea.

Normally, drifting mines have some sort of self-destruct device so that they do not constitute permanent hazard to shipping.

A more elaborate type of drifting mine was known as the Leon mine (see Figure 1). This was drifting mine designed to maintain a pre-set depth under water by means of a hydrostat and a sma electric motor that actuated a vertical propeller, rotating in either direction so as to drive the mi either upwards or downwards. Leon mines could be launched into a harbour or anchorage and wou drift towards an attacking enemy fleet, detonating when struck by a ship. They might also be dropp by a fleeing warship so as to threaten its pursuers, or so as to drift down tide towards an enemy flee They had a limited life and would sink harmlessly to the bottom when the battery ran out of power.

Moored mines

These are by far the most widely used type, and are moored to the sea bed by a cable. They can b detonated in a number of ways:

- By contact using a trigger mechanism outside the mine itself.
- By ‘influence’, either magnetic or sonic.
- By means of long whiskers or antennas projecting from the mine.
- By remote control by an observer on shore.

Normally, moored mines have a deactivating device that makes them safe if the mooring line shou

part.

Limpet mines

These are fixed to the hull of an enemy ship by frogmen or midget submarines.

After the Anglo-American war, the next use of mines in warfare was during the Schleswig-Holstei war of 1848–51 fought between Prussia and Denmark. Denmark had by far the most powerful fleet ar the Prussians feared that they would use it to force their way into Kiel harbour. They employed system of ground mines that could be set off by means of an electrical current from on shore. This ha been devised by Professor Himmel of Kiel University – an early example of a 'boffin' being used gain military advantage. The system was successful in that the Danish fleet was deterred from forcin an entry.

Much more extensive use of mines was made in the Crimean War (1854–6). Russia was at war wit Britain, France and Turkey, and being the weaker power at sea, was active in employing mines t protect its harbours. Two types of mine were used. Ground mines detonated by observers on sho were employed, as well as moored contact mines containing 25 lb of gunpowder, which incorporated most ingenious fuse that was to be the forerunner of the system used for many years almo universally. A glass tube was encased in a lead 'horn' that would bend as soon as it was contacted by ship, breaking the glass tube. The broken tube would release the sulphuric acid that it contained into mixture of potassium chlorate and sugar. This caused a small explosion, which in turn detonated th gunpowder. These were sometimes known as 'Nobel mines', after their inventor (the father of th famous Alfred Nobel) Immanuel Noble. At least two British ships were damaged by these mines whe they attempted to approach the Russian base at Kronstadt in the course of the war. At the same tim the Russians employed some large ground mines with electrical detonation. These do not appear have been fired.

The American Civil War (1861–5) saw extensive use of mines mainly by the Confederates – agai the weaker naval power. Many of the mines used were simple kegs of gunpowder, often laid in pai with a friction device like a match head to fire them when they were struck. As an alternative, som were fitted with chemical fuses similar to the Russian horns. A more elaborate type of mine, th Singer mine, consisted of a metal cone filled with gunpowder, on top of which sat a heavy metal l secured to a length of chain. These were tethered a little below the surface of the water. When a vess hit the mine the lid was dislodged and fell off, jerking on the chain and setting off a friction fuse. Th Singer mines were remarkable in that if the lid was knocked off by accident when the mine was bei laid, a safety pin prevented the fuse from being activated. Another innovative development was know as 'The Devil Circumventor'. This was a mine designed to be laid in shallow rivers. It consisted of case containing 100 lb of gunpowder, fitted with detonating horns. This was mounted on top of a spa which in turn was connected to a universal joint on top of the anchor weight that held the whole devi to the bottom, so that it stuck up rather like an underwater lollipop. Connected to the anchor w another mine sitting on the seabed, so that any attempt to sweep the device was sure to detonate th underwater mine. This was the first example of an anti-sweeping system. Ground mines were als employed by Confederate forces, one containing 1,000 lb of gunpowder and detonated electricall successfully destroyed a powerful Federal gunboat.

No account of mining in the Civil War can be complete without mention of the use of towed mine or 'spar torpedoes'. Spar torpedoes were explosive devices mounted on long spars sticking out fro the side of fast-moving steam launches or stealthy semi-submersible boats. These would b manoeuvred so that the mine on the end of the spar would strike the target and explode. A furth

development of the same principle consisted of a launch that would tow a mine behind it on the end a long cable. The launch would then try to cut across the bows of a moving target so that the mi struck it. These weapons were extremely risky to those who used them and were to be render obsolete by the introduction of quick-firing secondary armament and self-propelled torpedoe Nevertheless, they were employed by both sides and achieved some notable successes.

In all, twenty-two ships were destroyed by mines during the Civil War, and many more severel damaged. The mine had decidedly come of age.

Two final nineteenth century wars saw a further significant development in mining technology. Th Austro-Prussian war of 1866 saw the development of the Hertz horn, which was first incorporated German mines during this conflict (see Figure 2). The Hertz horn was to become a feature of the va majority of contact mines used in both world wars. It consisted of a lead horn containing a glass tu similar to the Russian mines described above, however in this case, instead of a chemical reaction, t fuse acted electrically. Breaking the glass tube released a bichromate solution onto two plates, o zinc, the other carbon. This immediately constituted a battery and generated an electrical current th passed to a platinum wire bridge embedded in fulminate of mercury; the current fused the bridge a ignited the priming composition, which in turn fired the main charge. This elegant device acted almo instantaneously and proved reliable and long lasting in service. Mines fitted with Hertz hor protected German harbours against the greatly superior French fleet in the Franco-Prussian war 1870 and thereafter the German Navy paid great attention to the manufacture and deployment moored mines.

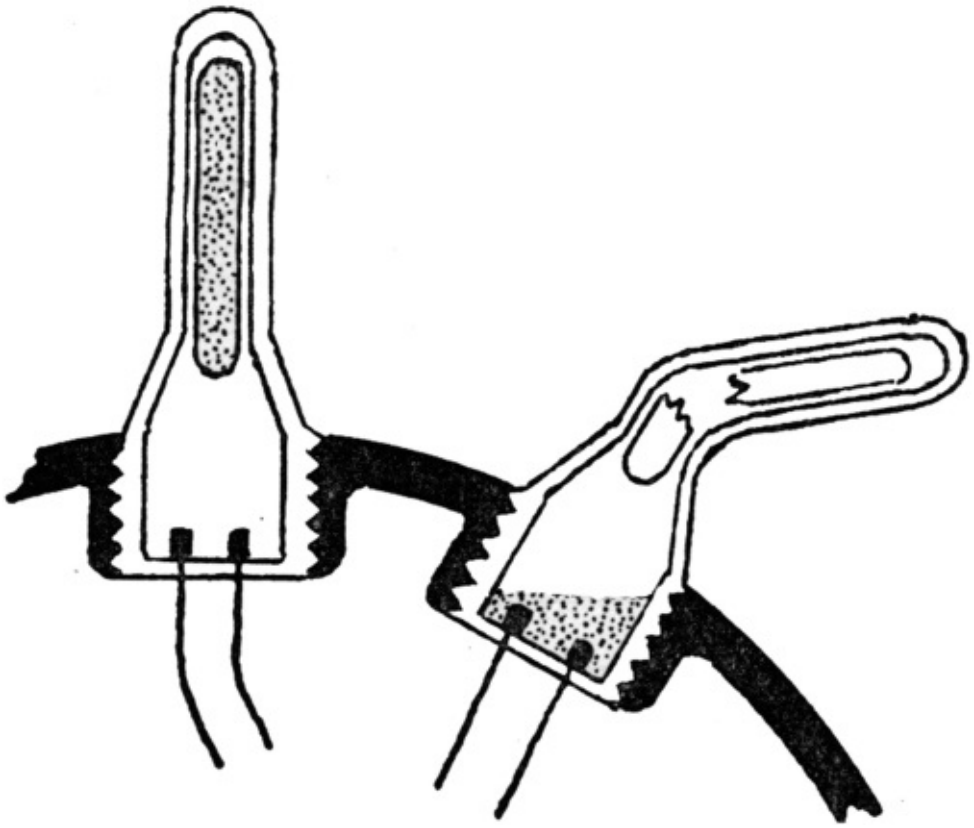

Figure 2: The Hertz horn. A ship striking the soft lead horn bends it and breaks a glass tube inside, which allows acid to contact two electrodes, setting up a battery that immediately generates a current detonating the mine. By far the most satisfactory system for detonating contact mines.

In the Russo-Japanese war of 1904–1905, mines were to prove a decisive weapon. The Russia Pacific Fleet was bottled up in Port Arthur. Russia was at the time probably the world leader in mi design and manufacture, having successfully used them in the Crimean war and in the subseque

Russo Turkish war. By 1904, Russian mines used either the Nobel or the Hertz firing systems an were filled with guncotton instead of gunpowder. They were mostly conical in structure with a sing horn projecting out of a domed top.

Japanese mines drew the first blood, however. At first, the Japanese had failed to obtain decisiv results by attacking the Russian fleet in harbour using torpedo boats. These did no great damage b seem to have demoralized the Russian Navy so that it did not interfere with Japanese troop landing behind the town. The supine performance of the Russian Navy prompted the selection of a mo aggressive commander. Vice Admiral Stepan Makaroff was dispatched to Port Arthur an immediately breathed new life into the fleet. The Japanese, however, decided to lay mines in th region of the port. These were moored contact mines detonated by a pendulum. The Russians appear have seen these being laid, but forgot about them in the heat of battle. On 13 April, Makaroff took h five battleships to sea to support an action between his own destroyers and the enemy. When th Japanese battle fleet appeared he retired, hoping to draw the Japanese ships into range of his coast artillery. As he neared the coast his ship *Petropavlovsk* struck a mine and was lost, together with th Admiral and most of the crew. A few minutes later a similar fate befell another battleship, *Pobied* she stayed afloat, however, and was towed home. Russia had lost the one commander who might hav won the war. This was an early example of a new tactic developed by the Japanese – offensive min laying close to an enemy coast.

On 15 May the tables were turned when the captain of a Russian minelayer managed to observe th normal course taken by blockading Japanese forces outside Port Arthur and two Japanese battleshi *Yashima* and *Hatsuse* blundered into a minefield that he cunningly laid in their path, sinking one an severely damaging the other. A little later two Japanese cruisers suffered the same fate. The Japanes had attempted to sweep part of the minefield and mark the unswept area with buoys, but the Russian some of whose junior officers seem to have shown a degree of aggression and resourcefulness th shamed their superiors, had cunningly moved the Japanese marker buoys. Although this impressiv success gave the Russians an opportunity to seize the initiative, deprived of their bold leader, they di not take it and stayed in harbour where their ships ended up being destroyed by the artillery of th advancing Japanese Army. Such was the ignoble end of the Russian Pacific Fleet. During th campaign they had laid 4,275 mines and these sunk two battleships, two cruisers, five gunboats s destroyers and a dispatch ship – a far greater haul than they achieved by all other weapons combine The Russians themselves lost one battleship, one cruiser, two destroyers, a torpedo boat and a gunbo to mines. The war concluded with the attempt by the Russian Baltic Fleet to intervene and i subsequent crushing defeat at Tsushima. Things might have turned out differently if Makaroff ha been in command at Port Arthur.

Mines and the Royal Navy

British observers had, of course, watched the development of mines but the Royal Navy, by f the largest and best equipped in the world, had been able to reach no conclusion regarding ho it should react. At first, mines were regarded as nasty, sneaky devices, which might be used b to protect a fleet anchorage from surprise attack, but which had no other purpose. Wider use of mine would tend to obstruct the fleet when manoeuvring at sea, and equally importantly would hamper th vitally important merchant service that carried Britain's overseas trade. Britain as the dominant se power, it was argued, would be mad to do anything that restricted movement of ocean-going vessel Mines were not ignored entirely, however, and the main fleet harbours were protected by a system o defensive mines installed, rather surprisingly, not by the Navy but by the Royal Engineers. The mine were of two types:

i) Observation mines containing 500 lb of gun cotton. A line of these would be laid across the harbou mouth. They were fired from on shore by hidden observers equipped with telescopes mounted o swivels, normally working from two observation stations. The telescopes would be pointed at th attacking ship and would follow it as it approached the harbour. An electrical contact would b made when the angle of the two telescopes indicated that the ship was over the mine, and the mi would fire. If the entrance to the harbour was narrow a single telescope was sufficient.
ii) Contact mines containing 76 lb of guncotton. These were contact mines fitted with a detonator fire electrically by anything that struck the mine, due to the displacement of mercury in a tube or a inertia weight. They were connected to a base on shore so that the mines would normally be in a inactivated condition, but would be set to ‘active’ when enemy ships were expected.

The Navy considered that such mine defences were a useful adjunct to gun defences, and adopted training regime under which officers and men were instructed in how to lay mine defences acro temporary fleet anchorages without the help of the Army. At the same time a system of counterminin was developed. A launch would lay a string of small mines as close as possible to an enemy defensiv minefield and detonate them electrically. The explosion of these small mines would set off the enem defensive mines and thus destroy the defences of the enemy harbour. It would have required pret cool nerves on the part of the crew of the launch to carry out such an operation in practice.

At the same time, consideration was given to the problems of mooring offensive and defensiv mines. A mine must be positioned below the surface of the sea, and must remain there whatever th state of the tide or weather. Its depth will vary according to the state of the tide and the strength of th currents, which will cause it to pull on the mooring rope and tend to drag it deeper in the water. La too deep, a mine is obviously ineffective; too shallow and it will be above water at low tide and th easy to avoid and destroy. This meant that early mine laying operations had to know exactly whe each individual mine would be moored and the mooring cable would be cut to length, taking in account tidal range and current. Obviously, this was highly inconvenient and the problem wa presented to HMS *Vernon,* the torpedo school at Portsmouth. This establishment was responsible f

torpedo and wireless development as well as mines and attracted some of the best brains in the Nav
Unfortunately, mines were at this stage the 'poor relation' in *Vernon*'s activities and this would lead
severe problems in 1914, but the mooring issue was elegantly resolved by one of the staff, Lieutena
Ottley. Ottley's device, known as the 'Plummet System' (see Figure 3), comprised a mooring cable f
the mine mounted on a rotating drum inside the mooring weight. When the mine is dropped it remai
floating on the surface, while the mooring weight sinks towards the bottom, unreeling the cable as
does so. Suspended beneath the mooring weight is a plummet on the end of a line whose length is t
desired depth of the mine beneath the water. When the plummet hits the bottom the tension on th
line is released, and this in turn locks the drum so that as the mooring weight continues its journey
the seabed it hauls the mine down after it to the set depth. The length of the plummet line can
adjusted according to the tidal state at the moment of laying and the local tidal range.

While the Plummet System was reasonably satisfactory, a more accurate arrangement w
eventually developed incorporating a hydrostat. In this system the mine and the mooring weight a
dropped together and sink to the bottom. After a set time a soluble plug dissolves and the mine
released and rises towards the surface, unreeling the mooring cable inside it as it does so. At a dep
determined by the setting of the hydrostat, the reel is locked and the mine is ready. An alternati
system allowed the reel to be mounted within the mooring weight. In this case the mooring line wou
be double and the hydrostat within the mine would lock the cable as it passed through a pulley whe
at the base of the mine. This system was used on German 'egg mines' (see Figure 4).

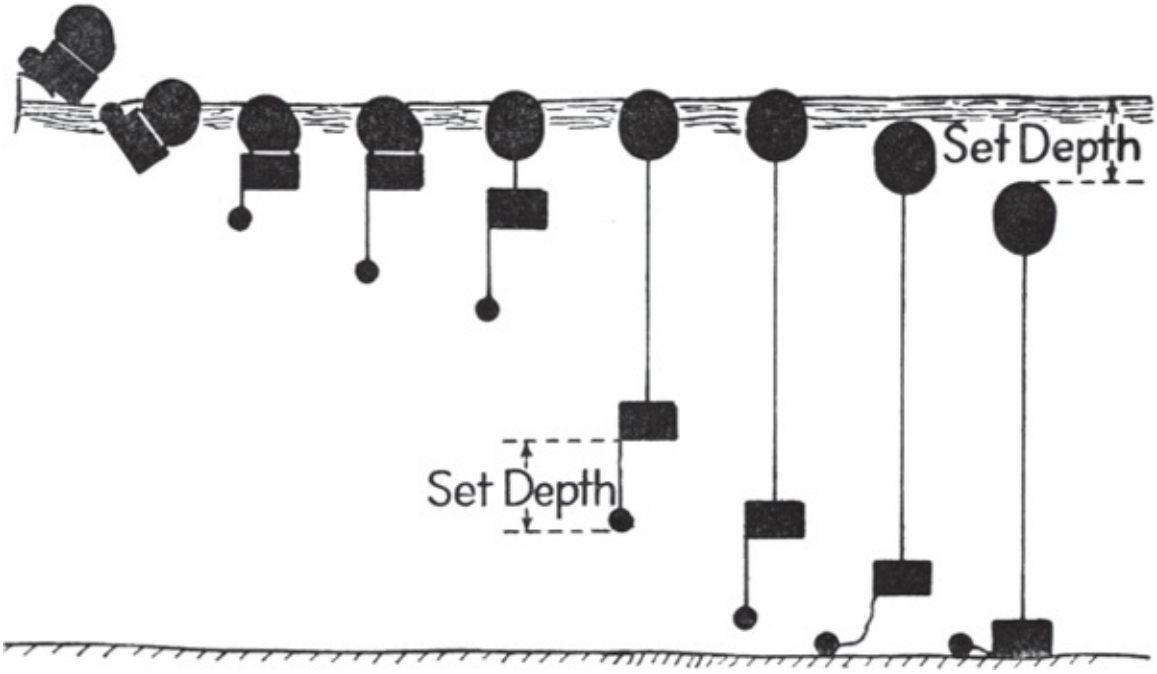

Figure 3: The plummet system of mooring. The mine and the mooring are released together, and the plummet wire starts to descend as soon as the mine is clear of the wash of the minelayer. The plummet dangles below the mine, the length of the wire holding it being the depth at which the mine will be below the surface of the water at the particular state of tide prevailing when the mine is laid. When the plummet strikes the bottom it locks the reel on which the mine's mooring cable is wound s that the mine is dragged down to the required depth by the mooring weight. Before the mines are laid the correct length of plummet wire has to be selected, taking into account the depth of water and the state of tide. The system could also be used to lay deep mines to catch submarines.

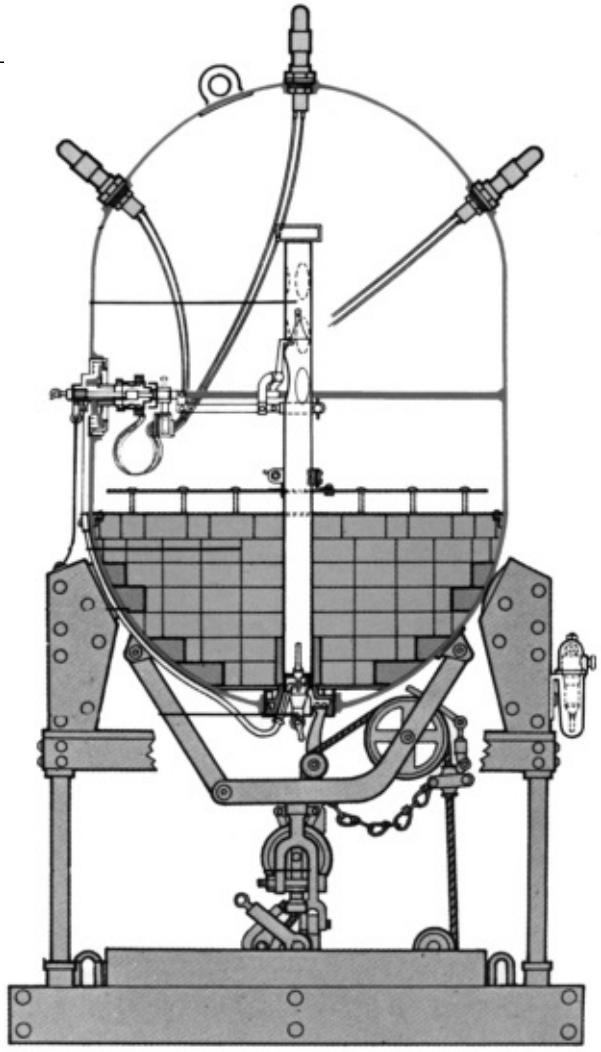

Figure 4: A German ‘egg’ mine of the type used by surface ships. The mine and sinker are dropped together and when the sinker has settled on the bottom the mine is released and floats upward, unreeling a double length of wire as it does so. When the mine reaches the required depth a hydrostat within it actuates a cable clamp. Hertz horns are used to fire the mine. The mine is moored by two wires, which tends to cause it to swing about too much in a tideway; otherwise this is an excellent design.

The Admiralty, however, remained doubtful about the value of mines, and in 1903 took the decisio to cease to deploy independent mines altogether. Mines were, according to official opinio ineffective in preventing attack by torpedo boats on a fleet in harbour, and the increased range an accuracy of heavy guns made them unnecessary.

The lessons of the Russo-Japanese war soon forced the Admiralty to change its tune. *Vernon* w once again ordered to produce a workable independent mine. In 1905, 1,000 ‘Naval Spherical Mine were ordered (see Figure 5). These were spheres filled with guncotton with horizontal firing arms o top, which when struck by a ship triggered a mechanical striker. They were fitted with the plumm system to control depth. The mechanical trigger system was selected because the Navy had a strong ill-founded objection to electrics at sea and thus considered the Hertz horns unreliable. Another fact was cost. A mine fitted with Hertz horns was estimated to cost £200 – twice the price of the selecte design. They also rejected pendulum or mercury-operated detonators because these had a tendency be triggered by rough seas. In practice, the Naval Spherical mine proved very unsatisfactory, ofte failing to explode when struck. At the same time, all the old observation mines and electr mechanical defensive mines were withdrawn. There must have been an audible sigh of relief amon junior officers detailed to man launches when the explosive counter-mining tactic for disposing

enemy mines was abolished in 1907.

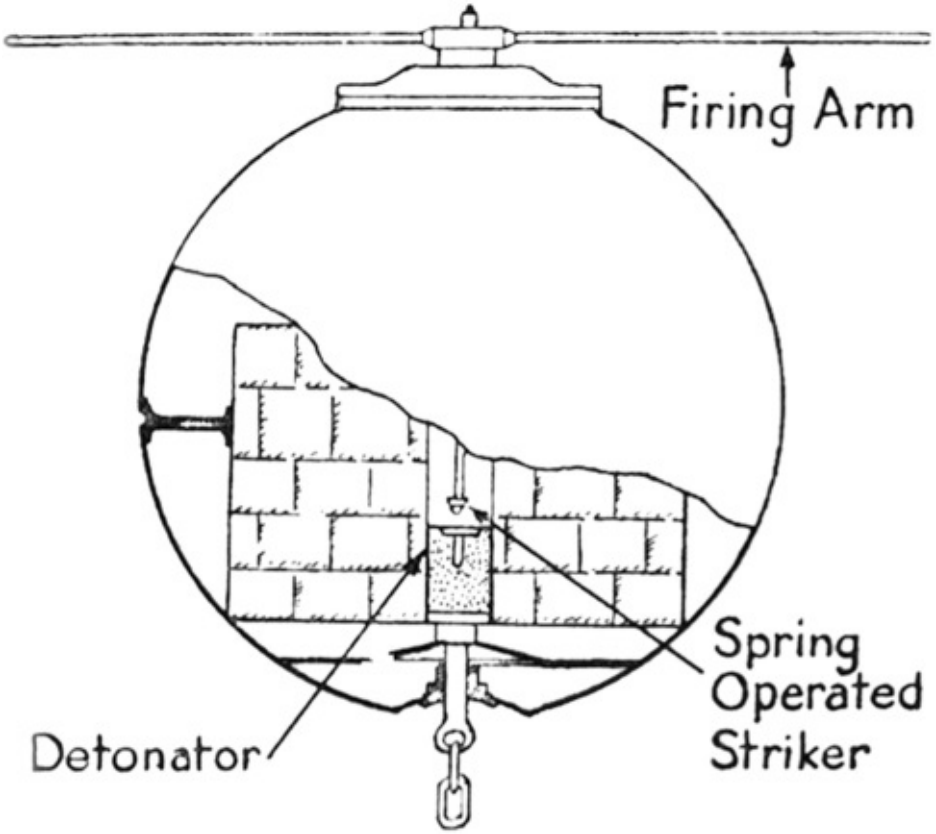

Figure 5: The british Naval Spherical Mine. This type was adopted in 1905. Contact with the firing arm released the striker and fired the mine. In practice, these were very unsatisfactory, frequently refusing to explode and coming adrift.

Enemy mines had to be countered, however, and some effort was put into devising a satisfacto means of sweeping them. The simplest device was a cable, dragged between two ships, ke underwater by weights. This was most unsatisfactory as it depended on the ships keeping exactly t correct distance apart to avoid the sweep dragging on the bottom or coming out of the water. A stud of systems used by fishing trawlers resulted in a proposal for an ‘otter’ or ‘kite’ that would mainta the sweep at a constant depth between two vessels. A lot of work was put into developing kites ar eventually a satisfactory arrangement was devised in which each vessel towed a kite, attached to t ship's winch, which remained at a selected depth under water depending on forward speed and t length of the tow rope (see Figure 6). It was so designed that it maintained position almost directly line with the towing ship's track. The kite was a substantial structure weighing about one ton. sweeping line about 500 yards long was streamed between the two kites, passing through a ring in t corner of the kites. The sweeping line itself was normally a two-and-a-half-inch cable. Initially, standard cable was used, but eventually, in 1916, a serrated cable that would cut through the moorin line more effectively, using a sawing action, was introduced. This worked even if the sweeper wa moving quite slowly. With luck the sweeping line would part the mine's mooring cable so that t mine would then rise to the surface to be disposed of by gunfire. At first rifles were used, these mig either explode the mine if a horn was hit, or might hole it and sink it. Later, sweepers were issued wi deck guns and even machine guns for the purpose. Frequently, the mooring line would not part and t mine would be dragged along until the sinker became detached, or the mine reached shallow enoug water to be clearly visible and could thus be destroyed.

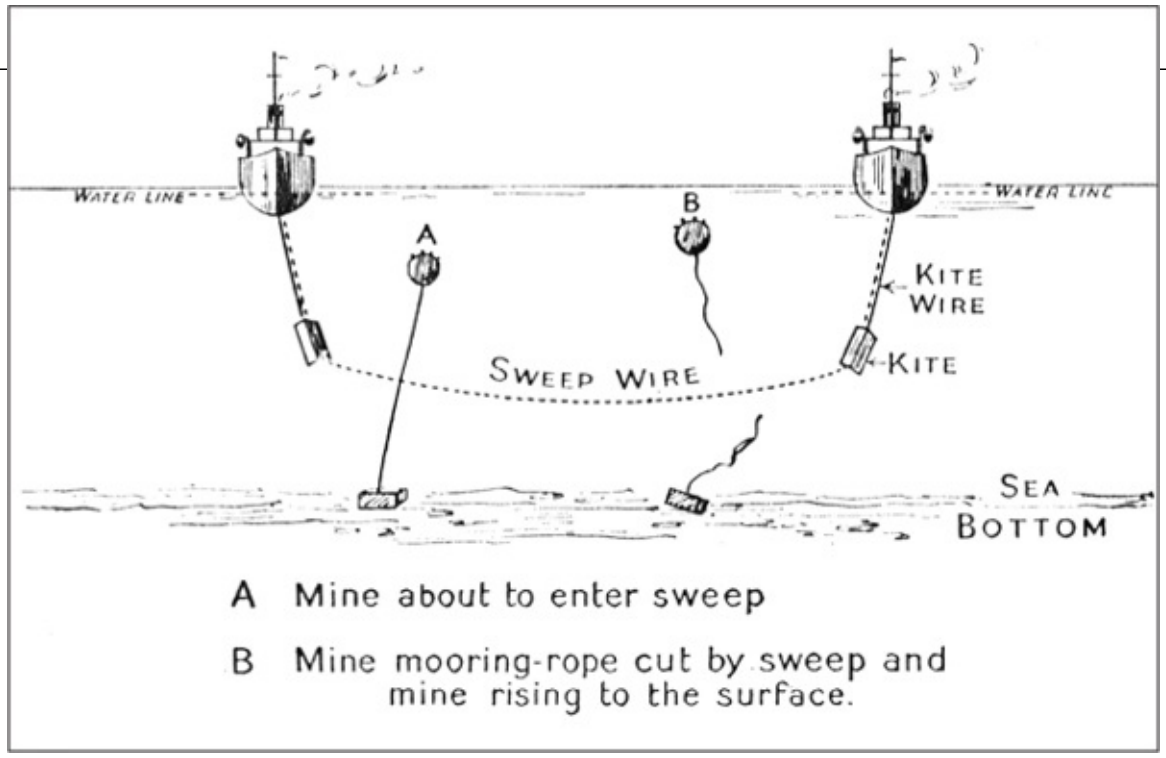

Figure 6: Conventional minesweeping gear – two trawlers pulling kites. The length of the kite wire and the speed of the trawlers determine the depth of the sweep wire between them. The sweep wire would typically be about 500 yards long. Serrated wires came into use during the war so as to improv the chance of cutting through the mooring, otherwise the mine and its sinker had to be towed into shallow water before it could be destroyed.

There were at this stage no purpose-built minesweepers. To protect the battle fleet at s moderately fast vessels were needed and for this purpose outdated gunboats or old destroyers manne by regular naval personnel were pressed into service. At the outbreak of the war the fast minesweepi fleet was commanded by Commander Preston, who was to prove an extremely able officer. H remained in minesweeping activities throughout the war, finishing up as Director of Minesweeping the Admiralty. The little ships had a torrid time of it in the early months, steaming ahead of the flee Unlike more recent destroyers these were all coal burners, and the furnaces had to be fed by men wi shovels, working in an incredibly confined space, as they struggled to keep station ahead of the flee The brief periods of rest they had in port were invariably interrupted by the filthy process of coalin Often, their range was so short when steaming at the required speed of twelve knots that they had set out with a deck cargo of coal. It soon became clear that the fast sweepers needed to b supplemented, and for this civilian vessels had to be recruited. These were fast railway packets, larg and with much longer endurance than the ancient warships. They were frequently used to sweep dangerous waters close to the enemy coast, to make sure that there was a safe area in which elemen of the Grand Fleet could manoeuvre or destroyers could carry out raids. Altogether, the fa minesweeping force had a demanding and dangerous task.

It was also anticipated that it might be necessary to sweep offensive enemy mines laid close British harbours or in shipping lanes. To achieve this an original approach was taken. Admiral Lo Charles Beresford, Commander of the Home Fleet, visited the Humber in 1907 to follow up suggestion that commercial fishermen might be capable of using their trawlers and drifters to perfor this function. He was impressed by their seamanship and skills in handling heavy gear at sea a reported favourably. Thus, the Royal Naval Minesweeping Reserve (RNMR) was formed. The me received some training but were not under naval discipline and did not wear uniform. They were und the control of their regular skippers, who normally went to sea wearing a bowler hat and a tweed su

which was adorned with Navy-issue brass buttons, of which they were extremely proud. Th deckhands were regular English and Scots east coast fishermen. In those days it took six years before boy going to sea on a trawler became qualified as a regular hand, so the level of seamanship and sh handling skills of these hands was extremely high – they had much more seagoing experience tha most naval ratings. As the war went on and the urgency of the mine issue increased, more and mo naval officers and petty officers found themselves posted to the minesweeping service.

The navigational methods used by trawlermen were, to say the least, unorthodox. In the days radio and satellite assisted navigation it is easy to forget what an inexact science this was in the ear twentieth century. Experienced navigators on warships were often fifteen or twenty miles out in the dead reckoning estimates after a couple of days at sea. If cloud cover was thick there was no way checking one's position by sun or star sights. Men who had been fishing the North Sea all their live however, simply knew where they were. The only instrument most of the little ships used was compass, and the forefathers of the RNMR skippers would probably have regarded that as a bit of a effeminate gadget. If you were a North Sea fisherman and didn't develop some sort of sixth sense f direction finding, you didn't last long. One Royal Navy officer described the achievements of a trawl skipper attached to his command. Often, the trawler had to separate from the rest of the flotilla an rendezvous later at some convenient spot in the North Sea. Whenever he was ordered to do this th trawler skipper asked for a bearing from Lowestoft. Given this, he never failed to appear on time the right place, although he had little idea of charts or instruments. A bearing from Lowestoft was a he needed to find his way to any spot in the North Sea. An amusing incident is recorded from minesweeper working out of Granton in a thick fog that had persisted for several days. The nav officer in command was unsure of his position until a deckhand caught a glimpse of a small bo through the fog. ‘We're fifteen miles nor'east of St Abb's Head,’ sang out the deckhand. ‘Rubbish replied the Captain ‘We're nowhere near there.’ ‘I can't help where you think we are,’ was the reply ‘But thaf s old Andy MacPherson in that boat and he's been shooting a line of lobster pots ‘ere thes forty years’. He was right, of course.

Two types of fishing boat were used. Most of the sweeping was done by steam trawlers; these wer steel-built coal-burning vessels of 200–300 tons and about 110–140 feet long, with 13 foot draft. To speed was 9–11 knots. Typically, they would have a crew of twelve. Accustomed to fishing as fa afield as the coasts of North Africa and the Arctic Sea, they were fine sea boats. As the wa progressed, many of them were fitted with 6-pounder quick-firing guns to sink mines and to ward o U-boats. There were many instances of them proving extremely aggressive in service. One of the fir U-boat sinkings of the war was achieved by Skipper Youngston of the *Dorothy Grey.* He used h trawler to ram his victim, which had attempted to enter Scapa Flow. He damaged her hydroplanes s badly that she became uncontrollable and drifted through the Pentland Skerries firing distress signal Most of her crew were rescued by a gunboat before the submarine sank in the turbulent water Youngston and his crew were awarded £500 by the Admiralty and a further £100 was given to anothe trawler, *Tokio,* which had assisted in the chase. On another occasion later in the war some trawle were escorting a slow convoy back from Ireland. All of a sudden there was a disturbance in the wat and a ‘huge’ submarine appeared and opened fire (she was actually probably one of the U.139 class cruiser submarines, of 2,000 tons surface displacement mounting two 5.9-inch guns and with a surfac speed of 16 knots). Following the lead of their commanding officer in *Conan Doyle,* the trawle formed into line of battle like so many ships of the line and returned the fire with their pur armament. The submarine closed the range, with her heavy guns and high speed she should have ha little difficulty in dealing with a handful of lightly armed fishing boats. One of them, *Asne,* was bad hit and suffered one man killed and four wounded, but the unequal battle continued. The trawle began to run short of ammunition and *Conan Doyle* signalled ‘Prepare to ram.’ It was not necessary.

lucky shot from the second trawler in line knocked the submarine's forward gun over the sid damaging the hull in the process. The powerful vessel decided she had had enough and dive suddenly. It was never determined whether or not she survived.

British trawlers were joined as the war went on by increasing numbers of captured German fishi boats and by various Scandinavian and even Spanish trawlers purchased by the Admiralty for w service. These were manned by naval and RNMR crews.

The other type of fishing boat used were the drifters, designed to shoot and then ride to drift net These were mostly wooden steam boats, but some had oil engines. They had a steadying sail to ho them into wind when riding to nets. Drifters were slower than the trawlers and had a shallower dra They were normally used for laying marker buoys to define the limits of minefields or for oth auxiliary duties.

Trawlers worked in groups of six to twelve vessels, each group being under control of a Royal Nav officer-frequently from the Royal Naval Reserve (RNR), or Royal Naval Volunteer Reserve (RNVR RNR officers were in some cases retired regular naval men, and sometimes volunteers from t Merchant Navy. The RNVR were mostly yachtsmen volunteers. They were something of figures of fu among their regular colleagues. On one occasion an RNVR officer unwisely picked up a small she that had been fired at his ship and had failed to explode. ‘By golly it's hot!’ he yelled as it burnt h hands before dropping it. For the rest of the war, whenever one of the crew met an RNVR officer the would start the conversation with ‘By golly it's hot.’ Relationships between fishing boat skippers an the naval officers they worked with seem to have been generally excellent, at least in British coast waters.

A few weeks after the outbreak of war some 200 fishing vessels were enrolled in the RNMR, an many more joined as the conflict took its course. Normal fishing activities were, of course, very muc restricted by the war, and skippers were often glad of the assured income minesweeping servic provided. Flotillas of RNMR sweepers were initially based on The Nore, Harwich, Lowestoft, Th Humber, The Tyne, and Granton in the Firth of Forth. Eventually, they spread to cover the whole c the British Isles.

This motley fleet was put under the command of Rear Admiral Ned Charlton, Ned was installed in succession of requisitioned steam yachts, and was frequently actively engaged in sweeping operation himself. He was popular with his men but not with Admiral Fisher, the First Sea Lord, who considere him an incompetent muddler. Fisher wrote to Jellicoe on 21 May 1915, with typical over statement.

> Minesweeping is really the one chief thing in the war and in view of the certainty (now very near us) of every yard of the Nor Sea being infested with mines, Charlton is quite unfit for so immense a job and Madden is the ONLY man.

However, Charlton lasted in his post longer than Fisher himself, as Ned Charlton remained i command of mine-sweeping until October 1916, when he was transferred to command the Cape Good Hope. Fisher resigned in May 1915. One incident that he recorded gives a good picture of ear sweeping operations:

> I was engaged in looking after the sweepers in a yacht manned throughout by RNR and RNVR officers, most of whom we undergraduates from Cambridge. It was a misty day and mines, we were led to believe, had been laid in the fairway. Wh searching we observed a mine blow up alongside a steamer about a mile away to the northward. Fortunately for us perhaps were heading south east and had to turn round to close her. Between us and the steamer was a patrol trawler heading nor Without the slightest hesitation this little vessel made a bee-line for the disabled ship which we could see was in a bad way wi one of the boats hanging vertically from the davits. When the trawler got within 150 yards of her there was a terrific explosion a the trawler's stern cocked up in the air and her still revolving propellers had disappeared under water before the pieces had stopp falling. We stopped at once and picked up seven survivors. We observed the bulky form of a man floating on the surface with h head under water. The bow wash seemed to dislodge some air out of his clothing and his body disappeared, a man in our bo immediately dived in after him and both were hauled on board together. The unconscious man was treated by our doctor bu