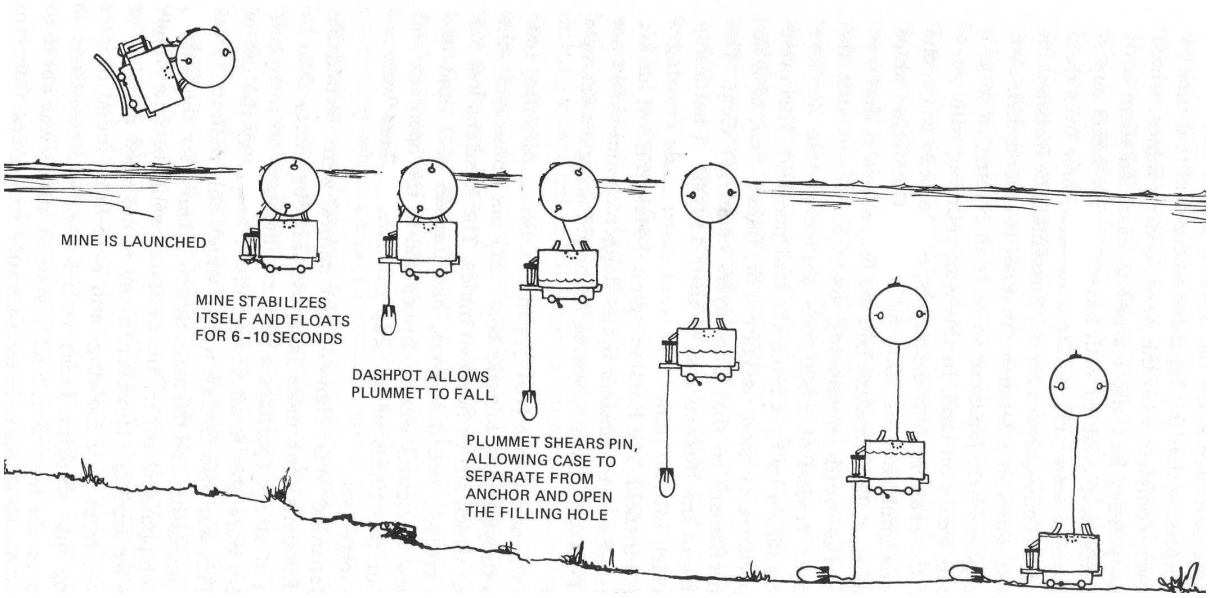
3. OF MINES AND MEN

This chapter covers the rudimentary details of naval mines. Those who choose to read it may acquire a heightened appreciation for the dangerous task of locating and destroying these large, often sophisticated "weapons that wait". They normally only show themselves by blowing immense holes in unsuspecting passing vessels. The result of a single successful mine explosion was typically one sunk ship, for all but the larger ships which, if not sunk, were crippled for months of repairs. It was the job of the minesweepers to prevent the destruction of Allied ships, even at the risk of their own wood-splintering end, by deliberately going where mines were expected to be. Minesweeper destruction, if it occurred, was preferable to the loss of larger, more precious vessels, or to the loss of amphibious landing craft with their packed loads of soldiers and marines. Naval mines of World War II were normally categorized by the method used to trigger detonation, as follows:

Contact mine, swept to the surface. Hit a prong and off it goes.

Contact mines: These are the traditional porcupine-exterior mines. Moored to the ocean floor at depths less than 100 fathoms (600 feet) using a connecting steel cable, they were set to lurk below the surface where passing ships could run into their prongs. They were swept using trawler-like gear that trailed in the water behind the minesweeper to cut the cable. The mine then floated to the surface, where it was detonated by gun-fire from a safe distance. Here is an illustration of how such a mine was sown:

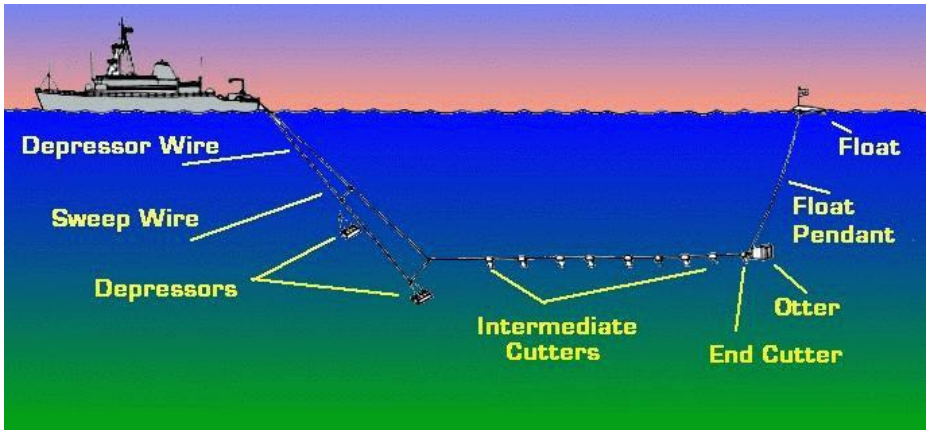


Acoustic mines: These use the sound of passing ships to detonate. They were swept by simulating such sounds causing the mine to explode where it is, hopefully not too close to the minesweeper. YMS's had noise-making devices on their bows, nicknamed hammer boxes, as seen on the bow of YMS 312 on page 7, that were rotated into the water when in use. These mines could be set to count ships, and only to detonate after a certain number passed, making sweeping more difficult. They were sown on the sea bottom in shallow waters. Perhaps surprisingly, it was found that a non-contact but close explosion under a ship caused more damage than a direct contact hit. Mines that do not have to contact a ship to explode, such as acoustic mines, are also called influence mines.

Magnetic mines: These use the magnetic signal produced by the mass of ferrous metal found in any modern ship. This signal can be reduced by degaussing coils, as we have seen, but not totally eliminated. These mines could also be set to count passing ships, and usually were sown on the bottom. They were swept using magnetic coil cables that were dragged in the water behind a minesweeper—a fluctuating electric current is sent through the coils causing the mine to ex-

plode where it is, again hopefully not too close to the minesweeper.

Pressure mines: Nearly impossible to sweep, this type uses the water pressure changes caused by a passing moving ship. They are complicated, as they must discriminate between changing pressure caused by ocean waves, tides, and deliberate explosions set-off nearby. They normally were only used in protected waters, such as in bays, to minimize accidental detonation by ocean swells. Various experimental methods were tried to sweep them, including towing a large unmanned barge at a safe distance. But nothing was used operationally in WWII, except divers in a few cases. These mines were first introduced by Germany in mid-1944. The US and Britain also made this type mine but only deployed them near war's end because of the extreme difficulty in sweeping them. (Today these mines are swept using robots that place small explosives on them to be detonated remotely. But such technology, relying on miniaturized electronics, was unknown in the 1940's). The pressure mines that the US laid near war's end had devices to neutralize themselves after a certain period, since they couldn't be normally swept.



Schematic of sweep gear for moored contact mines.

Combination mines: These used some multiple combination of the above detonators, with counters, to make sweeping more difficult. Near war's end, the counters had vacuum tube circuits to carefully measure signals to prevent easy sweeping and timers for the counters to ensure minimum intervals between counted events. They were swept by repeatedly running minesweepers through the mine area, using all sweep devices simultaneously or sequentially. But even this was not always fully effective, and these mines had to have self-neutralization timers.

As an example of the effort mines could require, after heavily-mined Cherbourg, France, was retaken from the Germans in 1944, eight sweeps were conducted every day for eighty-five days before the harbor was deemed fully safe.


Minesweeper exploding a mine that had been swept to the surface, with gunfire from a stand-off distance. Note the size of the explosion versus the size of the ship.

The mines described above can be used only in relatively shallow water, not in deep ocean. They can be sown by ship, submarine, or aircraft. Influence mines are most often shaped like torpedoes, making them easy to be sown from subs or dropped by airplanes, using parachutes. For deep ocean, only floating mines, that move unpredictably with the currents, were available at that time. But these are unpredictable, and sink friend as well as foe. An international agreement in 1907 prohibited floating mines and also required that a nation that sows mines keep records of where they are for destruction at war's end.

The first naval mine was invented by a Yale student, David Bushnell, in 1777. It was tried, unsuccessfully, against British ships in the Delaware River at Philadelphia. By WWII, mines had proven themselves to be a relatively cheap and effective way to both defend one's own harbors, and also to sink ships in the enemy's waters. Typical mine warhead size was the equivalent of 500 to 1,000 lbs. of TNT, sometimes as

much as 2,000 lbs. 300,000 mines were laid down by Britain and the US together in WWII. Of these, about 200,000 were for defense, and sank virtually no ships, except a few Allied ones by mistake, but accomplished their mission by keeping enemy submarines out of Allied harbors. The remaining 100,000 offensive mines, 75,000 in Europe and 25,000 in the Pacific, sank or severely damaged 2,665 Axis and Japanese ships. In the last four and a half months of the air-dropped mine campaign against Japanese home waters in 1945 by B-29 bombers, 670 of their ships, including 65 warships, were sunk or severely damaged. This is about equal to the number of US ships torpedoed by German U-boats in the Atlantic in the entire war. Few people seem to know any of this, a tribute perhaps to the un-dramatic, but very deadly nature of mines.

German U-boats laid down 338 mines in US Atlantic coast waters in 1942 to 1944, that sank or damaged 12 US ships, without losing a sub in these operations. About 100 US minesweepers were needed for war-long sweeping along the east coast and in the Caribbean to protect against more possible U-boat mine-laying. So even the threat of mines can have a sizeable impact.

Sweeping was normally done by multiple minesweepers in concert. It is a little like mowing grass, except that each part of the "lawn" being swept for mines has to be gone over multiple times. The minesweepers went in an echelon formation, with their contact sweep gear covering overlapping areas. Since the sweep gear is behind the ships, the first ones to go in an un-swept area take extra risk in making the first pathway. Precise navigation is needed to ensure effectiveness. The ships that followed were required to stay within the swept areas, as marked on their charts before the invasion landing and by buoys left by the minesweepers.

Japan laid over 50,000 mines during the Pacific war. Not all landing sites, harbor approaches and the like were mined. But the possibility of mines meant that any new areas entered had to be swept. Luckily for the men of YMS 339, the Japanese "only" used the simpler types of mines, mostly contact mines and some magnetic mines. But, as we shall see, before the war's end Maurice and his crew would be asked not only to face Japanese mines but also their own more dangerous Allied ones, and to do so while under enemy artillery fire.

Post-WWII air-launched combination type bottom mine.