MINES AND MINESWEEPING IN THE LATE WAR

I have found that most people have a very vague idea about mines and minesweeping, and it is the purpose of this talk to give you a somewhat clearer conception of the important part that mines played in the late war, and of the methods to counteract them.

Mines were first used at the time of the Revolutionary War when someone discovered a method of exploding gun powder under water. The original mines were crude affairs and it was necessary to attach them to the hull of a ship and explode them by lighting a fuse. Mines were used more or less from then on, and their development progressed slowly until the last few years, when they became so effective in connection with the airplane that they were one of the main factors in causing the surrender of Japan.

Until World War II had been well started, the only mines used were the moored contact type. This type of mine is a steel sphere 30 inches in diameter containing 300 pounds of solid T.N.T. which fills it about half full, a booster charge of black powder , a firing cap and an electrical mechanism which fires the cap. The Electric current required to operate the firing mechanism is generated by two dissimilar metals such as copper and iron coming in contact in the presence of salt water which is the electrolite, and this combination is known as a sea battery. In a contact mine there are four copper rods protruding from the mine case and insulated from it. When a solid object hits one of these rods, the

rod is bent and touches the steel mine case which immediately sets up an electric current inside the mine, which in turn operates the firing mechanism and the mine explodes. Contact mines are held in position at a predetermined depth below the surface of the water by an anchor which lies on the bottom, and a mooring cable, as the mine case has positive buoyancy and will come to the surface if the cable holding it to the anchor is cut. These mines can be layed in water varying in depth from 6 feet to 3,000 feet, the maximum depth being determined by the weight of the mooring cable. The deeper the water in which mines are layed the smaller the size of the mooring cable, and it has been found that 1/4 inch steel wire is the lightest that it is practical to use, as wire any smaller is not strong enough to hold a mine for more than a very short time. The depth below the surface at which the mine case is located varies from 6 to 180 feet and this is determined by the type of ship to be destroyed. Around Japan the depth of the mine cases varied from just under the surface to 150 feet, the mines nearer the surface being for the destruction of surface ships and the deeper ones for submarines. According to international agreement all contact moored mines must have a safety device which disarms them when they come to the surface as a result of the parting of the mooring cable. The reason for this is to protect neutral ships in cases where floating mines are carried by ocean currents and winds into neutral waters.

However, this safety device could not be depended upon as marine growth and corrosion of the mine case often prevented it from operating, particularly if the mine had been in the water a long time.

DRAW PICTURE OF MOORED MINE

Contact mines were used both offensively and defensively. The Germans used them offensively when they mined the waters adjacent to the British Isles to damage their shipping and prevent supplies and food from being brought in, and we used them defensively when we layed mine fields outside of our principal harbors to prevent the entrance of enemy ships.

The operation of clearing mines is known as mine sweeping. The method used for sweeping moored mines was developed in World War I by the British and our Navy, and was adopted from the methods used by the Gloucester fishermen. Instead of using a net, a steel wire is used but the same principles are used to make the wire operate. DRAW PICTURE sweep wire 51/64, 300 fathoms, paravane, depressor float, float pendant, bridles, span pendant, depressor wire, cutters.

FORMATIONS USED

Deep Mines 900 yds between ships abreast
1000 yds between lines

Depth of ~~sweep~~ float dependant upon depth of mine cases and depth of water.

Shallow Mines 50 yds inside float

1000 yds between ships

11° 200 yds effective path

Jap Mines

Chemical horn

Draw Picture

When the late war started, the first thing the British had to contend with was the moored contact mine which the Germans began at once laying in all the sea lanes approaching the British Isles. These mines were layed by ships, submarines and aircraft, so that the British never knew when or where mines were layed. This presented the first major problem of the war to the British Navy, and all kinds of small ships were taken by the Government and pressed into this service. It was of vital importance to Great Britain to keep their channels and harbors open to commerce. All important channels and harbors had to be swept daily regardless of the weather, and it was a pretty rough and dangerous job, not only from the point of view of being blown up by a mine, but also from the sweep gear itself which is very difficult and extremely dangerous to handle particularly in rough weather. But the British went at this job in their usual tenatious manner and kept traffic moving. I heard a story of a German mine layer which layed mines regularly every night in the Thames estuary, and each day the mines were swept by British minesweepers. This went on for some time until one day the British did not sweep the channel. The following night the German minelayer came in as usual laying mines, but the channel not having been swept, she hit one of her own previously

layed mines and sank. The skipper of the Garman ship was highly incensed at the British for using what he termed unscrupulous methods.

Soon after the war started, you will remember that we heard reports of Hitler's secret weapons. It seamed as if Hitler threatened to use a new secret weapon which would immediately cause the British to surrender, every few weeks, but the first one which he actually did use and cause both the British and ourselves considerable anxiety and loss of shipping was the magnetic mine. The British first learned of this mine by ships being sunk in channels and areas which had presumably been cleared of mines. Fortunately at almost the very beginning of their use, a magnetic mine was found on a beach and it was immediately taken under study by the hardy bomb disposal people and all of its secrets discovered. They found that this mine was not moored, but rested on the ocean floor and as a result it could only be used in relatively shallow water, that is water under 150 feet in depth. It carried a much larger charge of T.N.T. and was detonated by the magnetic field of a ship passing over or near it. As you probably know, a steel ship is really a large magnet with a strong magnetic field around it. The field varies for different ships, depending on the size and various other factors, but there is always a magnetic field strong enough to effect the delicate mechanism in the mine. It was a great advantage to find out what made the mine work and how it operated, but it was quite another problem to find a way to get rid of the mine without damage. A ship used to clear this type of mine was in

danger of exploding the mine in the same respect as any other ship because all except a few very small ships used for mine-sweeping were built of steel. So the problem divided itself into two categories. (1) to find a means of eliminating or reducing the magnetic field of a ship to a minimum and (2) to eliminate the mine without danger to the sweeping ship. Both problems were undertaken concurrently. Even before Pearl Harbor our Navy was co-operating with the British in developing practical methods. It was discovered that the natural magnetic field of a steel ship could be considerably reduced by running electric cables around the ship and energizing them in such a manner that an opposite field would be produced equal in strength to the ship's natural field. This was known as degaussing, and was eventually done to all naval vessels of the allied countries and greatly reduced the effectiveness of the magnetic mine. All ships were ordered to energize the degaussing coils when in water of 100 fathoms or less. At most ports there was a degaussing range over which it was required that all ships pass when first entering or leaving. This could hardly be avoided as the range consisted of an electric loop which ran across the main channel on the bottom and indicated to a station on shore the strength of the magnetic field of a ship passing over it. The ship going over the range was required to signal the settings of the degaussing coils to the shore station so that adjustments in the settings

could be made if found necessary.

In connection with degaussing, a story is told of a British ship which had just entered an English Port and anchored. Shortly after anchoring the degaussing current was switched off and the ship immediately blew up. As it happened it had anchored over a megnetic mine and while its degaussing coils were operating, its field was not sufficient to effect the mine but as soon as the current was switched off the natural field of the ship exerted itself and exploded the mine. This proved the effectiveness of degaussing in a rather positive manner.

While degaussing was very important in shallow water, it had many drawbacks. In the first place it required a large amount of current and many small ships had difficulty in keeping their auxiliary generators in operation. It also effected the magnetic compass. While most naval ships had gyro compasses which were not effected by the degaussing current, they also had magnetic compasses to be used in case the gyro failed, and these compasses were knocked crazy. Even though the magnetic compasses were compensated against the action of the degaussing current, still a large amount of deviation developed. Another objection was that it was necessary to change the coil settings on each 15° change of course. We used our degaussing coils very little in the Pacific as the depth of water is so great that there is only danger from magnetic mines when within a very few miles from shore and there is not much shore.

The sweeping of these magnetic mines was the next problem to be solved. All through 1941 the navy was equipping small ships with various devices to explode the mines without danger to the ship. After many experiments, a method was developed whereby a strong magnetic field could be set up 600 feet astern of the ship by towing two buoyant electric cables, one 1,500 feet long and the other 600 feet long. On the end of each was a copper electrode 50 feet long, and kept from sinking by floats. The electricity was supplied by a diesel driven generator which supplied current up to 3,000 amperes at 180 volts. The amount of current put out depended upon the salinity of the water. Water of a low salt content would cause the current output to drop to 2,000 amperes or less. The current passed out one cable, through the sea water and into the other cable thereby setting up a magnetic field between the electrodes. Other devices were developed for controlling the current output and the direction of the current flow thereby changing the poles of the field. Magnetic minesweeping was usually done by ships in pairs going along together abreast about 400 yards apart. In this way the magnetic fields produced by each ship could be adjusted so that the strength of both fields together was much greater than the sum of the two individual fields.

As soon as a method for exploding magnetic mines safely had been developed and put into use, it was found that only one sweep was not sufficient. The ingenious enemy installed a simple device on their mines so that one magnetic field passing over the mine would turn this device one step, but would not actuate the firing mechanism

This device could be set so that it would take any number of magnetic impulses from one to ten to explode the mine. This added considerably to the time and effort required for sweeping.

The speed of the sweeping ships was kept to 8 knots to allow time for the magnetic field to have its effect, and to cover the area thoroughly. The width of the path covered by two ships abreast is about 500 yards. When it is necessary to sweep channels many miles long and 1,000 to 1,500 yards wide for mines some of which have ten steps in their firing mechanism, it requires a good many ships or many long and arduous hours for two ships.

After this came the acoustic mine which was exploded by the noise made by the engines and machinery and propellers of the ships. These were swept by means of installing a so-called hammer box which was lowered over the bow of the minesweeper to about 6 to 7 feet below the surface of the water, the sound being produced by either a compressed air or an electric hammer hitting a steel diaphram. This would produce sufficient sound, if properly operated, to explode a mine a safe distance ahead of the sweeper, about 100 yards. A story is told of a small minesweeper operating its hammer box in the Caribbean. As the sweeper was going along some natives were seen fishing from a small boat ahead. Flag signals were run up to warn the fishermen that a minesweeper was approaching and they would be in danger if a mine should explode, but they paid no attention not knowing or caring what the flags meant and went on with their fishing. Suddenly the boat and

and fishermen rose high in the air as a mine exploded almost underneath their boat. Strangely enough no damage was suffered by either boat or fishermen, and after recovering from their surprise they swam to their boat, righted it and began collecting the fish killed by the explosion. The minesweeper proceeded on its way, completed the sweep of the channel, turned around and came back. As it approached the fishermen the second time another explosion occurred throwing boat, fishermen and fish again into the air, and again no casualties were suffered. However, these fishermen always had a particular grudge against that minesweeper. It happened that these were two of the few acoustic mines that a German submarine had layed off Puerto Rico. Another device for sweeping these mines was called parallel pipes, consisting of two ordinary galvanized steel pipes one inch in diameter and set in a frame so that they were nearly in contact their entire length. This was towed over the side of the ship and as they passed through the water a vibration was set up which produced sound waves in the water sufficient to explode this type of mine.

Of course this country and Great Britain were not idle in the developement of mines. We divided mines into two catagories; contact mines and influence mines; the latter including magnetic, acoustic and pressure mines. Some very ingenious and diabolical mines were developed by us. No mine was allowed to be used until a method for sweeping it had been developed. Also the firing mechanisms in the mines were not to be altered unless by instructions from

Washington. Most all of our influence mines used in the Pacific were layed by planes of the 20th Air Force based at Guam. In the summer of 1945, a mine had been developed which was particularly destructive in that it was impossible to sweep it by any known means. These mines were sent out to Guam before a method of sweeping them had been developed. The Twentieth Air Force, however, promptly began dropping them in the harbors of Japan with disastrous results to the Japs. In Shimonosihi Straits for example, over 7,000 influence mines were dropped, many of them being this new mine. After the Japs surrendered these mines naturally became a considerable embarrassment to the U. S. Navy as we could not use these harbors.

In Fukuoka Harbor for example, over 300 mines had been dropped by the 20th Air Force. They consisted of 6 different types.

3 kinds of magnetic Mines

very sensitive

moderately sensitive

and insensitive

2 types of Acoustic mines

one set off by the noise produced by any ship and which could be exploded safely in the ordinary manner.

The other type was set off by a very low frequency sound wave which was only produced by a very slowly turning

propeller, and this sound could not be duplicated.

And last but not least, the pressure mine. This was set off by the difference in pressure in the water caused by a ship moving through it. As a ship moves through the water it builds up a pressure ahead of it and causes a lessening of pressure astern. This difference in pressure was sufficient to explode this type of mine by any except very small ships. It was practically impossible to sweep this mine as the ~~general need~~ equipment used for sweeping was usually destroyed when the mine exploded.

All of these mines had the Japs pretty well tied up and and the harbor had 17 wrecks in it as a result. In Shimonoseki Straits there were over 170 wrecked Jap ships, and the only way an important ship could be sent out or brought in was by sending a ship ehead with a skeleton crew on board to deliberately explode any mines in the channel. Even then if there was more than one mine the ship ahead could only get one mine and the rest of the mines were still there to do their job. It must have been very discouraging to the Japs to lose ships every day to clear the channels and then the following night to have more new mines dropped.

The Japs had rather crude methods of sweeping and all the work of ~~throwing~~ STREAMING the gear and recovering was done by hand. ~~Their ships were small crowded.~~ They were willing enough to sweep their harbors and followed the instructions we gave them very gladly, but we could not entirely rely on the Jap sweeping because they didn't have the equipment. Any harbor into which we intended to send our

large ships just had to be swept by our own sweepers, using the most complicated methods, it seemed to me that could be devised. We had a rough idea from the 20th Air Force where the mines had been dropped, but the error in position reported by the plane pilots varied from one to 10 miles. A channel 10 miles long and 1,000 yards wide from the sea to the entrance of Fukuoka harbor had to be swept, using a different method for each type of mine and every bit of water had to be gone over five separate times for some mines. As small sweepers were used ~~and~~ in a column formation and the tidal currents were variable and very strong, it was almost impossible to do the job without using many ships. The channel in the harbor was about 6 miles long and presented the same difficulties except that several sharp turns were necessary, and the area at the shore end of the channel was not large enough for many ships to turn around. However, this job was finally accomplished without exploding one mine. The Japs had apparently gotten all mines either by sweeping them or exploding them with the ships which had blown up and sunk.

Another problem in the occupation of Japan was the sweeping of the Japanese moored mines which they had layed in the approaches to their harbors and in various other areas. There were large enemy mine fields in the China Sea which had been layed for the destruction of our submarines, and another large field in Korea Strait which runs between the main Japanese Islands and Korea. This field

consisted of two lines of mines layed at considerable depths and two lines of mines located just below the surface. As I said, the Japs methods were very crude and as a result would require a very long time to clear all these mines. The mine line in Korea Strait being about 50 miles long, so it was decided that our minesweepers would be given the job of clearing the deep mine lines, and the Japs be made to clear the shallow lines. This was not too popular with the Japs. My group of ships was given the job of sweeping the deep mine lines and the Japs started in a half hearted way on the shallow lines. As they made very little progress and complained that their sweep gear was inadequate, they were allowed to stop until their ships could be equipped with the gear we used and their personnel taught how to use it. So we were given the job of clearing one end of the shallow mine lines for about 5 miles to make a channel. After we had done this and gone back to the deep mine lines again, the Japs returned with better ships equipped with our gear to finish up the shallow mine lines. I assigned one of my ships to supervising them and act as a reference vessel for them to locate themselves. On the third day after they had made this fresh start, and they had made one trip across the mine line, on the next trip the leading ship went on the wrong side of the buoy which had been layed on the mine line, hit a mine and blew up killing most of the crew. This occurrence still further cooled their enthusiasm and all operations by them were stopped. After we had cleared up the deep mine lines and had returned to our base at Sasebo, I was told

that we were being given the job of clearing up the Western half of the shallow mine lines that is between Tsushima Tiushimu Island and Korea, and that when we had done that we could go home. I had now thirteen ships of my squadron and about ten small vessels for destroying the mines swept. I divided the group into two units, one of six and the other of seven ships with five or six destruction vessels apiece and put one of the division commanders, who had had the most experience, in command of one unit and I took the other. One unit started in one end and the other on the other end. We would get under way at 6:30 each morning at which time it began to get light, and finish each afternoon at about 4 so as to be able to recover all gear and anchor before dark. I assigned one ship from each unit to act as a reference vessel. This ship would take station each morning on the mine line about 100 yards from the buoy layed after the last pass made on the previous afternoon. We would get in our formation on the way out from the anchorage, stream the gear and be ready and all in position before reaching the mine line. The guide ship would carefully plot its position and check with the reference vessel so as to be sure we were in water that had been swept. When the last ship of the unit had crossed the mine line, a small vessel astern, previously assigned, would drop a buoy to mark the mine line for the next pass. Then the unit would reverse course and echelon and go back across the line and so on. We tried to make about 5 passes across the line each day and hoped to cover 1,000 yards on each pass, but we could never quite accomplish this as the ships

astern were constantly dodging mines cut by the ships ahead, and also losing their gear caused by mines exploding when caught in the sweep gear. However, we finished the job in 10 days and swept, according to my figures, 1,001 mines.

After this we returned to Sasibo, and the Admiral was as good as his word and sent us all home.