Submarine, Hard to Make, Easy to Break

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One Set of Men Devote Energies to Developing Submersibles, Another to Destroying Them—The Dangers of the Deep

EVER since the first torpedo launched by a submarine sent its victims to a watery grave inventors have busied themselves with means of combating this sea menace.

In order to understand the problems which beset the inventors of anti-submarine devices one must know something of the construction of the submarine and its method of attack.

Submarines are built with two hulls. The inner hull is intended to withstand the water pressure when submerged and is stronger than the outer. The two hulls are connected by stout braces so that the outer hull and the braces are a protection against the tremendous pressure the submarine has to stand when beneath the surface.

Oil Carried in Hulls.

The space between the hulls is divided into compartments which are used for carrying oil for fuel and other compartments which are used for the water ballast the submarine must take on in order to submerge. When the submarine is ready to dive, water is admitted to these compartments; when the vessel rises to the surface the water is forced out of the compartments.

In attacking a submarine it is necessary to do more than damage the outer hull. The patches of oil which are frequently seen floating on the water after a submarine has been attacked are not by any means a sure indication that the Kaiser's sea monster has been sent to the bottom. In order to destroy a submarine by shell fire both hulls must be pierced.

But the German submarine has its Achilles heel in the horizontal rudders which it carries both forward and aft. Once either of these two pairs of rudders is damaged the submarine cannot maintain its chosen depth. It must either sink to the bottom—and if in water more than 200 feet deep such a sinking would be fatal—or it must rise to the surface and subject itself to the enemy fire.

Storage Batteries a Danger.

A very great source of danger to a submarine which is attacked by bombs or shells is the storage batteries necessary for supplying the electric power by which it must travel when submerged. It is quite possible that a shock caused by a heavy explosion may destroy the storage batteries and release an acid which will eat its way through the metal of the hull.

The moment this acid comes into contact with the sea water a deadly gas is formed and the crew must die the same horrible death that Germany has been inflicting on her enemies by using poison gas on the battlefields. Other weak spots on submarines are the periscopes, conning towers and screws.

Curiously enough the U-boat can be most successfully hunted from the skies. If the weather is clear and the sea is calm an aviator will be able to detect a periscope from a height of several hundred feet much more easily than it could be seen from a position near the surface. Periscopes are so small and nowadays so well camouflaged that it is difficult to detect them from a boat. But to the eyes of an aviator they stand out prominently against the sea water.

What the "Blimps" Do.

The airman is assisted in his search for concealed U-boats by special optical instruments which not only increase his range of vision, just as your vision would be aided by looking through a pair of binoculars, but are adapted to aid in seeing beneath the water.

Where the water is unusually clear an airman flying at an altitude of from 1,000 to 2,000 feet can detect a submarine which is submerged to a depth of 100 feet. This, it must be borne in mind, is only possible under the most favorable conditions. If the water is rough or not clear or if the weather is unfavorable it is quite impossible to detect the submarine.

One of the reasons why it is possible for a seaplane to bomb a submarine is that it can approach its prey without making its presence known by the noise of its engine. This is possible because the lapping of the waves and the sound of the wind drown the noise of the seaplane's engine.

The "blimps" of the British have been very successful in hunting submarines. They are a cross between an airplane and a dirigible. They have an airplane body and power plant and are like the dirigible inasmuch as they carry a gas bag.

This dirigible feature enables them to stop and investigate anything they see which is suspicious. An ordinary airplane cannot do this; it must always fly at a high rate of speed. The blimps are equipped with bombing devices and wireless. They make excellent coast patrols.

There have been literally thousands and thousands of plans for combating the U-boat. Many of these inventions have been misguided efforts of well meaning but ignorant persons. That is to say, persons who are ignorant of ordinary mechanical principles.

For example, take the innumerable devices which employ electro magnets and magnetism as the basis of a plan for annihilating the submarine. Many men seem to think that if ships equipped with magnets are sent out they can draw a submarine from its course just as the small boy picks up a needle with the pocket magnet. Perhaps the reason this impression is so general is that magnets have been successfully used in manufacturing plants for lifting masses of iron or steel. They forget that the magnet must be placed in contact with the mass of metal before it can lift it.

It is absurd to suppose that a magnet can deflect a torpedo which weighs between two and three thousand pounds and is tearing through the water at a rate of some forty miles an hour.

Many inventors seem to think that it is possible to send forth a sort of electrocuting current through the water. Others have planned means of shooting forth electric bombs, and innumerable inventors believe that it is possible to electrify the water or the atmosphere in such a way that submarines would be destroyed. Such ideas are utterly impracticable. But electricity in combating the submarine is invaluable for sending signals and messages. Clever inventors are constantly working along these lines, and each day conceive an improvement in the use of electricity for this purpose.

Ever so many devices have been suggested which are intended to protect cargo carrying ships by means of nets or screens. These generally are very unsatisfactory. In order to be of protection to the ship the net must be held at a distance of from twenty to thirty feet away from the side of the vessel.

If a ship is lying in a harbor it is an easy matter to protect her with such a net. But if she is steaming through a heavy sea, the tremendous weight of the water dashing against the nets would destroy them. Even under ideal conditions dragging heavy nets would cut down the speed of any vessel to about five or six knots.

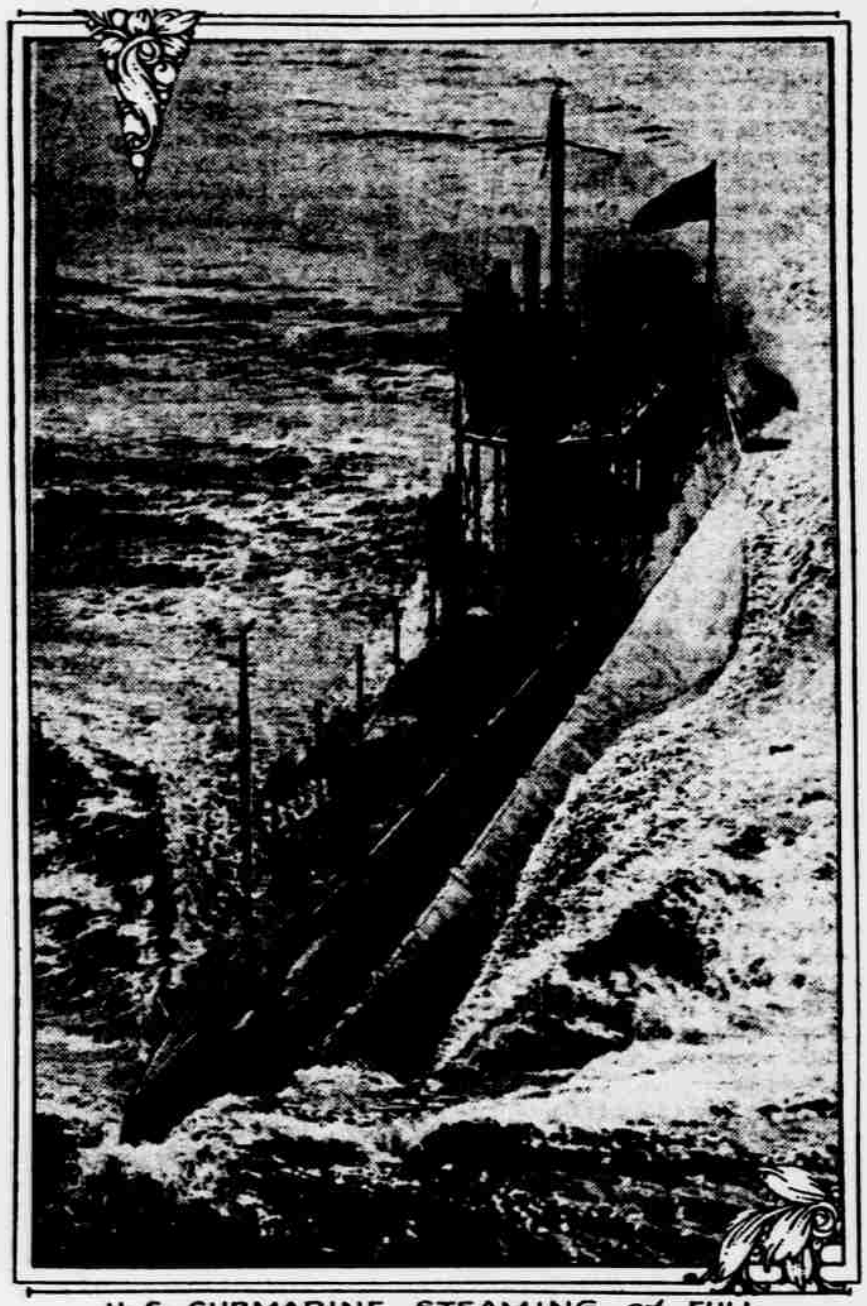
Another system somewhat similar to the use of nets is that of towing steel plates on each side of the vessel. It is said that none of these suggestions has been approved by the Navy Department.

One of the surest protections against the deadly torpedo is to divide the hull of a vessel into many compartments.

The hull is divided into a great many compartments. If a torpedo manages to puncture one of these compartments those adjoining it are immediately filled with compressed air, so that the water pressure is equalized and no more can enter. An advantage possessed by the Wotherspoon system is that it necessitates very little change in the design of the vessel. Battleships have always been built with hulls divided into many compartments in order to protect them from taking in too much water in case of a collision.

As compressed air is used on battleships to run the refrigerating machines, to fire and charge the torpedoes and to remove the hot gases from the gun barrels after firing, the installation of the Wotherspoon method was a very simple thing. All that had to be done was to connect the compressed air supply with the compartment pipes. It was not necessary to change the design of the inner hull.

One interesting solution of the submarine problem consists of a series of buoys which are large enough to accommodate four men and afford them living quarters for days at a time. The buoys have a three inch rapid fire gun mounted on the upper deck. Beneath the gun deck are the living quarters for the crew and below that is a tank which can be filled with water ballast when the buoy is to be sunk. At the bottom is a cylindrical compressed air tank.



U.S. SUBMARINE STEAMING AT FULL SURFACE SPEED.

The buoy is as large as an ordinary room, being about sixteen feet in diameter. Each buoy has telephone connections with the land station, a microphone for detecting the approach of the submarine by the hum of its engine and a complete wireless outfit. A gasolene engine is used to fill the compressed air tank. The buoys are to be connected by nets. If a submarine strikes the net during the day a flag indicates the fact and at night an incandescent lamp gives warning of the enemy's presence.

Duties of the Crews.

The duties of the crew are divided. One man would always be on deck as a lookout; another would be detailed to the wireless apparatus; a third would be ready to perform any duty which might be necessary in an emergency, and the fourth man would be sleeping. In that way three of the four men are always on duty.

Many interesting sound recording devices have been designed with the intention of locating submarines or moving torpedoes. These electrical ears open up a big field to the inventor who has sufficient scientific training to develop the subject. Water is a wonderful conductor of sound and for that reason sound recording devices are particularly advantageous in eluding the submarine and its torpedo.

Devices which depend upon optical means for detecting submarines are not likely to be of as great assistance as the sound recording devices. The exhaust air from its propelling engine causes a stream of bubbles to appear on the surface of the water in the wake of a torpedo. If the sea is very rough it is practically impossible to discover these bubbles.

Before the bubbles are seen the torpedo may have travelled anywhere from fifty to two hundred feet in the direction of its target. Therefore, it is a lively ship which can elude the torpedo once it has started on its path.

Fast Ships Immune.

It is a curious fact that ships which can exceed fifteen knots have suffered very little from submarine attack. Slow vessels, on the other hand, have no chance when attacked by a submarine. In order to be able to evade the submarine, a vessel must have a greater speed than that of the submarine when submerged.

The newest German submarines are said to have a submerged speed of about ten knots and a surface speed of seventeen knots per hour. Records show that the slow vessels, once they are singled out by the submarines for attack, are doomed. The number of slow vessels which have escaped is so small as to be negligible.

Smoke screens have been found very useful to vessels which have high speed and are capable of quick manœuvering. When the vessel sights the periscope of a submarine, smoke boxes are got out and thrown overboard. The boxes are filled with a substance which when burning gives forth a very dense smoke. The vessel, hidden behind the smoke screen, can change her position and escape the torpedo.

A Cheerful Sendoff!

DOWN in south Jersey they are wide awake. The hour hand of the Jersey clocks had not gone twice around the dial after 300 newly drafted men in a certain city had been called for physical examination when the postman brought to each of them an invitation to buy a cemetery lot. The invitation read as follows:

"Which is the better time to consider a matter of this character? Now, when there is ample time for calm, deliberate selection, or later, perhaps, when there is a necessity? Experience has proved the former the better course; there is a satisfaction in owning an unused plot and in knowing you have relieved others of a responsibility."

There are possibilities for the humorist in this, if any one feels like getting fun out of it. Probably it does not seem funny to the young men about to be taken from their work and their wonted ways of daily living to go into the trenches.

The clerk of the county is going to investigate the manner in which the names got out, and it may not be funny then for the people who sent out these cheerful invitations.

Somebody ought to investigate, while investigation is in order, the psychology of these Jersey geniuses.