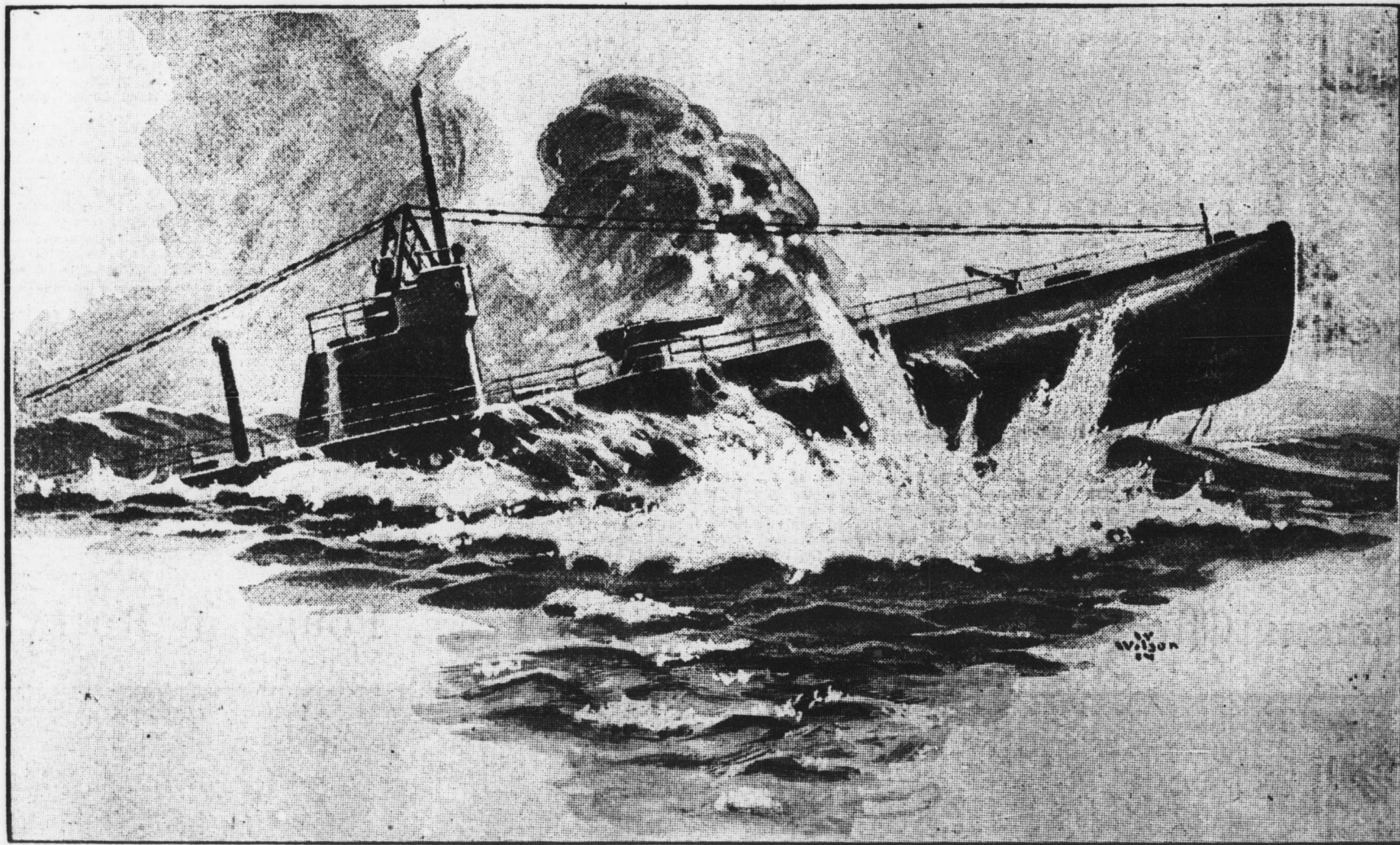


When the Next "Sub" Sinks

"Is There Any Hope?" Tapped the Men in the Doomed S-4—Here Is the Answer to Their Question—The Story of Everything That Has Been Done to Make Sure There Is Hope for Future Submarine Crews That Are Trapped on the Bottom of the Sea.



"Submarines wrecked by enemy shellfire must look to salvage ships for aid."

By Comdr. Edward Ellsberg

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THE week before Christmas, 1928. A little vessel pitched wildly to the wintry seas off the tip of Cape Cod, while a few cork buoys tied to a diving hose marked the spot, 100 feet below, where the S-4 lay.

All the world during that sad week figuratively listened in on the Falcon's microphones as from the depths the feeble raps of a hammer beat out in dots and dashes the last messages of the six men trapped inside the torpedo room of the smashed submarine. "Air getting very bad. Please hurry," and finally, "Is there any hope?"

The storm blew on; those on the Falcon listened helplessly; the men inside died. The storm at sea finally subsided.

But another storm arose—a storm of public opinion, which in the press and in Congress burst into the demand that never again should such a tragedy be possible. And it is one of the features of our age that, regardless of apparently insurmountable difficulty, what public opinion truly demands speedily becomes feasible.

There is nothing really new in submarine salvage or rescue apparatus. The sole new features of the present year are that since the S-4 disaster, public opinion has been focused on the subject, funds have been made available for experiment and equipment and the few hide-bound technicians who were so obsessed by the idea that "a submarine is primarily a warship" that they were unable to visualize reasonable safety for the crews have been swept into the discard.

The S-4 and the S-51, which was sunk shortly before her, were not the first American submarines to be lost, nor will they be the last. It is rational to expect that so long as there are submarines, there will be submarine accidents; a reasonable degree of preparation therefore is certainly warranted.

One of the early ideas in submarine work was to provide a simple rig which the crew could hastily don in an emergency and escape through a flooded compartment. Before the World War our Navy experimented with breathing apparatus of this type. On one of the German submarines surrendered after the armistice was found a booklet describing such a device, with an illustration showing the crew

of a sunken submarine seated in a flooded room, each man wearing the breathing device and waiting his turn to escape up the hatch.

WHILE the idea was not new, little was done toward making it practical till the pressure of public opinion after the S-4 disaster forced the development of this idea along with other rescue experiments. Under Lieut. Momsen's direction, the rescue breathing mask was developed in a novel and much simplified form, consisting principally of a rubber bag of the approximate capacity of the human lungs, together with a mouthpiece for breathing, a nose clip for sealing the nostrils, a small soda lime cartridge for purifying the rebreathed air and an automatic vent valve.

With this apparatus, under proper conditions, a man can breathe under water for the relatively short period required to rise to the surface, and can then use the inflated bag (or "lung") as a life preserver.

For cases where outside rescue apparatus cannot be applied in time, and where the crew must escape by its own efforts, the value of this apparatus is inestimable. If a submarine is properly fitted with escape hatches, it is likely that if the boat could not be lifted quickly the crew, wearing the "lungs," could emerge to safety. This can be done with certainty from compartments fitted with double-doored airlocks. However, in cases where the compartment itself must be flooded first to equalize the pressure and allow an outside hatch to be opened to the sea, it is not probable that in the confined space inside the submarine, with the boat lying at an unnatural angle and wreckage floating in the water, a large group of men could extricate themselves, one by one, through a narrow hatch and rise to the surface.

The rescue of the crew of a sunken submarine may be attempted in various ways—the crew may emerge to safety assisted by the "lung" or an ordinary diving helmet, leaving the boat on the bottom; or the boat may be

lifted with the crew in it. The rescue methods developed may aim at one or the other of these two means. In time of peace, the rescue of the crew is most important and the salvage of the boat is secondary; in time of war, when the safety of the Nation itself is at stake and men are being sacrificed by the thousands on the battlefield in that cause, the sunken submarine boat itself becomes far more important than her crew, and its quick salvage and return to the fighting line may be of the utmost importance.

A MODERN submarine costs over \$3,000,000 and takes over a year to build. It is the most effective weapon known for keeping an enemy fleet off shore and preventing bombardment of coastal cities. In time of war, the value to the Nation of each submarine goes far beyond its money cost. One has only to remember the frantic efforts of this Nation to purchase warships when the Spanish War broke out, and the millions of dollars spent in the last war in salvaging wrecked ships of all sorts, to realize how difficult it is in war time to get ships.

The question of submarine salvage and rescue work must be considered in both its war-time and its peace-time aspects, and the means adopted be such as to cover both cases as well as possible.

Submarines may sink from collision damage, from failure of the control mechanism or from enemy action due to depth bombs, or gunfire. Providing that the depth of water is not over 300 feet (and this is likely in most cases of supmarine operations) divers can work, and escape for the crew is possible.

If the boat is sunk by flooding at one end and the crew is left in possession of the control room amidships, it is extremely probable that the crew themselves will be able to bring at least the unflooded end of their boat to the surface and thus escape from the bottom without external aid. This has happened in the cases of two of our S boats, the S-5 and the S-48, which, sunk by flooding, due to gross

carelessness, lay for a number of hours on the bottom. On the S-48 the crew finally managed to lighten up the bow till it broke surface. They escaped through the torpedo tubes. On the S-5 the crew, after a desperate struggle in deep water, floated their stern, which barely projected above the sea, with the crew still trapped inside. There they stayed until a passing steamer cut a hole in the submarine's plates and rescued them.

In both these cases the boats went down undamaged; it can be expected in similar future cases that the crews can rescue themselves, provided only that an escape trunk is fitted at each end of the boat.

IF a submarine is damaged in collision or injured by bombs or shells it is unlikely that the crew can raise any part of her unaided. If the boat is wholly flooded as a result of the damage, the crew will all be dead and (in peace time) there will be no need for haste in salvage. If part or all of the crew is still alive inside the boat, then one end of the boat or the other will be buoyant and unflooded, and consequently relatively easy to lift. In such a case the rescue method which best suits the needs of peace and war and which exposes the trapped crew to the least risk is to raise the boat, or at least that end of her in which the crew is alive.

To permit this, it is necessary to have close at hand the lifting rig, the salvage ship with its trained crew and divers, and the submarine herself must be fitted with the means for quickly attaching the lifting pull. And, finally, it must be possible for the men inside the boat to live until the boat is raised.

Toward all these points tremendous strides have been made in the last year. Taking the last point first: It is perhaps not generally known that of the crew of 40 men inside the S-4, not one man was drowned as a result of the flooding from the collision, nor was lack of oxygen the immediate cause of any deaths. Inability to get rid of the carbon dioxide from their breathing killed off the 34 men aft in less than 24 hours; the same excess of carbon dioxide, together with cold, killed the six men trapped forward.

To avoid this, all submarines now are being supplied with chemicals which will keep the air purified for a reasonable length of time