

Salvaging the Fleet

The remarkable story of how science outwitted the men who scuttled the German Fleet at Scapa Flow.

This story appeared in the magazine *Modern Wonder* (below), in June 1938. It is worth re-telling, partly because of the ingenuity of those who carried out the work, but mostly in recognition of the bravery of the divers, welders and other workmen who patiently laid their lives on the line in what must have been years of extremely dangerous hard graft.



‘Two hundred feet under the sea at Scapa Flow in the North of Scotland there is an engineering shop where scores of men without diving suits or anything of the sort, work every day. It is to be found in the upturned hull of the German battleship, *Grosse Kurfurst*, which was sunk there together with the rest of the German Grand Fleet just after the war [WWI].

These men are performing a feat which was intended to be impossible, and they are defying nature by a new application of the use of compressed air. Without ropes or cables, and with nothing but air pumps, they are raising a whole battle fleet from the bed of this northern ocean. When the German commanders sank their ships at Scapa, where they were interned, they were determined that the victorious allies should never have any benefit from them. So, instead of just sinking them, they did so in such a way that all the bigger vessels turned over and came to rest upside down

on the bed of the sea. [They also broke the terms agreed in the armistice by sinking their ships, adding to their general disgrace at being captured without a fight].

It was thought that in this position they could never be raised. But the curious thing is that it is the very fact that they lie bottom up which has made the feat of raising these monsters possible. The principle is simple; the salvage men merely pump air into the wreck until the total weight of the wreck and the air in it is less than the same volume of water. Then up she comes.

But this means terrific pressures, and it is fairly certain that had the ships been sunk right way up their decks could not have withstood them. As it is, the heavy double bottoms are just in the right position to take these pressures, and so it is possible to use the compressed air method for the job. And there is no other known salvage method which could have brought these big ships from the great depths at which they lie. So that the fact that they are rapidly being brought to the surface today, is entirely due to the German officers’ ruse.

However simple the principle of the thing may be, the job of lifting these wrecks is complicated enough and there are many dangers to be faced. Divers go down first of all and seal up all the valves with which the Germans flooded their ship. Then long airlocks are lowered to the divers. These are simply heavy steel tubes – they weigh about twenty tons – through which a man can pass and which reach from the wreck to some distance above the surface of the sea. The divers fix these to the hull with bolts and then brace them with stay wires also attached to the hull, until the whole structure is so strong that even the heaviest seas could not tear it off.

These airlocks are most important because they are highways from the inside of the wreck to the outer world (*below*). They carry both the engineering team who will work inside the wreck for months, and the air which will eventually bring it to the surface. There may be as many as ten of these airlocks to



different sections of the wreck, and it takes a lot of careful work to fix them. Only when they are fixed, however, can pumping start. They are, of course, sealed at the top by double doors, and when you start pumping air into them you push the water down. The more air you pump in, the farther down you press the water, until finally it is possible to enter the wreck through the airlock and find it empty of water. You can then move about and work inside it just as in any engineering shop – except for one snag, and that is that the air around you is compressed air.

Our bodies are built to work in air at ordinary atmospheric pressure and when they are asked to do so under a pressure several times as great, they may rebel. In fact, it is quite easy to work in these battleships if you are perfectly healthy and observe certain precautions. The principal precaution is that in coming out of the high pressure you should do so gradually.

What happens is that the men come up from the wreck into the airlock and sit between the double doors at the top while they reduce the pressure in the tiny chamber formed by the part of the lock between these two doors. There is a carefully worked out scale of time for reducing this pressure, which depends on the maximum pressure at which the men have been working and the time they have been under. But there comes a point where they may work for, say, two hours and then have to spend two hours reducing pressure in the decompression chamber, as they call it, in the airlock.

The great danger about this compressed air work is that the men get terribly painful nitrogen bubbles in their blood if the decompression is too fast, [we call this 'The Bends'.] The cure is simple; the patient is put into a special chamber and the air in it is pumped up to the pressure at which he was working. When that is reached, the bubble disappears and then slowly, very slowly the pressure is reduced to that of the outside air.

But to get back to the salvage operations.

There is a good deal of work to be done from the time the men first get inside the wreck to the moment when it comes up to the surface. In the first place, it has to be divided off into compartments which are all sealed up so that air can be pumped into one and not into another. The result of being able to pump more air into one section and less into others is that you can control the wreck when it begins to rise and thus bring it up on an even keel. It also means you can keep it on the bottom till you are ready to bring it up. You can push the water out of the section where the men are working, but allow it to fill all the others, so that there is no tendency for the wreck to rise.

There was an occasion early one morning when a weak pipe which had passed unnoticed burst and allowed air from one section to rush into another. The result was that the wreck shot to the surface, but it sank almost immediately and was raised later.

Another danger the workers in the wreck have to face is that of encountering gases and bad air. They are working with oxy-acetylene cutting torches, and in the presence of dangerous gases these may well cause an explosion such as has already happened on two occasions. On one of them, three men were entombed and the salvage manager, Mr. T. Mackenzie, was blown right out through the bottom of the wreck. The first intimation those on the salvage steamer above had of the accident was the sight of their manager floating unconscious on the surface. However, he soon recovered.

The work in the wreck before it is raised goes on for months, for not only has it to be divided into sections, but all the bulkheads and divisions have to be strengthened and reinforced to withstand the terrific pressures to which they are later subjected. The final thrill comes when the wreck is raised. The salvage steamer, with the huge compressors which pump air into it at the rate of five thousand cubic feet a minute, moves off a safe distance, lengthening the pipelines which connect it to the airlocks jutting out of the water. These compressors, the most powerful afloat, are set going at full speed, and gradually the water in the various sections of the wreck is pressed down. Then a movement is seen and the airlocks rise a foot or so, showing that the wreck is dragging itself clear of the mud in which its superstructure is firmly anchored.



Suddenly, with a rush, and in less than ten seconds, the whole twenty-five-thousand-ton mass rises to the surface (*left*). Terrific fountains of oil and mud and water shoot up. And so fast is the rise that even when the wreck is ten feet or more above the surface, walls of water six feet high can be seen cascading off it.

The airlocks, of whose height only ten feet or so was visible a few seconds before, now stand two hundred feet in the air, the whole forest of bracing wires showing. And sitting on top of one of them all the time has been an engineer whose duty it was to watch the pressure gauges. You can imagine his feelings, being ten feet above water one moment and then thrown two hundred feet into the air in less than ten seconds (*left*), with a twenty-five-thousand-ton ship appearing beneath him! When I asked one of these men about this experience all he would say to me was, "Never again, never again!"



But this is not the end of the job. The wreck has to be prepared for its journey south to Rosyth, on the Forth, to be broken up. And all the time the pumping must go on, because the bottom, or rather, what used to be the deck of the ship, is open to the sea and the compressors have to keep pressing the water down to prevent the wreck from sinking.

The superstructure which would foul dock entrances down at Rosyth has to be blasted away and dropped to the bottom again. Then houses are built on the upturned hull (*below*), to house its crew and the compressors which will take over the duties of those on the salvage steamer when the wreck begins its long journey to the south. Although there have been times when mishaps have been very near, they have never really happened and all the giants have been brought safely to Rosyth. Already the tonnage of the ships raised from the bottom of Scapa Flow totals two hundred and fifty thousand and

there are several more twenty-five-thousand-ton battleships, apart from the *Grosse Kurfurst*, on which the men have worked. By the time they are all raised the total will be nearly four hundred thousand tons, a world's record salvage feat.'

