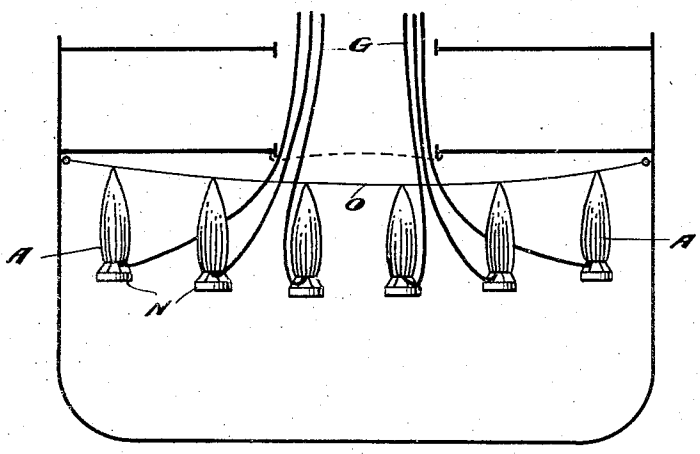
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APPARATUS FOR RAISING SUNKEN VESSELS

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APPARATUS FOR RAISING SUNKEN VESSELS

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The object of this invention is to provide an improved method of and apparatus whereby sunken vessels or objects may be raised expeditiously and economically from the sea bed.

Many well known methods have been used for this purpose in the past, such as the attachment of camels to the outside of the vessel by means of cables, with or without the assistance of pontoons floating on the surface. The camels as used are bulky, expensive and difficult to attach to the vessel, and other difficulties are encountered.

According to this invention a series of relatively small deflated air bags or containers is placed within a sunken vessel, and said bags of sufficient capacity are, when in readiness, filled with air enabling the vessel or object to rise.

These bags have an opening at the bottom; air to their capacity is forced into them by individual pipes leading to their interiors; and air pressure in excess of the water pressure at the opening in their bottoms is relieved by the escape of air from the openings. The opening at the bottom of each container should be appreciable.

As an example: if a bag is placed below the surface of the water so that its bottom is one hundred feet therebelow it will require an air pressure inside the bag of one hundred feet head to fully inflate it, and as the bottom has an opening any excess air will escape through that opening and rise to the surface, thereby ensuring that the bag at no stage of inflation is subject to a greater pressure than the head of water at the bottom of the bag, thus equalizing or balancing the pressure inside and outside the bag at its bottom. Therefore the stress on the material which may be canvas, silk, or other suitable flexible material, preferably treated as by coating with a rubberized solution or the like, to make it impervious to air, is reduced to a minimum.

There will, however, be a stress in the bag which will be calculable and predetermined progressively from the bottom to the top of the bag. Again assuming one hundred feet head of air pressure within the bag, and as to all intents and purposes it is a closed vessel as its opening is sealed by water, and assuming that the side of the bag is eight feet high and the top of the bag has been flattened against the underside of the ship's deck, there will be a positive pressure of ninety-two feet on the outside at the top. Therefore there will be a positive pressure around the top of the bag equal to eight feet of water. This can be calculated in the

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design of the bag to enable it to withstand the extra pressure. The differential in pressure between the bottom and top of the bag remains constant at all depths, thereby maintaining a predetermined calculatable stress in the bag, as the pressure within the bag cannot at any time exceed the water pressure at the bottom of the bag because as the air pressure increases above the water pressure the excess air will be released from the opening in the bottom of the bag.

A cylindrical bag having a conical or domed top is preferable as a certain amount of slack is thus available where it may be pressing on irregularly shaped obstacles such as the beams on the underside of the ship's deck. The lifting power of the bag will be equal to the volume of water that it displaces, after making allowance for the weight of the bag and fittings that go with it.

Apparatus for carrying the invention into effect will now be described in connection with the accompanying drawing wherein the figure is a pictorial view of deflated bags suspended on a wire on the underside of a ship's deck.

When sufficient of the bags A to effect a lift have been attached to the vessel or object desired to be lifted, the ropes previously placed in position around the bag A to reduce the volume to a minimum are removed and air is introduced into the bags A through a suitable pipe G. This should be done as far as possible distributing the air evenly amongst the bags A and when the bags A have been inflated sufficiently, the vessel or object they are attached to will rise until the tops of the bags A reach the surface of the water. The vessel or object may then be towed to a suitable beach or dock, or if there is sufficient tide, temporary repairs may be carried out at low tide, or alternatively by divers working in shallow water, where they can work much more expeditiously than in deep water.

A great advantage with these bags A is that a bag of say twelve feet in diameter and eight feet high exerts a positive lift of about twenty-five tons, and they may be attached with comparative ease at many places on sunken ships or objects. For instance, there are numerous port holes on ships, scupper holes, mast stays or the like, all of which will take a reaction of say up to thirty tons, whereas it would not be possible to attach a large camel exerting a lift of say three hundred to four hundred tons.

Irrespective of what type of bag A or fitting is used, if sufficient bags have been placed in position and air is introduced into the bag A through

the pipe system G and the bags fully inflated, they will displace a volume of water equal to their displacement, and as soon as sufficient water has been displaced within the hull of the ship it will become buoyant and normally will rise to the surface where it can be towed to a beach or dry dock if there is one in the vicinity. Otherwise sufficient repairs can be effected when it has been beached, to allow it to be towed to the nearest dock.

It is of course understood that suitable equipment will be available on the rescue ship to provide a sufficient volume of air to inflate the bags A within a reasonable time and that careful control will be exercised over the filling of the bags to ensure that they are filled as evenly as possible, and that precautions will be taken against the fouling of air lines G when the vessel commences to rise.

In the pictural illustration the bags A are supported in deflated condition by a wire O, which is strung from side to side of the vessel. These bags are conveniently spaced from each other as shown in the figure so that when inflated they occupy the space of the vessel hold. The pipes G extend above the upper deck of the vessel and may be connected to suitable pumping apparatus.

Preferably the wires O are mounted closely adjacent to the under side of one or more decks of the vessel, as shown, in order that the bags will occupy a minimum of cargo space.

A further point to be noted is that when a vessel has been raised to the surface a very large

volume of water which will have entered the vessel while submerged will have been displaced by the air within the bags, and it will therefore require a minimum of pumps to evacuate the balance of water in the ship.

I claim:

1. Apparatus for raising a sunken vessel comprising a series of inflatable bags each having an open bottom, flexible means attached to the closed tops of the bags and suspending them beneath and adjacent a deck of said vessel, and means for inflating the bags by the introduction of a gaseous medium through their bottoms.

2. Apparatus for raising a sunken vessel comprising a series of inflatable bags each having an open bottom, flexible means attached to the closed tops of the bags and suspending them beneath and adjacent a deck of said vessel, and means for inflating the bags by the introduction of a gaseous medium through their bottoms, said inflating means comprising a series of flexible conduits.

3. Apparatus for raising a sunken vessel comprising a series of inflatable bags each having an open bottom, flexible means attached to the closed tops of the bags and suspending them beneath and adjacent a deck of said vessel, and means for inflating the bags by the introduction of a gaseous medium through their bottoms, said inflating means comprising a series of flexible conduits adapted to extend to the surface of the water.

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