G. LESOURD.

APPARATUS FOR RAISING SUBMERGED BODIES.

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1,079,500.

Patented Nov. 25, 1913.

Fig. 1.

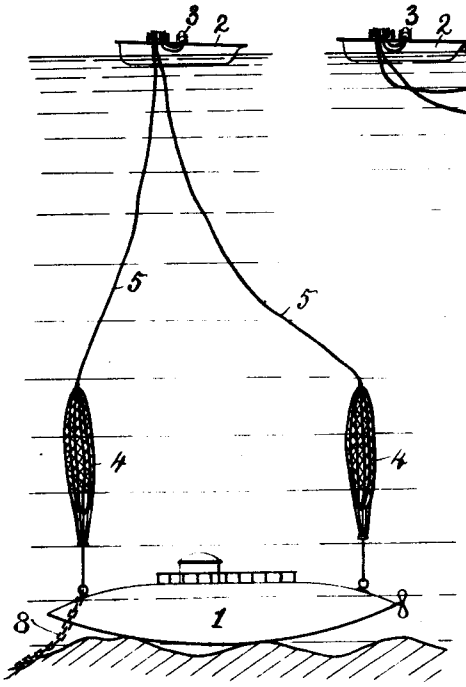


Fig. 2.

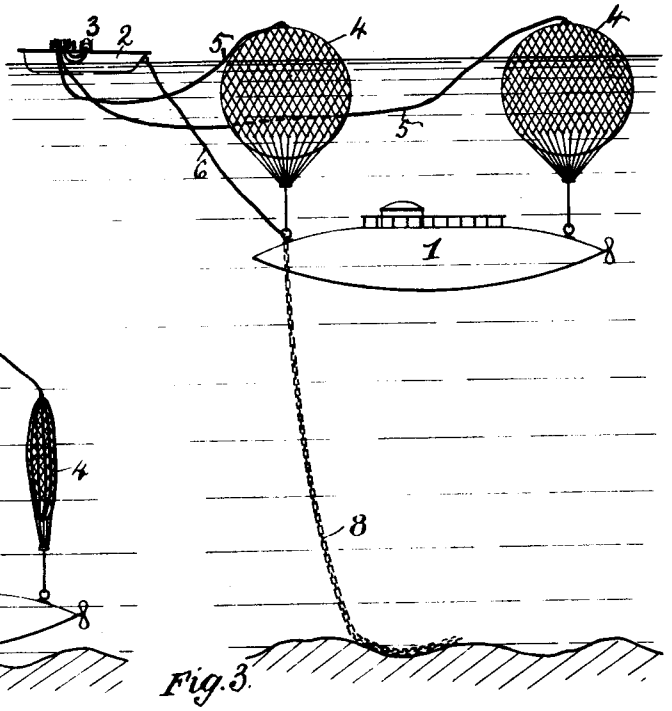
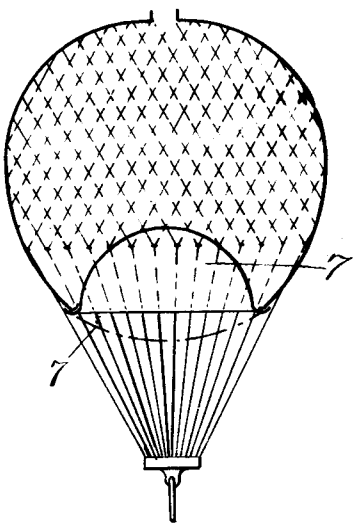


Fig. 3.



Witnesses:
A. A. Smith,
K. O'Hara.

Inventor:
Georges Lesourd
per
Lawrence Langner
Attorney.

UNITED STATES PATENT OFFICE.

GEORGES LESOURD, OF PARIS, FRANCE.

APPARATUS FOR RAISING SUBMERGED BODIES.

1,079,500. Specification of Letters Patent. Patented Nov. 25, 1913.

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To all whom it may concern:

Be it known that I, GEORGES LESOURD, a citizen of the Republic of France, residing at Paris, France, have invented new and useful Improvements in Apparatus for Raising Submerged Bodies, of which the following is a specification.

The present invention has for its object the raising of submerged bodies and in particular submarines and the wrecks of sunken vessels, and consists in the improved system as hereinafter described and recited in the claims hereinafter appearing.

The raising of a submerged body provided with two rings or eyes will be described by way of example. The same principle will obviously apply to a body provided with any number of eyes and whatever their number may be, instead of utilizing a single balloon, it is obviously possible to employ several, in such a manner that the volumes to be dealt with are reduced and the result less troublesome in case of accident; these balloons can also be caused to act either upon a system of cables attached to all the eyes or separately to each eye.

In the accompanying drawings: Figure 1 represents a sunken body with deflated balloons or envelops attached thereto. Fig. 2 represents the balloons inflated and floating and the body raised, and Fig. 3 represents the envelop provided with an inner ballonnet to enable the volume of the balloon to increase.

The body 1 to be raised being submerged (Fig. 1) the salvage vessel such as a gunboat torpedo boat or the like 2 provided with air compressing apparatus 3 and if possible with a reservoir and a pressure regulator, and with the apparatus required for the descent of a diver, proceeds to the place of immersion; the diver descends with two cordages which he attaches to the eyes. By means of these cords acting as guides two deflated balloon envelops 4 are lowered being covered with a net ending in suitable means of attachment, the strength of which should of course be proportionate to the weight to be raised. As the whole thus constituted is lighter than water, it is lowered with the assistance of counterweights of suitable magnitude for bringing the whole steadily to the level of the eyes in following the cords. The diver then attaches to the eyes the various cords corresponding to the nets of the envelops and then cuts away the counterweights in succession. Merely owing to difference of density, the envelops and their nets immediately assume a vertical position. At any point on these envelops and preferably at their upper part a connection is provided for a flexible india-rubber tube 5 of relatively small cross section and of appropriate texture, which is also connected with the air compressor of the salvage vessel. When these arrangements have been carried out compressed air is sent into the envelopes through the flexible tubes thereby gradually inflating them; as soon as their volume is such that the weight of water displaced permits of raising the submerged body in conformity with the principle of Archimedes the balloons and the submerged body immediately assume an upward movement toward the surface. This movement may be regulated either by the escape of air from the automatic apparatus or at will by means of a cock provided on the salvage vessel and enabling a portion of the air supplied through the flexible tube to be discharged to the exterior by hand. These two members are specially necessary in the case of a wreck adhering firmly to the bottom in which case the force necessary for detaching it will of course be very much greater than that necessary for producing a simple upward movement. In this case in order to avoid an upward movement of excessive suddenness and the possible bursting of the balloons when their envelops are thin it is necessary to be able to rapidly discharge sufficient air for approximately reëstablishing equilibrium. As soon as the upward movement has commenced the body dealt with is floating under water and it is known that bodies of this kind present practically no resistance to their displacement in any direction. Consequently the extremely slight frictional effort exerted by a cord 6 (Fig. 2) towed by the salvage vessel is sufficient for transporting the wreck to any desired place. If it be desired to effect the raising operation in several successive stages and to cause the wreck to rest in succession upon bottoms at decreasing depths it is only necessary to effect a slight deflation of the balloon in order to render their ascensional force zero or negative and a very slight reinflation is then sufficient to cause the whole to float again. As owing to the provision of the automatic valve or of the hand cock the internal and external pressures are always

substantially in equilibrium the envelop will never be subjected to strain on this account and the only strain that it will experience will be the tension of the meshes of the net upon its surface as a result of the weight raised but if a net of sufficiently close mesh and of adequate strength be used and if canvas be interposed beneath the knots there will be no difficulty in avoiding the inconvenience that this tension might produce. It will also very probably be advantageous as in the case with atmospheric balloons to unite the several cords of the net to a ring of sufficient diameter in order to prevent the balloon from being unduly contracted below and the excessive bearing of the cords upon the walls of the envelop.

The automatic discharge apparatus may consist either of a balance system for rendering its effect less sudden or merely of a valve held by a spring and opening toward the exterior.

In the case of large wrecks where the strength of the cords of the net might create a difficulty the single balloon referred to above might be replaced by a number of small balloons of less capacity each of which would only have to raise a proportion of the weight compatible with its rigging; this arrangement presents the further advantage of obviating re-immersion such as would result in the case of the rupture of a single balloon. Furthermore as the diameter of this smaller balloon is far less the wreck can be brought much closer to the surface of the water so that it can be transported into shallows and even into ports or docks.

By way of example and in order to demonstrate the simplicity of the method it may be mentioned that in order to raise a wreck of 50 tons assumed to be absolutely full or filled with water a balloon of 500 cubic meters at the maximum would be required, that is to say a balloon 10 meters in diameter which corresponds to one of the smallest sizes of aerostat hitherto employed. This volume would be much more than sufficient even for a wreck of 500 tons absolutely full or filled with water because as soon as it has been detached from the sea bottom in accordance with the principle of Archimedes this wreck would itself experience an upward thrust equal to the volume of the water that it displaces. Finally therefore the ascensional force of the balloon should be reduced by the volume corresponding to the exact volume of all the solid materials of which the wreck is composed. In the case of a submarine vessel still having a certain number of watertight compartments the problem would be rendered much easier still because the volume of these compartments would also have to be deducted from the volume of the balloon. Consequently as soon as the position of the wreck has been properly noted the salvage vessel can leave the wreck for a greater or less distance or approach it by means of its propelling mechanism and in short keep at the desired range as the flexible tube and the guide rope can be of sufficient length for maintaining the sole necessary connection between the salvage vessel and the wreck. The balloons can be immersed in an exceedingly simple and rapid manner and they can be fixed to the eyes merely by means of hooks in view of the initial upward movement which the envelop immediately assumes as soon as it is freed from the counterweight which has served to submerge it. When the balloon and the wreck together have been brought to the condition of a floating body, the same salvage vessel by means of a single cord can tow them with a very small effort where desired and it is also possible in accordance with the currents and the state of the sea, to effect this towing either under water or on the surface. Finally, by means of a plurality of ballonnets the wreck can be brought to within a very small distance of the level of the sea and consequently it can readily be towed either into dock or into a roadstead.

When the air supply tube has been fixed at any point, say at the lower part of the balloon, it may be advisable to weight the portion of the tube in closest proximity to the connection because the india rubber tube has a tendency to float with considerable buoyancy and might therefore exert prejudicial traction upon the connection. Inversely, if for special reasons armored tubes of greater density than that of the water have been employed, instead of loading them they should be lightened by arranging cork rings or by similar means.

It has already been stated that in order to avoid the action of the net and in particular of the knots upon the relatively thin envelop, recourse can be had to a protecting envelop. It is obvious that this protecting envelop might present the same form as the balloon as a whole which would in this case be housed inside it and subsequently inflated in precisely the same manner as that adopted for footballs. In order to prevent excessive pressures upon the lower part of the balloon, it might be attached to a circle presenting a diameter slightly greater than that of the inflated balloon. This circle should come somewhat lower than the equator of the balloon and the extremities of the meshes of the net are attached thereto. This circle is then united with the body to be raised by means of a suitable number of cables attached to it in a suitable manner and ending at shackles fixed directly to the hooks for raising the submerged body. It will of course be understood that hempen or other cable can be employed, or steel cables may

be used and that these cables can be attached by any convenient means in such a manner as to impart greater elasticity to the whole and distribute the tractional efforts more uniformly.

It should be noted that a special feature of this invention resides in the fact that the rigid wreck is connected with a raising element which is essentially soft and deformable, by means of a flexible and extensible whole thereby avoiding all jerks such as most frequently result in breakages especially in the case of a powerful effort ceasing suddenly when a wreck adhering to the sea bottom has been detached. This elasticity between the rigid wreck and its raising element subjects the cordages to far smaller strains than usual so that their strength can be utilized almost to the full.

In order to avoid the sudden effort due to the detachment of the wreck or even for preventing the too rapid ascent of the balloon and wreck as a whole, a sort of guide rope 8 formed for example of a link chain or cable of suitable weight can be employed, one of its extremities merely being attached to the wreck or to the cable from one of the balloons and an appropriate length being allowed to trail along the sea bottom. At the moment of the detachment and even during the raising of the wreck, if the ascensional force is excessive it can immediately be reduced by the weight of the link chain which is gradually lifted so that a condition of equilibrium is speedily established which greatly facilitates the transportation of the whole under water, and which is counterbalancing the ascensional force of the balloon will enable the exhaust sleeve or devices such as valves and cocks, etc., to discharge sufficient air to avoid excessive pressure which might burst the envelop. The chain might be constituted by a succession of weights spaced along a cord. A sort of internal ballonnet 7 might also be provided as stabilizing means, this ballonnet communicating directly at its lower part with the water so that its tendency would be to become filled with water so long as the pressure of the water was greater than the internal inflation pressure of the large balloon and to become emptied of water when this pressure became greater than that of the water, that is to say, in particular when the balloon ascended too rapidly. The automatic deformation of the balloon in question owing to the loss of a portion of its water would correspondingly increase the inner chamber of the large baloon and consequently reduce the pressure of the air by the same amount. Even in the case of an envelop the inflation of which did not require an effort greater than the pressure of the water an open orifice might always be left at the lower part of the balloon and serve absolutely the same purpose as the sleeve of an atmospheric balloon.

In cases in which the wreck should not be provided with sufficient means of attachment or should have foundered in a bad position one or two balloons might be employed for changing its position or merely for raising it at one end thereby enabling the divers to readily pass the necessary chains or the like around it. It is also possible in certain special circumstances instead of inflating the balloon from the exterior to connect it by means of a flexible tube to a suitable socket provided in advance in the hull of a submersible vessel in such a manner that the sailors imprisoned in the interior would be able to inflate it themselves either by means of compressed air or by means of tubes of compressed or liquefied gas.

What I claim and desire to secure by Letters Patent of the United States is:—

1. An apparatus for raising submerged bodies comprising an inflatable balloon, a source of fluid pressure, a tubular connection to lead pressure to said balloon when submerged, a connection from said balloon to said submerged body, means upon said balloon for automatically equalizing the internal and external pressures on the balloon and a heavy guide rope for retarding the ascent of the apparatus.

2. An apparatus for raising submerged bodies, comprising a plurality of inflatable balloons, a source of fluid pressure, a connection from said source of pressure to each of said balloons, an inner water ballonnet in each of said inflatable balloons to automatically equalize the internal and external pressures on the balloons, and a heavy guide rope connected with one of said inflatable balloons for retarding the ascent of the apparatus.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEORGES LESOURD.

Witnesses:
DEAN B. MASON,
GABRIEL BELLIARD.