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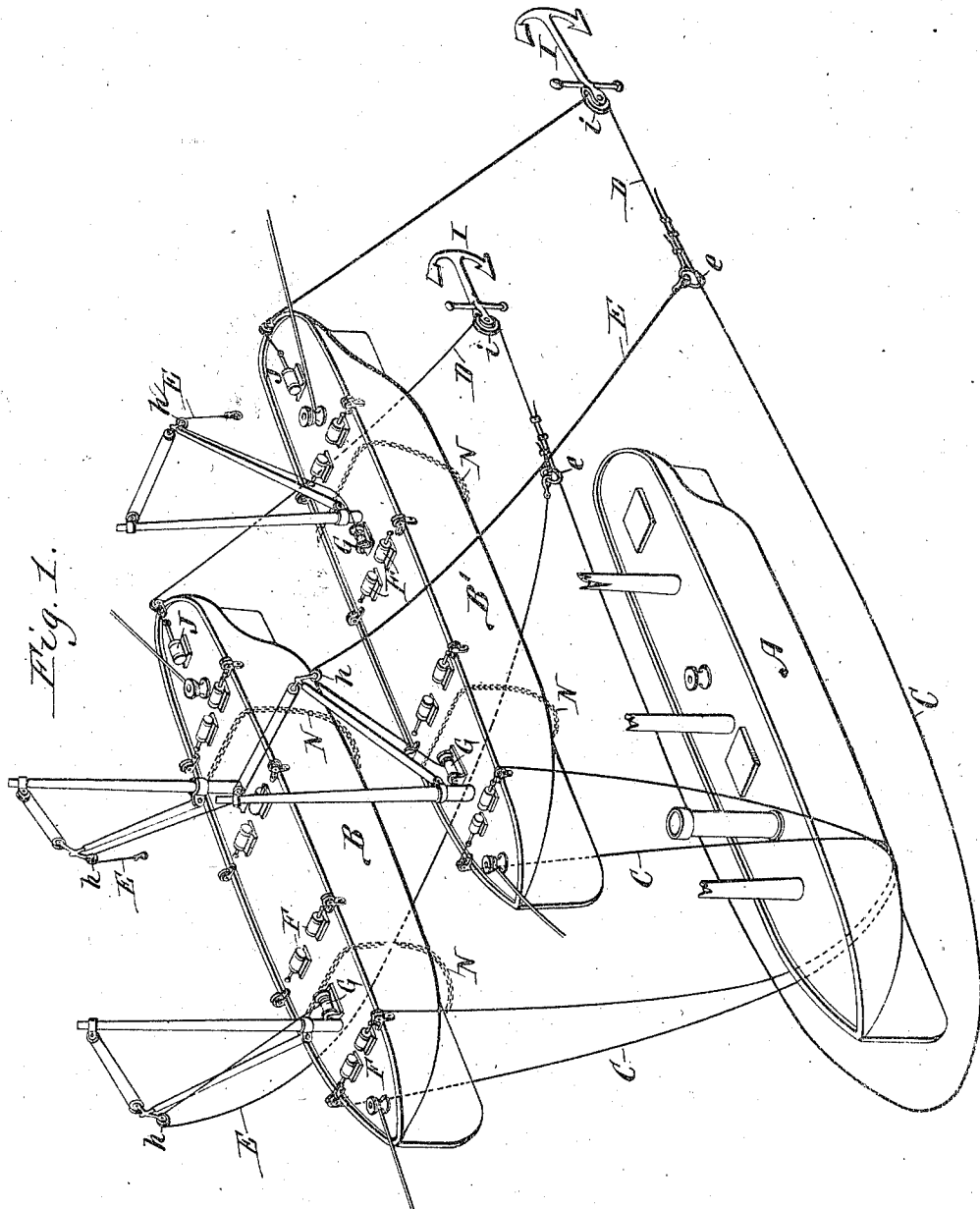
3 Sheets—Sheet 1.

E. B. PETRIE.

APPARATUS FOR RAISING SUNKEN VESSELS.

No. 526,163.

Patented Sept. 18, 1894.



Witnesses:  
Theo. L. Popp.  
Emil Neuhart.

Enos B. Petrie Inventor.  
By Wilhelm H. Popp.  
Attorneys.

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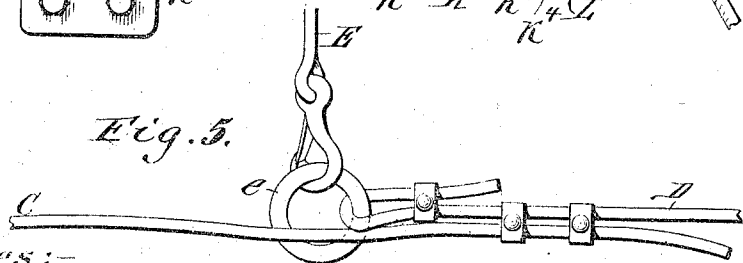
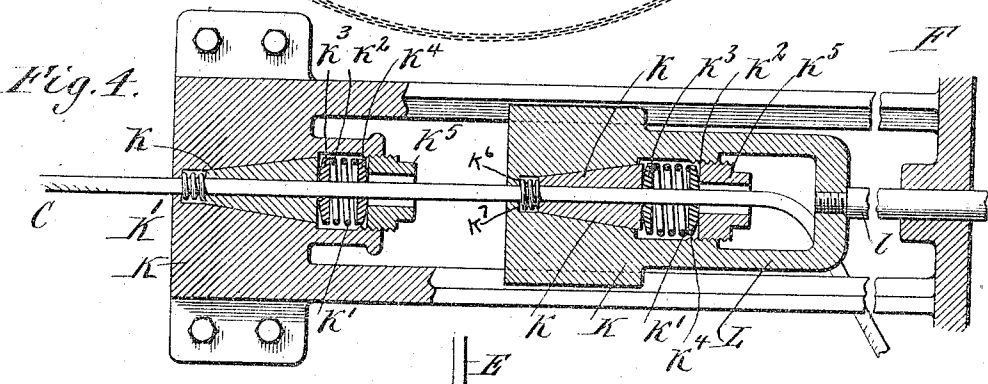
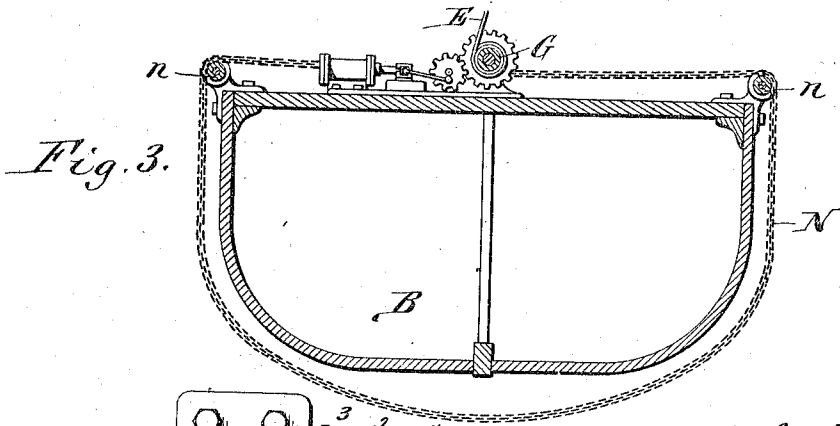
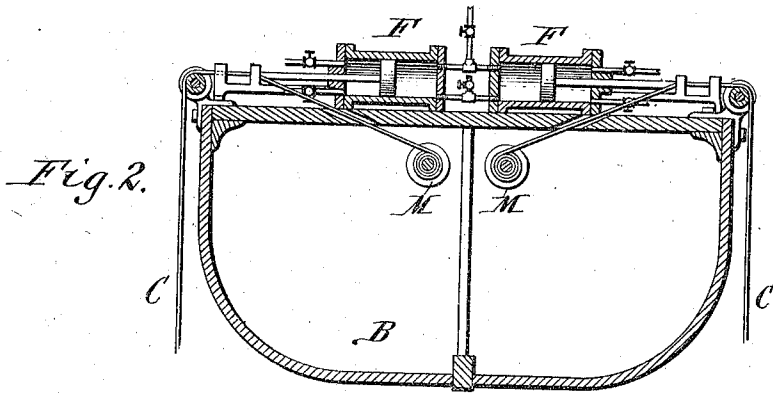
3 Sheets—Sheet 2.

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Witnesses:-

Theo. L. Popp.  
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Elias B. Petrie Inventor  
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(No Model.)

3 Sheets—Sheet 3.

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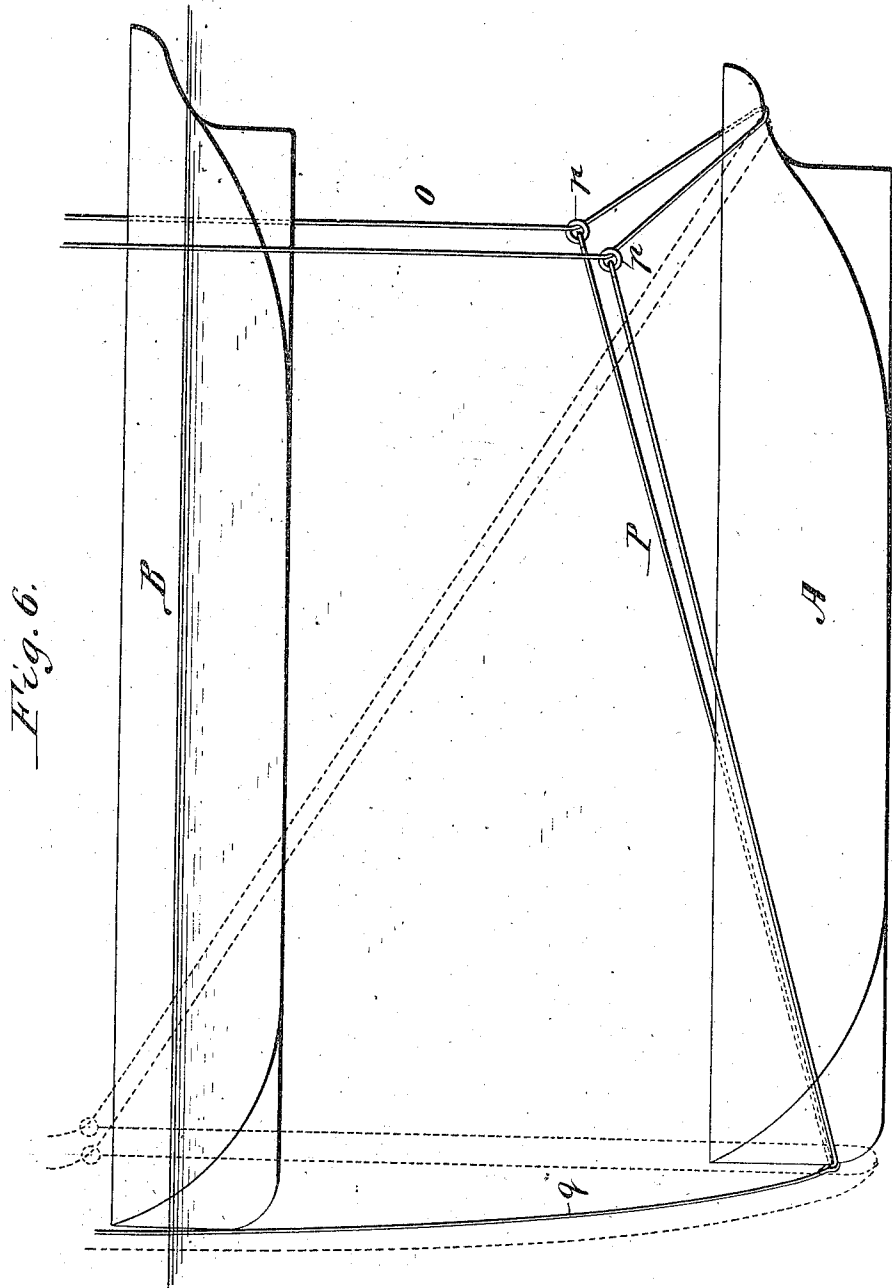


Fig. 6.

Witnesses:  
Theo. L. Popp  
Emil Newhart

Enos B. Petrie Inventor.  
By Wilhelm H. Brown  
Attorneys.

# UNITED STATES PATENT OFFICE.

ENOS B. PETRIE, OF BUFFALO, NEW YORK, ASSIGNOR OF ONE-HALF TO  
GEORGE H. BLANCHARD, OF BOSTON, MASSACHUSETTS.

## APPARATUS FOR RAISING SUNKEN VESSELS.

SPECIFICATION forming part of Letters Patent No. 526,163, dated September 18, 1894.

Application filed March 27, 1894. Serial No. 505,233. (No model.)

*To all whom it may concern:*

Be it known that I, ENOS B. PETRIE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Apparatus for Raising Sunken Vessels, of which the following is a specification.

This invention relates to an apparatus for raising sunken vessels and is designed more especially for recovering vessels which are sunken to a depth that it is impracticable for divers to operate.

The object of my invention is the provision of an apparatus whereby the lifting cables may be adjusted around the sunken vessel from the wrecking vessels or floats, without the service of a diver, and which is sufficiently powerful to raise large and heavy vessels and their cargoes.

In the accompanying drawings consisting of three sheets:—Figure 1 is a perspective view of my improved apparatus, showing a pair of cables adjusted around a sunken vessel. Fig. 2 is a cross section of one of the wrecking vessels, the plane of section being adjacent to a pair of the hydraulic jacks. Fig. 3 is a similar section taken adjacent to one of the transfer chains. Fig. 4 is a fragmentary horizontal section, on an enlarged scale, of one of the hydraulic jacks and the cable grippers co-operating therewith. Fig. 5 is a view of the detachable connection between the auxiliary hoisting cable and the hoisting loops which are placed around the sunken vessel. Fig. 6 is a side elevation, showing the manner of placing the hoisting loops around a sunken vessel resting upon a rock.

Like letters of reference refer to like parts in the several figures.

A is the sunken vessel to be raised, and B B', are two parallel wrecking vessels or floats which are anchored adjacent to each other directly over the wreck. These wrecking vessels should be of sufficient size and buoyancy to sustain the wrecked vessel when raised and should have the necessary strength and rigidity to bear the severe strains to which they are subjected.

My improved apparatus includes a series of main lifting cables or loops C, C, which pass around the hull of the vessel at suitable in-

tervals; draft cables D, D, whereby each main lifting cable, after being dropped to the bottom of the sea in the form of a horizontal loop, is drawn under the hull of the wreck; auxiliary hoisting cables E, E, whereby the branches of such lifting loops are raised to a perpendicular position, and powerful lifting devices F, adapted to be connected with the perpendicular loops, for raising the wrecked vessel. One of these cables is wound upon a hoisting drum G, arranged on one of the wrecking vessels, while the other is wound upon a similar hoisting drum, arranged on the other wrecking vessel. Each of these hoisting cables is provided at its lower end with a ring or other attachment e. Both of the auxiliary hoisting cables pass over the outer side of the two wrecking vessels, and in order to keep them clear of the sides of these vessels and of other lines or cables, they preferably run upward from the hoisting drums and over pulleys h, attached to over-hanging derricks or booms arranged upon the decks of the wrecking vessels, as shown in Fig. 1.

The draft cables D are detachably secured at their free ends to the rings e, of the hoisting cables and extend rearwardly from these rings around submarine guide pulleys i, and thence upwardly to hydraulic jacks J, arranged respectively upon the wrecking vessels, preferably at the stern thereof. The guide pulleys are attached to anchors I, dropped a short distance beyond the wrecked vessel and on opposite sides of the same. The hoisting drums and jacks of the auxiliary hoisting and draft cables may be of any ordinary or suitable construction.

The ends of the lifting loops are adapted to be detachably connected to the adjacent portions of the draft cables, preferably without bending the same, as shown in Fig. 5, so as to facilitate their subsequent attachment to the main lifting devices F. These lifting devices preferably consist of hydraulic jacks, of the well known cylinder and piston type, the ends of each lifting loop being connected with the piston rods of two such jacks located upon the two wrecking vessels, respectively. Each of the lifting jacks operates in conjunction with two cable grips or clutches, as shown in Fig. 4. One of these clutches is carried by

the piston rod of the jack and draws in a certain length of the lifting loop during every inward stroke of the piston rod, while the other is secured to the adjacent edge or other stationary part of the wrecking vessel and serves to prevent the length of cable which has been drawn in by the piston rod from slipping back during the outward or return stroke of the rod. The movable or draft clutch preferably consists of a sliding block K, carried by a cross head L, secured to the piston rod  $l$ , and two wedges  $k, k$ , which are arranged in a forwardly tapering opening of the sliding block and adapted to wedge into said opening and impinge against opposite sides of the cable during the inward or active movement of the piston rod, so as to pull the cable with it.

$k'$  is a spring whereby the wedges are caused to bear against the cable with sufficient force to be drawn into the tapering block by the cable. This spring is arranged in an internally screw threaded socket,  $k^2$ , formed in the rear side of the sliding block and is compressed between a washer  $k^3$ , bearing against the adjacent ends of the wedges and a washer  $k^4$ , bearing against an adjusting collar or sleeve  $k^5$ , which engages in the internally threaded socket  $k^2$ . This adjusting collar enables the tension of the spring  $k'$ , to be properly regulated. During the outward or return stroke of the piston rod, the wedges are loosened, permitting the clutch to advance on the cable for taking a new hold on the same.

$k^6$  is a spring interposed between the small ends of the wedges and a shoulder  $k^7$  formed at the small end of the tapering opening of the blocks. This spring is compressed when the wedges are forced into the opening of the block and assists by its reaction in releasing the wedges and also serves to retain the wedges in their proper relative position.

The stationary or detent clutch  $K'$  is constructed in all respects like the draft clutch just described, except that the block which receives the wedges, instead of being movable, is secured to a stationary part of the vessel in front of the movable clutch. During the advancing stroke of the draft clutch K, the wedges of the detent clutch release their hold upon the cable, allowing the same to be hauled in by the draft clutch, but during the return stroke of the latter, the wedges of the detent clutch grasp the cable and prevent its slipping back. The lifting loop connected with the jacks is thus gradually hauled up, by the reciprocating movement of the pistons of the jacks.

While I prefer to employ the clutches herein shown and described, they may be replaced by clutches of any other suitable construction.

Under each lifting jack a drum or reel M is preferably arranged, upon which drums the slack of the lifting cables is wound, these cables running from the rear side of the draft

clutches downward through openings in the deck and thence to the drums.

In raising a sunken vessel by my improved apparatus, a cable of sufficient length to form one of the lifting loops is attached at one end to the free ends of the auxiliary hoisting cable, and draft cable carried by one of the wrecking vessels. This lifting cable is then carried around one end of the wreck in the form of a loop, by a tug or other craft, and its opposite end is attached to the free ends of the auxiliary hoisting cable and draft cable carried by the other wrecking vessel, after which the lifting loop and the draft and hoisting cables connected thereto are allowed to sink to the bottom of the sea as shown by the horizontal loop in Fig. 1. The lifting loop thus lowered is next drawn under the wreck by hauling in the draft cables, whereby the ends of the lifting loop are pulled forward, dragging the loop under the wreck. The branches of the loop are now raised to a perpendicular position by means of the auxiliary hoisting cables, as indicated by the depending loops in Figure 1, and after the loop has been raised its ends are detached from the hoisting cables and one of such ends is attached to the clutches of a hydraulic jack of one of the wrecking vessels and the other end to the clutches of an opposite hydraulic jack on the other wrecking vessel.

For the sake of clearness, a single loop is referred to in the above description, but the loops are preferably arranged in pairs, as shown in Fig. 1, and the ends of one loop of each pair are connected with opposite hydraulic jacks located on the outer sides of both wrecking vessels, and the ends of the other loop of the same pair are connected with opposing hydraulic jacks arranged on the inner sides of the wrecking vessels. By this arrangement, the strains exerted by the loops of each pair is equalized on both sides of the wrecking vessels, preventing undue careening or capsizing of the same.

After the first pair of lifting loops has been adjusted and connected with the hydraulic jacks, additional loops are successively lowered around the wreck, and drawn under the same to the proper point, raised to a perpendicular position and attached to the series of hydraulic jacks upon the wrecking vessels, in the manner described, with reference to the first pair of loops, the hoisting and draft cables being detached from each pair of loops, preparatory to connecting the loops to the hydraulic jacks and being then attached to the next pair until all the loops have been adjusted and connected with their respective jacks, as many pairs of hydraulic jacks being provided upon the wrecking vessels as there are loops. After the various lifting loops have been connected with the hydraulic jacks the latter are set in operation, whereby all of the loops are simultaneously hauled up and the wrecked vessel is raised. Each pair of lifting loops is preferably hauled up a short

distance after being adjusted around the sunken vessel, so as to raise the latter slightly and permit the succeeding lifting loops to be drawn under the same more easily.

5 In order to facilitate the hoisting of the various lifting loops and avoid entanglement of the same with the different lines and cables extending from the wrecking vessels, each of these vessels is provided with two derricks and hoisting cables one located near its bow and the other near its stern, as shown in the drawings.

To enable those branches of the lifting loops which run over the inner sides of the vessels to be passed under the wrecking vessels conveniently, transfer chains or cables N are employed which are arranged under the bow and the stern of each wrecking vessel. These chains are endless and pass around the hull of the wrecking vessels, the same being guided upon rollers n, attached to the outer side of the vessels and being shifted by means of tackle connected with the hoisting derricks, or by any other suitable means. The branches of the lifting loops which are to pass over the inner sides of the wrecking vessels are successively attached to these transfer chains on the outer sides of the two vessels and the chains are then moved in the proper direction to carry such loop-branches to the inner sides of the vessels, after which the branches are again disconnected from the chains and attached to their respective hydraulic jacks.

The various jacks may be connected by pipes with an accumulator or a common pressure tank and a valve controlling all of the jacks may be arranged in the main pressure supply pipe, and an independent valve may be arranged in the branch pipe leading to each jack, to enable each jack to be operated independently of the rest, if desired.

In raising a vessel sunk upon a sandy bottom, the apparatus hereinbefore described is sufficient, as the sand permits the lifting loops to be drawn under the wreck, but in raising a vessel sunk on rocks, it is necessary to raise the vessel at one end sufficiently to draw the lifting loops under the same. For this purpose, the apparatus shown in Fig. 5 may be employed. This consists of an upright lifting loop O passing around the overhanging stern of the sunken vessel and connected at its ends to hydraulic jacks upon the two wrecking vessels, and an inclined retaining loop P, passing around the bow of the sunken vessel, whereby the lower portion of the lifting loop is held at the proper angle to prevent its slipping off the stern. This retaining loop is provided at its ends with rings p, through which the branches of the lifting loop pass loosely. Upon operating the hydraulic jacks connected with this lifting loop the stern of the sunken vessel is raised, permitting the main lifting loops C, hereinbefore mentioned, to be successively adjusted around the vessel in the manner described. These retaining and lifting loops may be adjusted from the

wrecking vessels in the following manner: The lifting loop O is first dropped between the two wrecking vessels behind the stern of the sunken vessel and it is then drawn forward around the stern to the position shown by dotted lines in Fig. 6. The retaining loop is next dropped adjacent to the bow of the sunken vessel, as shown by dotted lines, and lifted to a point opposite the straight portion of the bow by means of a cable q, extending upward to one of the wrecking vessels. The rings of the retaining loop are then passed over the branches of the lifting loop and the latter is attached to the clutches of a pair of opposing lifting jacks. This permits the branches of the retaining loop to drop to the position shown by full lines, and upon operating the jacks, the two loops form a sling which firmly embraces the bow and stern of the sunken vessel and whereby its stern is raised.

I claim as my invention—

1. In an apparatus for raising sunken vessels, the combination with a wrecking vessel having a hoisting device, a number of lifting loops adapted to pass vertically around the hull of the sunken vessel, a submerged guide wheel or pulley anchored beyond one end of the vessel and a draft cable for drawing said loops under the sunken vessel passing forward and upward around said guide wheel and connected with the hoisting device on said wrecking vessel, substantially as set forth.

2. In an apparatus for raising sunken vessels, the combination with a wrecking vessel having hoisting devices, of a number of lifting loops adapted to pass vertically around the hull of the sunken vessel, hoisting cables detachably secured to the branches of said lifting loops and leading to hoisting devices on the wrecking vessel, submerged guide wheels anchored beyond one end of the sunken vessel, and draft cables detachably connected with the branches of the lifting loops and passing forward around the submerged guide wheels and upward to hoisting devices on the wrecking vessel, substantially as set forth.

3. The combination with a hoisting apparatus, of a clutch adapted to grip the hoisting cable and consisting of a block having a tapering opening, and an internally screw threaded socket communicating with the large end of said opening, wedges seated in said opening and adapted to grip the cable, an externally screw threaded adjusting sleeve or follower engaging with said socket, and a spring interposed between the large end of said wedges and said sleeve or follower, substantially as set forth.

4. The combination with a hoisting apparatus, of a clutch adapted to grip the hoisting cable and consisting of a block having a tapering opening and an internally screw threaded socket communicating with the large end of said opening, wedges seated in said opening and adapted to grip the cable, an externally

screw threaded adjusting sleeve or follower  
engaging with said socket, a spring inter-  
posed between the large end of said wedges  
and said sleeve or follower and a spring  
5 bearing against the small ends of the wedges,  
whereby the latter are held in their proper  
relative position, substantially as set forth.

Witness my hand this 20th day of March,  
1894.

ENOS B. PETRIE.

Witnesses:

CARL F. GEYER,  
ELLA R. DEAN.

Correction in Letters Patent No. 526,163.

It is hereby certified that the residence of the assignee in Letters Patent No. 526,163, granted September 18, 1894, upon the application of Enos B. Petrie, of Buffalo, New York, for an improvement in "Apparatus for Raising Sunken Vessels," was erroneously written and printed "Boston, Massachusetts," whereas said residence should have been written and printed *Boston, New York*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 2d day of October, A. D. 1894.

[SEAL.]

JNO. M. REYNOLDS,  
*Assistant Secretary of the Interior.*

Countersigned:

S. T. FISHER.

*Acting Commissioner of Patents.*