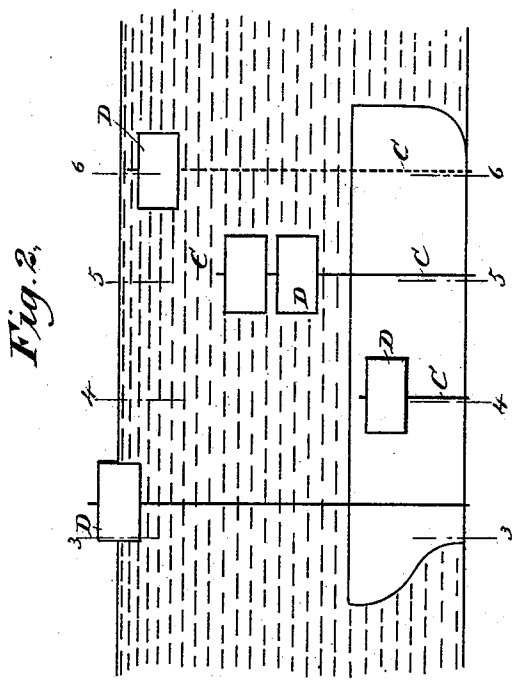
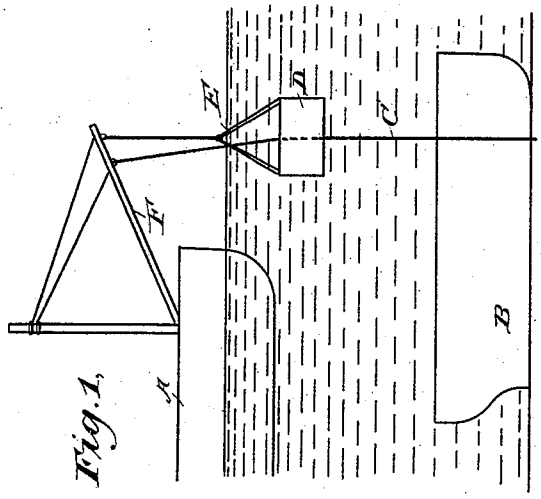
(No Model.) 6 Sheets—Sheet 1.

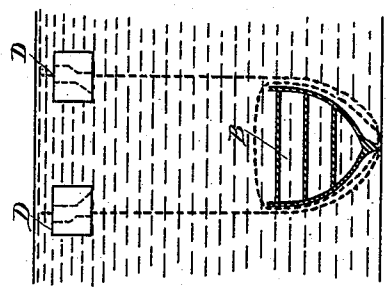
I. E. & W. L. CHAPMAN, T. KIVLIN & E. M. STODDARD.

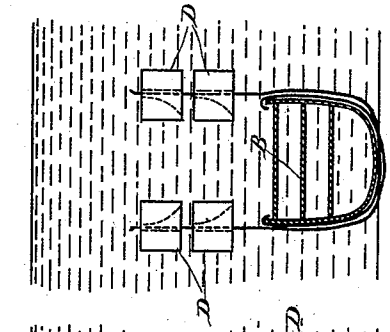
APPARATUS FOR RAISING SUNKEN VESSELS.

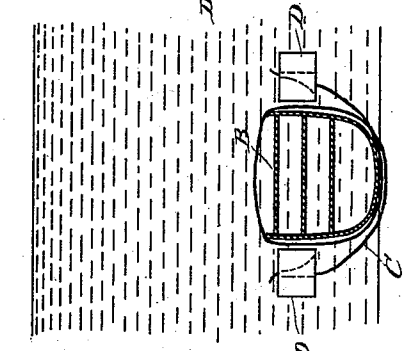
No. 563,565. Patented July 7, 1896.

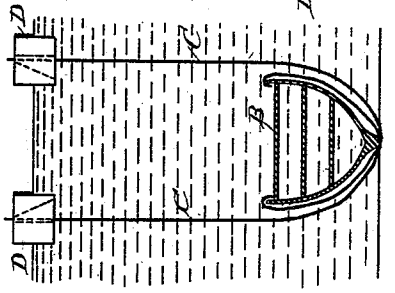












WITNESSES.

Edward Thorpe.

Fred. J. Hoosteg

INVENTORS
I. E. Chapman
W. L. Chapman
T. Kivlin
E. M. Stoddard
BY Munn & Co
ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

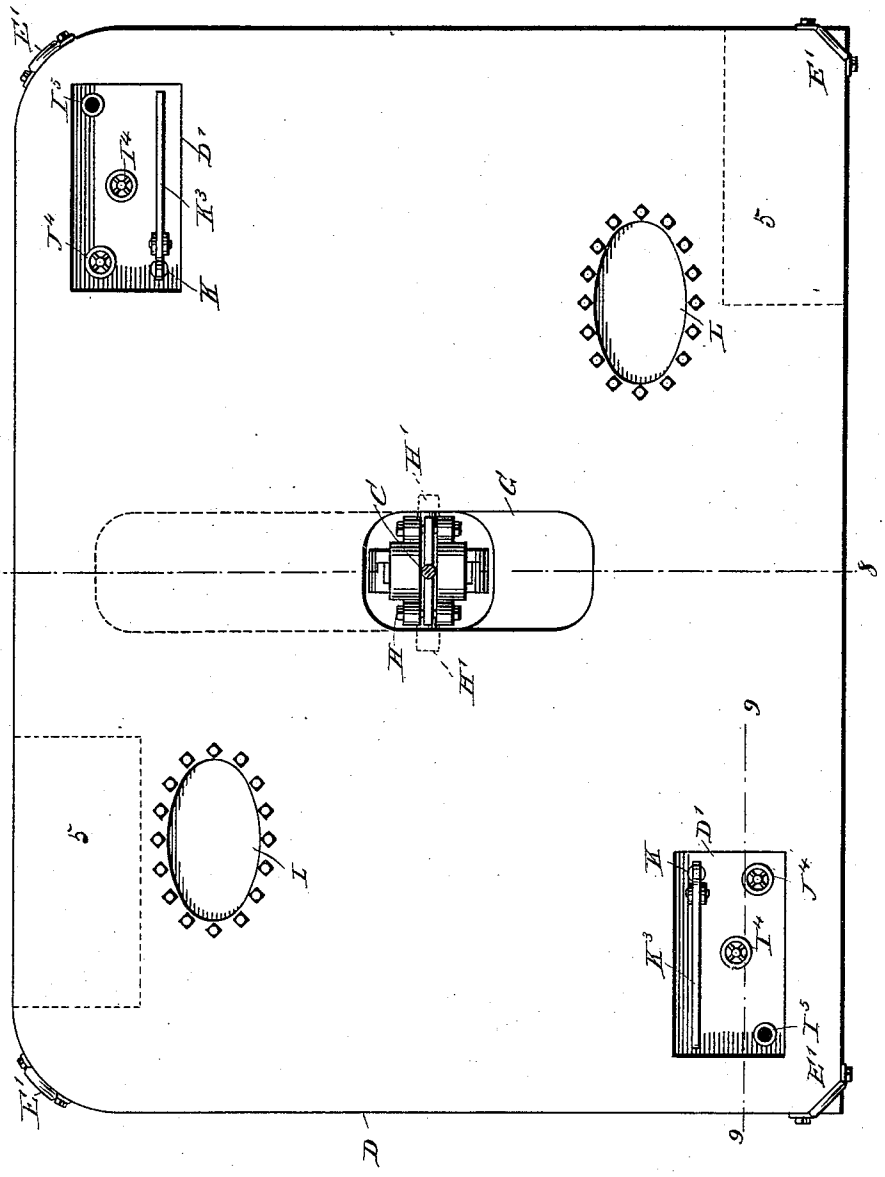
(No Model.) 6 Sheets—Sheet 2.

I. E. & W. L. CHAPMAN, T. KIVLIN & E. M. STODDARD.

APPARATUS FOR RAISING SUNKEN VESSELS.

No. 563,565. Patented July 7, 1896.

Fig. 7.



WITNESSES:

Edward Thorpe.

Chas. G. Hoostay.

INVENTORS
I. E. Chapman
W. L. Chapman
T. Kivlin
BY Em Stoddard
Munn & Co
ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

6 Sheets—Sheet 3.

E. & W. L. CHAPMAN, T. KIVLIN & E. M. STODDARD.

APPARATUS FOR RAISING SUNKEN VESSELS.

No. 563,565. Patented July 7, 1896.

Fig. 9.

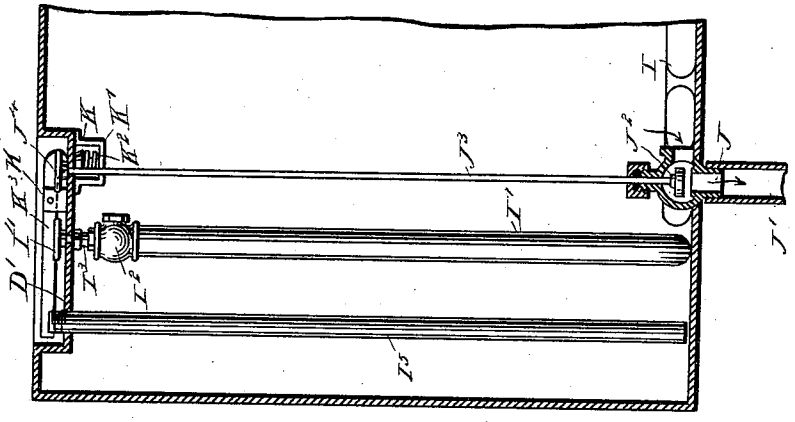


Fig. 8.

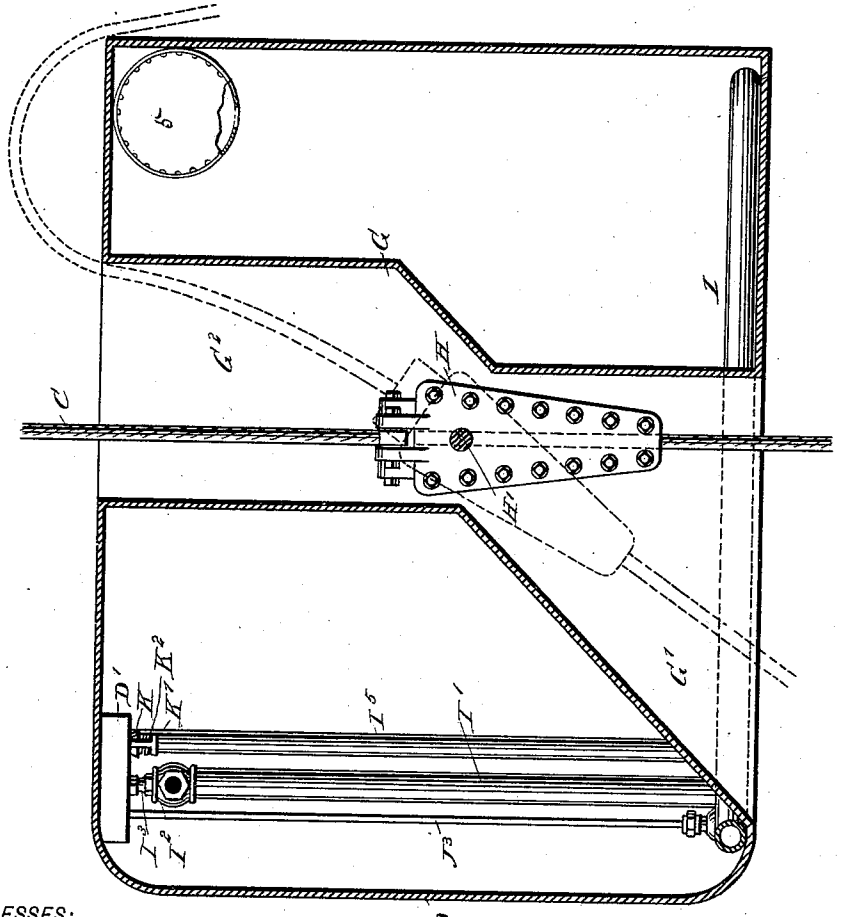
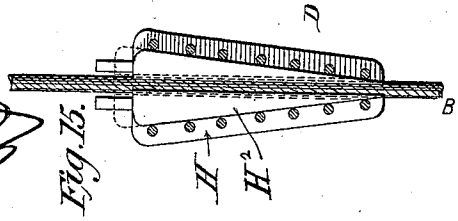


Fig. 15.



WITNESSES:

Edward Thorpe

Fred. G. Barker

INVENTORS

W. L. Chapman

T. Kivlin

E. M. Stoddard

BY Munn & Co

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

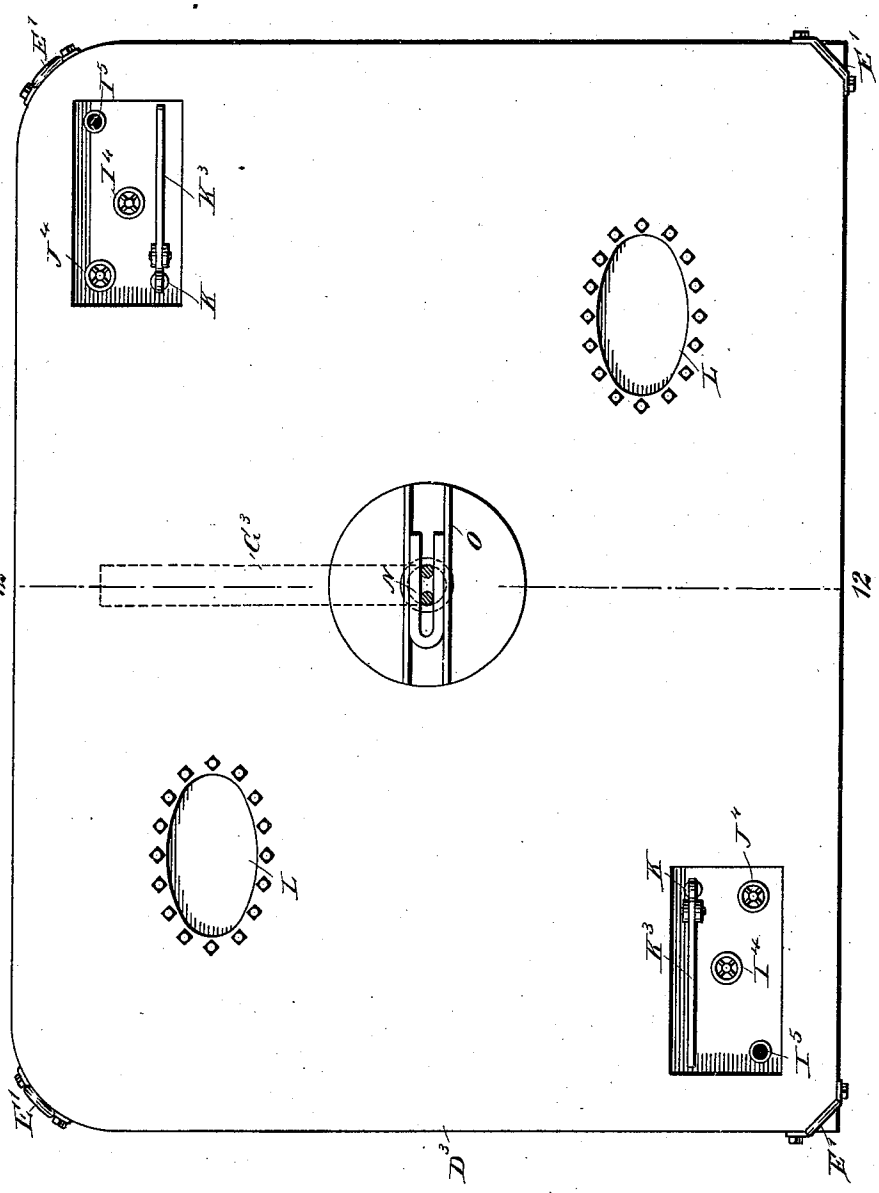
(No Model.) 6 Sheets—Sheet 4.

I. E. & W. L. CHAPMAN, T. KIVLIN & E. M. STODDARD.

APPARATUS FOR RAISING SUNKEN VESSELS.

No. 563,565. Patented July 7, 1896

Fig. 10.



WITNESSES:

Edward Thorpe.

Thos. J. Hooker, Jr.

INVENTORS
I. E. Chapman
W. L. Chapman
T. Kivlin
BY Em. Stoddard
Munn & Co
ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

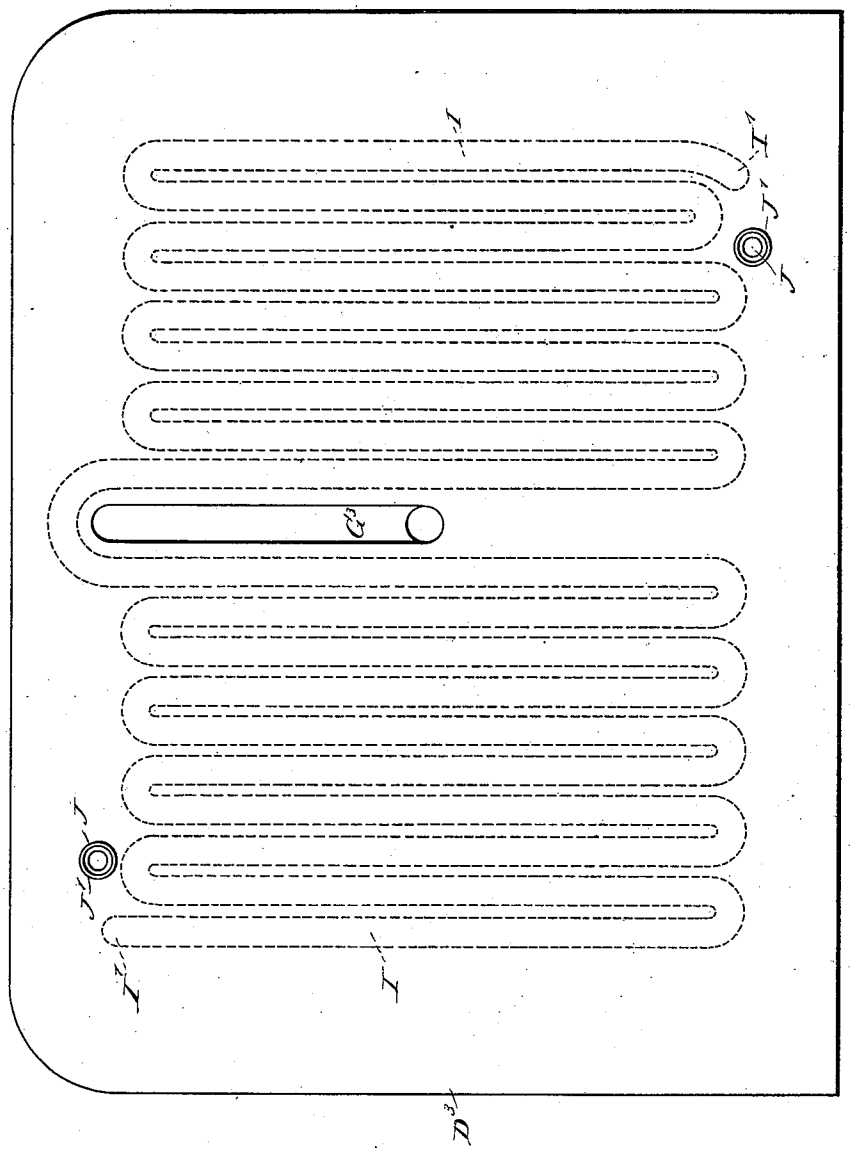
(No Model.) 6 Sheets—Sheet 5.

I. E. & W. L. CHAPMAN, T. KIVLIN & E. M. STODDARD.

APPARATUS FOR RAISING SUNKEN VESSELS.

No. 563,565. Patented July 7, 1896.

Fig. 11.



WITNESSES:

Edward Thorpe.

Thos. G. Hoover

INVENTORS
I. E. Chapman
W. L. Chapman
T. Kivlin
E. M. Stoddard
BY Munn & Co
ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 6 Sheets—Sheet 6.

I. E. & W. L. CHAPMAN, T. KIVLIN & E. M. STODDARD.

APPARATUS FOR RAISING SUNKEN VESSELS.

No. 563,565. Patented July 7, 1896.

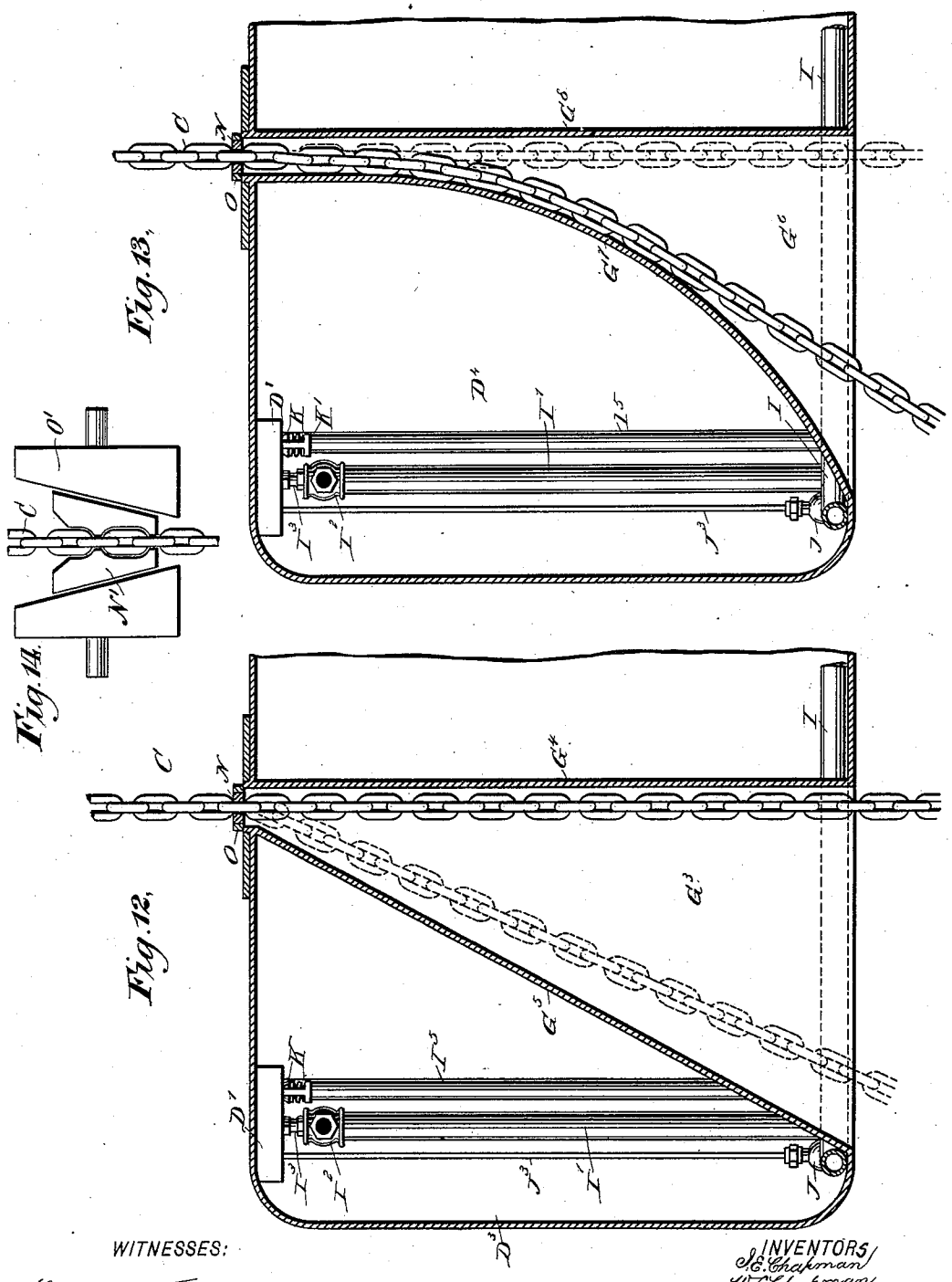


Fig. 13.

Fig. 14.

Fig. 12.

WITNESSES:

Edward Thorpe.

Thos. G. Hoster, Jr.

INVENTORS/
I. E. Chapman
W. L. Chapman
T. Kivlin
E. M. Stoddard

BY Munn & Co

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ISAAC E. CHAPMAN, WILLIAM L. CHAPMAN, AND THOMAS KIVLIN, OF BROOKLYN, NEW YORK, AND EBENEZER M. STODDARD, OF NORFOLK, VIRGINIA, ASSIGNORS TO THE CHAPMAN DERRICK AND WRECKING COMPANY, OF NEW YORK, N. Y.

APPARATUS FOR RAISING SUNKEN VESSELS.

SPECIFICATION forming part of Letters Patent No. 563,565, dated July 7, 1896.

Application filed May 13, 1895. Serial No. 549,140. (No model.)

To all whom it may concern:

Be it known that we, ISAAC E. CHAPMAN, WILLIAM L. CHAPMAN, and THOMAS KIVLIN, of Brooklyn, in the county of Kings and State of New York, and EBENEZER M. STODDARD, of Norfolk, in the county of Norfolk and State of Virginia, have invented a new and Improved Apparatus for Raising Sunken Vessels, of which the following is a full, clear, and exact description.

Our invention relates to apparatus for raising sunken vessels, and more particularly to the manner of manipulating the lifting-cables and attaching the same to the wreck or vessel and to the structure of the pontoons, the means for charging the same to create buoyancy, the manner of arranging the pontoons, and their gripping devices.

The object of our invention is to provide apparatus which may be employed to raise wrecks, or lift and carry vessels over shoals.

To this end our invention consists in the apparatus and in the combinations of elements and parts hereinafter described and claimed.

By the use of our improved apparatus the raising of wrecks and the lifting of vessels over shoals are rendered easy and practicable under any condition or character of water or weather, and can be done with or without the aid of divers. The apparatus may be operated at the surface of the water, may be disposed alongside the wreck or sunken vessel, or at any distance between the same and the surface of the water, and is capable of being used singly or in series, in slack or in tide water, or in shallow or deep water, the apparatus being at all times under perfect control of the operator. Moreover, when the lifting power of the apparatus is once applied, it does not lose its effect and is fully retained, although capable of being regulated or governed until the purpose is accomplished.

Reference is to be had to the accompanying drawings, in which similar reference-characters indicate corresponding parts.

Figure 1 is a side elevation showing a pontoon being lowered on the lifting-cable to position relative to the wreck. Fig. 2 is a side elevation showing several different ways in which the pontoons may be disposed in order to raise a wreck. Figs. 3, 4, 5, and 6 are cross-sections of Fig. 2 on the lines 3 3, 4 4, 5 5, and 6 6, respectively. Fig. 7 is a plan view of one of the pontoons on an enlarged scale. Fig. 8 is a transverse section of Fig. 7 on the line 8 8. Fig. 9 is a vertical section of Fig. 7 on the line 9 9. Fig. 10 is a plan view of another form of pontoon, showing a chain cable gripped at the deck of the pontoon by improved means. Fig. 11 is an inverted plan of the pontoon. Fig. 12 is a transverse section on the line 12 12 of Fig. 10. Fig. 13 is a like view showing a different form of trunk or cable passage. Fig. 14 is a detail side elevation of another form of chain-holding device or grip. Fig. 15 is an enlarged view of the grip shown in Fig. 8, showing the detail of its construction.

In this specification the term "cable" is employed as comprehensive of any kind of wire rope, link chain, or other means which may be used to pass around a wreck or vessel and to which the pontoons may fasten or be gripped to effect the lifting of a wreck or vessel. Therefore, when any part of the apparatus is particularly adapted to be used in connection with a particular kind of cable, said term will be properly qualified.

In using our invention, we bring a wrecking-steamer or a floating derrick A over the wreck B, as shown in Fig. 1. As many cables as are deemed necessary are then passed from the steamer A under the wreck B, and attached to the sides of the wreck by hooking one end thereto, as shown in Figs. 3 and 5. The other end of the cable is extended upward to the steamer A, as shown in Fig. 1. If desired, the cables may be passed completely around the wreck, so that both ends pass upward to the steamer A on opposite sides of the wreck, as shown in Figs. 4 and 6.

By fastening and applying the cables to the wreck in the manner described and shown, the cables are caused, in either case, to firmly grip the wreck or vessel and are thus prevented from slipping or rending. The wreck is prevented from turning over in the cables, and the cables cannot come out from under the wreck in case one end thereof is raised

faster than or before the other. Moreover, the pontoons are prevented from pulling from or against each other. Furthermore, the manner of attaching the cables to the vessel avoids the possibility of injury to the latter, inasmuch as the cables are caused to exert the majority of their strain upon the sides of the vessel in a vertical direction. Each of the cables forms a guide for the pontoons D, one or more of which may be lowered upon each cable.

The steamer A conveys the pontoons to the desired place, and the latter are suspended and lowered from a boom F, carried by the steamer A, as shown in Fig. 1.

The pontoons are preferably of the construction and shape shown in Figs. 7, 8, and 9, are made of boiler-plate, and are of such size and weight as to render them capable of easy transportation by railroad or vessels, or of being towed afloat in the water to the place of operation. Manifestly, however, the shape, size, weight, and material of the pontoons may be varied without departing from the spirit of our invention, and in this connection it may be said that pontoons of cylindrical form have been found advantageous for certain purposes.

Each pontoon is provided with manholes L in its top to give access to the interior when necessary, the same being of any approved form and construction. Each pontoon is also provided at each of its corners with a staple or eye E′, adapted to be engaged by hooks on the chains E, as shown in Figs. 1 and 7, in lowering the pontoon into the water or in taking the same from the water.

Each pontoon is provided with an air-chamber 5, located at each end thereof at the top, the purpose of which is to provide the pontoon with nearly enough buoyancy to overcome, or counteract, the dead-weight of the pontoon when the latter is filled or nearly filled with water and submerged. Each air-chamber has an opening or vent in the bottom, by which it will be seen that as the hold of the pontoon fills with water the air in the chambers will become compressed. If water should enter the chambers, the air would be compressed until the pressure were sufficiently great to expel the water or create a pressure which would prevent more water entering said chambers. As the pontoon approaches the surface of the water the water in the chambers and pontoon will be expelled by reason of the decrease of external pressure. In this manner the displacement caused by the air in the chambers nearly and automatically counteracts or equalizes the weight of the pontoon when submerged, thus making it easy for workmen on a vessel to handle it, and also enabling the pontoon to maintain level deck and keep right side up.

The pontoons are also constructed so as not to have any of the operating or manipulating devices appear or project beyond the walls or surface thereof. To this end all the operating or manipulating devices are either located inside the pontoons or are arranged in depressions formed or arranged below or within the surface or walls thereof. This arrangement and construction avoids all possibility of the manipulating or operating devices becoming deranged or broken by contact with obstructions or with the wreck or vessel, thus insuring perfect and effective operation of the pontoons. Depressions suitable for this purpose are shown at D′, Figs. 7, 9, and 10, one being arranged at each end of the pontoon in the deck. These depressions are formed by depressing the metal of the deck in any suitable manner.

The pontoon is made hollow, or is provided with a hold, which is to be filled with water to sink or submerge the pontoon along the guiding-cable to the proper position or depth. After the pontoon has been submerged the water is forced therefrom by pneumatic pressure, the gas taking the place of the expelled water and rendering the pontoon buoyant, which quality causes it to exert, by certain devices hereinafter described, an upward pull on the cable and through the latter lift the wreck.

In order to submerge or sink the pontoon, openings are provided in the bottom, one being located at each end of the pontoon, preferably directly below a depression D′. These openings are closed by valves J^2 of the construction shown in Fig. 9. If desired, the pipes J J′ may be extended from the valve-openings. The valves are closed by a stem J^3, entering the valve-chamber through a suitable stuffing-box, the other end of the stem passing up through the bottom of the depression D′, within which the stem is provided with a suitable operating-handle J^4, by which the valve is opened or closed, being left open for the free escape of water or air throughout the entire use of the pontoon in the operation of raising a wreck and closed only when the pontoon is not in use.

The pneumatic power employed in rendering the pontoons buoyant is preferably in the form of compressed air, contained in one or more series or coils of pipes I, suitably secured to the bottom of the pontoons, said coils having each end I′ extending upwardly to near the top of the pontoon and just below the bottom of the depressions D′, (see Fig. 9,) where said extension is provided with a valve I^2, the stem I^3 of which passes through the bottom of the depression D′, (see Figs. 7 and 9,) where it is provided with suitable means I^4 for operating it by hand. Instead of the hand operating means shown at I^4 for releasing the compressed air from the coils, the stem may be operated by means of a lever located in the depression D′, which lever may be operated by a diver, or by a rope extending to the surface of the water and there attached to a buoy or small boat.

The pneumatic power may be conveyed or forced into the pontoons by means of air-compressors or compressed-air reservoirs located on the steamer A and connected by a hose to a pipe I^5, extending through the depression D′ into the pontoon and nearly to the bottom thereof. The pipe I^5 is provided with a quick coupling of any character or approved form at the upper end, which enables a diver to easily and quickly connect the air-hose; or the air-hose may be connected to the pipe before the pontoon is submerged and the other end may be buoyed up, so as to enable a connection to be made at the surface of the water without the aid of a diver.

In lieu of either of the above-described means for creating buoyancy of the pontoon the pneumatic power may be obtained by generating gas through the agency of chemicals carried in the pontoon, which when intermingled with each other or with water produce a gas which will force the water from the pontoon and create the necessary buoyancy. It will of course be understood that the chemicals will be selected with reference to their ability to generate gas at the proper time and in the manner desired. Gas may also be generated to create buoyancy of the pontoon by decomposing the water in the pontoon by a process of electrolysis and through the agency or medium of an electric plant on the steamer A, connected by wires running to the pontoon and there connected to zinc plates or other necessary devices within the hold of the pontoon. When the gas used is in the form of compressed air in the coils I, the latter are preferably charged on shore, it being only necessary then to convey the pontoons to the place of operation for attachment to the guiding and lifting cables.

The pontoons are usually provided with both the compressed-air coils I and the pipe I^5, so that in case of accident to the coils I the pontoons can be charged with gas from the steamer A by coupling a hose to the pipe I^5, as previously described. A very important advantage arises from the use of the compressed-air coils and their arrangement in the manner shown on the bottom of the pontoons, inasmuch as they act as ballast to keep the pontoon steady and on an even keel while the same are being submerged or while they are acting to lift the wreck. Moreover, by supplementing the coils by the air-forcing devices above referred to the pontoon may be rendered buoyant quickly and easily at such times when the coils are not used, or when they may have given out, or when the air in the pontoon has been allowed to escape in order to reduce the lifting strain or sink the pontoon a second time.

Ordinarily the compressed air would be allowed to enter the pontoon so as to fill the latter and force out the water in from fifteen to twenty minutes, the valves in the bottom being of a size sufficient to allow the escape of the water without undue pressure and said valves being closed only when the pontoon is afloat and not in use as a lifting power, as hereinbefore stated.

It will be seen that as the valves in the bottom are open at all times when the pontoons are in use the pressure within the pontoons is automatically regulated as they ascend with the load, owing to the free escape of the gas from said valves due to excess of pressure. Thus as the pontoons near the surface and the outside pressure becomes less the gas escapes through the valves and the inside pressure is automatically relieved, avoiding liability to burst.

Each pontoon is provided at or near its center with a vertical passage or trunk G, through which passes loosely the cable C. The trunk may be constructed variously, as indicated in Figs. 8, 12, and 13.

In Fig. 8 the trunk is shown as extending vertically through the pontoon, with the part G′ thereof, below the horizontal diameter, flaring entirely to one side, and the part G^2 thereof, above the said diameter, flaring in the opposite direction, thus leaving two oppositely-disposed vertical walls extending, respectively, from the bottom and top to the horizontal diameter. This form of trunk allows the cable to be gripped at or near the center of the pontoon and below the center of buoyancy, which gives the pontoon the ability to float upright and keep its deck level. Thus gripping the cable prevents any undue friction or chafing of the latter against the walls of the trunk, and the central location of the cable-grip affords better opportunity for bracing the pontoon, and when the latter is located alongside the wreck the side pressure will be more evenly divided over the sides of the pontoon. This location of the cable-grip also places the strain below the center of buoyancy of the pontoon, thus also preventing listing of the latter.

In Fig. 12 the trunk is shown as extending vertically through the pontoon and located at one side of the vertical center thereof, one wall, G^4, being vertical and the opposite wall, G^5, diverging from the top to the bottom of the pontoon, thus throwing the trunk-opening G^3 to one side of the vertical center of the pontoon. In this form the cable-grip may be located at or below the deck of the pontoon, being here shown as at the surface of the deck. This form of trunk allows the pontoon to be used alongside or above the wreck, and little loss in displacement results. Another advantage resulting from this form of trunk is that it obviates the necessity of employing leaders for the cable, which would prove obstructions in the trunk; for, by making one wall vertical and the other flaring and gripping the cable at the side of the trunk next the vertical wall, when the pressure of the water on the flaring wall creates a tendency in the pontoon to roll or list the cable hugs

the vertical wall and rectifies such tendency and keeps the pontoon on an even keel and its deck level.

In Fig. 13 the trunk is shown formed substantially like that of Fig. 12, the only difference being in making the flaring wall G^7 curved. This form has all the advantages of that of Fig. 12, and also the advantage that when used to lift alongside the wreck the strain on the lifting-cable will be in a vertical direction, or at a right angle to the deck of the pontoon. This makes it easier and more practicable to apply the grip to the cable.

From the above it will be seen that each pontoon has but one cable-trunk, and but one cable-grip is located therein, inasmuch as each pontoon is designed to lift on only one cable. It is practicable, however, to arrange one pontoon above the other on the same lifting-cable, as shown in Figs. 2 and 5.

H, Fig. 8, indicates one form of the gripping device, which is automatic in its action in gripping the cable as soon as the pontoon begins to rise. While this form of grip is capable of operating in connection with any character of cable, it is here shown as specially adapted to a wire-rope cable. As herein shown, the grip is located at or near the center of the pontoon and below the center of buoyancy, thus bringing all the strain exerted by the grip on the cable below the center of buoyancy of the pontoon. This prevents listing of the pontoon and tends to keep an even keel and level deck. The grip H is pivoted to or supported on trunnions in the trunk of the pontoon, this permitting a swinging movement of the grip and allowing the cable to lead straight from the grip whatever position the latter may assume. The grip H consists of a frame having trunnions H′, projecting laterally therefrom, which are supported in any suitable manner in the trunk, as shown in Figs. 7 and 8. The frame of the grip is also provided with a central longitudinal passage, the walls of which converge from the top to the bottom, and support and guide two independent wedge-shaped gripping plates or jaws H^2. The adjacent faces of these jaws are constructed so as to exert a firm grip upon the cable, and may be formed complemental to the outline of the cable which is employed. The cable passes loosely between the jaws and is only gripped thereby when the jaws assume a position in the lower end of the frame H. The frame and jaws are provided with any suitable means for preventing the entire withdrawal of the latter from the former while the grip is being used. The jaws H^2 have a free sliding movement inside the frame H, and when the frame is lowered upon the cable, or the cable is pulled up through the frame, the jaws have no gripping action. When, however, the frame is drawn up along the cable, or the cable is drawn down through the frame, the jaws immediately have a gripping action. Therefore, when all the parts are assembled and it is desired to submerge the pontoon, the latter will slide freely down the cable; but when the pontoon becomes buoyant and begins to rise the grip automatically fastens upon the cable and, through the latter, exerts an upward pull upon the wreck. Moreover, as the strain becomes greater the grip manifestly becomes tighter, thus avoiding any possibility of the grip slipping at a critical moment.

In Figs. 10, 12, and 13 another form of grip is shown, this form being especially adapted for operation in connection with a chain cable. As shown in the figures, the deck of the pontoon, around the opening of the cable-trunk, is provided with a projection forming a journal for a rotating plate O, having an opening coinciding with the opening of the trunk, and also having a diametric groove in its face in which slides a **U**-shaped gripping-key N. The chain cable passes through the plate O and through the trunk, and is gripped to the pontoon by adjusting the key N so as to make the legs thereof embrace the flat sides of one of the links of the cable. It will be apparent that as the link of the cable immediately above and below the grip is at a right angle to the gripped link it will be impossible for the cable to become loose or to get away from the pontoon. Manifestly, this form of cable is simple and cheap, and when fastened upon the cable will yield or give to accommodate the twisting of the chain, thereby preventing any kinking of the latter, or any undue strain upon the pontoon. Moreover, it will be clear that the grip can be applied at any point to the chain irrespective of its position, and by having the key fit snugly in the groove of the rotating plate it is prevented from spreading or breaking and losing its effective grip upon the chain.

In Fig. 14 is shown another form of automatic grip similar in its operation to the grip in Fig. 8, but shown as especially adapted to a chain cable. This grip may be disposed at any point in the trunk-passage of the pontoon, so as to obtain any and all advantages accruing from the different shapes given the said passages. In this figure, O′ indicates a frame suitably supported in the trunk-passage and having a guideway, converging from top to bottom, for the reception and maintenance of a two-part grip N′. The grip consists of two wedge-shaped blocks or jaws, having opposite gripping-faces provided with recesses for the reception of certain links of the cable and projections to enter certain other links of said cable. It will be clear that when the cable is lowered through the passage of the pontoon, or the pontoon is caused to rise along the cable, the gripping-jaws will automatically seize and tightly grip the cable, because such actions will force the gripping-jaws into the small end of the frame. When, however, the cable is pulled up through the pontoon or the latter is caused to descend along the cable, the latter will be automatic-

ally released, because the gripping-jaws are forced into the larger end of the frame. Any means may be employed to limit the movement of the jaws in the frame and to prevent the entire withdrawal of the former from the latter during operation.

In the bottom of each of depressions D′ of the pontoon is an aperture formed to receive a conical automatically-closing exhaust-valve K, which is supported and held in place by an expansion-spring K^2 of any suitable form, which latter is supported and retained in operative position by a bracket K′, affixed to the bottom of depression D′ inside the hold of the pontoon. The upper end of the valve is operated by a lever K^3, suitably pivoted at K^4, the valve being normally relieved from the pressure of the lever by reason of the handle or operating end being made heavier. The lever K^3 may be manipulated by a diver, or by means of a rope connected to the lever-handle and extending to the surface, where it may be attached to a buoy or small boat. This valve has several functions and bears an important relation to the operativeness of the pontoon. After the pontoon has once been submerged and the water forced therefrom to render the same buoyant, the pressure of the gas therein may be regulated in accordance with the depth of the surrounding water and as necessity demands by manipulating the lever to open the valve and allow the gas to escape. Again, after the buoyancy of the pontoon has served its purpose and it is desired to again submerge the same, the valve is manipulated as described, the gas is allowed to escape, and as this takes place the water again enters through the valves J^2 in the bottom and the pontoon can again be sunk along its guiding-cable to the depth and position desired. The spring K^2 holds the valve K normally closed, and the pressure of said spring is reinforced by the air-pressure within the pontoon when the latter is buoyant, the valve thus being automatically closing.

It will be noticed that, and as hereinbefore stated, the several manipulating devices of the several valves, &c.—that is, the valve-handles and manipulating-levers—are located in the depressions D′ or are within the surface of the walls of the pontoon, so that the latter may be placed one on top of the other without danger of breaking, injuring, or displacing said devices.

In addition to the foregoing detailed description of the construction and operation of the different devices constituting our invention, but a brief description of the operation of the several devices and the apparatus as a whole is deemed necessary.

After the cables have been fastened to the wreck or vessel in any of the ways hereinbefore described, the free end of the cable is run through the trunk of the pontoon and the grip carried thereby, as previously set forth. The valves J^2 in the bottom of the pontoon are now opened, permitting water to enter the hold. If the pontoon is charged with sufficient gas to prevent its being submerged, the valve K is opened, whereupon the pontoon will fill with water and sink along the guiding-cable. The discharge of gas by opening the valve K may be regulated so as to keep the pontoon under control, thus enabling its position to be subject to the will of the operator. As soon as the pontoon reaches the desired position and a sufficient number have been submerged and disposed for the purpose they are rendered buoyant by any of the described means, which causes them to start upward to the surface of the water along the guiding-cables. At this moment, if the automatic grips are in use, they seize and tightly grip the cables, thus transferring their lifting power and strain to the cables, causing the latter to firmly bind upon and lift the wreck. If, however, the grip shown in Figs. 10, 12, and 13 is in use, the key N must be adjusted upon the chain before the pontoon is rendered buoyant.

The number of pontoons used depends upon the weight of the wreck and the displacement required to lift it. The character of the pontoons used depends upon the disposition which is to be made of them. The means employed to render the pontoons buoyant depends upon circumstances, convenience, and the character of work to be done.

One of the important features of our invention resides in the capability of the pontoons to be readily manipulated, so that perfect control of the latter and of the wreck or vessel is always maintained. The structure and character of the pontoons, as can be clearly seen, are such as to render them easily manageable and maintained under perfect control. To maintain the wreck or vessel under perfect control at all times is an essential thing and can be readily accomplished by the disposition which we make of our apparatus. Some of the pontoons are used at or near the surface of the water and disposed at or near the ends of the wreck, so as to prevent the latter from coming up end first or from turning over sidewise. When the wreck is partly raised, or comes up so that some of the pontoons show above the surface, others can be readily submerged a short distance—say from ten to fifteen feet—and their lifting power applied so as to entirely relieve the pontoons which are afloat or showing from lifting strain. These may again be submerged as others make their appearance above the surface, thus keeping the lifting power and the wreck or vessel under perfect control. Moreover, by using cables which are independent of each other and disposing thereon one or more pontoons, said cables and complemental pontoons are independent of each other in operation, and if one cable should break or become displaced, or a pontoon should fail to work for any reason, the remaining cables and pontoons will be unaffected and will perform their work perfectly.

Furthermore, as will be apparent, the lifting strain of the pontoons is limited and is always less than the breaking strain of the cables, thus making it impossible for a single pontoon to exert sufficient strain to break a cable. Again, by using a series of chains, fastened upon the wreck or vessel in the manner described, each independent of the others, they can be disposed at any point along the length of the wreck or vessel, and the pontoons can be placed wherever a chain is placed, making it unnecessary to space the chains in accordance with the size of the pontoons, or in respect to their trunk-opening.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The described apparatus for raising sunken vessels, comprising a series of lifting-cables each having one end connected directly to one side of the vessel and having its body portion extending transversely of and beneath the vessel, and pontoons connected to said cables and located on the side of the vessel opposite that to which the cables are attached.

2. The described pontoon having an air-chamber located in the hold thereof and an opening for the admission of air and water into said hold, said air-chamber also having an opening communicating with said hold, whereby substantial equalization of the pressure of air and water in the hold is secured.

3. The combination with a pontoon having means for the admission of water into the hold thereof, of an air-chamber disposed in said hold and having a passage opening into the hold whereby the pressure of air and water in the hold may be nearly equalized, and means for charging the pontoon to force out the water and render the pontoon buoyant.

4. The combination with a pontoon having a hold, the compressed-air coils therein, said compressed-air coils being so disposed at the bottom of the hold as also to afford ballast; substantially as described.

5. The combination with a pontoon having a hold, and an ingress and egress valve, of compressed-air coils disposed on the bottom of the hold, and means for releasing the air in the coils.

6. The combination with a pontoon having a hold and a depression, of compressed-air coils disposed in the hold and having an extension terminating adjacent the depression, and means within the depression connecting with the said extension to discharge the gas therefrom.

7. The combination with a pontoon having a hold, and a depression in its deck, of compressed-air coils disposed in said hold, and having an extension provided with a valve terminating adjacent the depression, and means within the depression connecting with and operating the valve.

8. The combination with a pontoon having a hold, and a plurality of depressions in the deck thereof, of compressed-air coils disposed on the bottom of the hold and having a plurality of vertical extensions terminating beneath and adjacent the respective depressions, and means in each depression connecting with the adjacent extension and operating to release the air.

9. The combination with a pontoon having a hold, and a depression in its deck, of compressed-air coils disposed in said hold and having an escape-valve, the stem of which enters said depression, and means for operating said stem.

10. The combination with a pontoon having a hold, an ingress and egress valve, and a depression, of an air-conduit passing through said depression and into said hold, and means located in said depression for opening or closing said valve and positively holding it in either position.

11. A pontoon having a hold, with a series of coils disposed therein adapted to contain compressed air, and a supplemental or auxiliary air-conduit extending from the outside to the inside of the pontoon.

12. A pontoon having a hold with a series of coils therein adapted to contain compressed air, said coils having a vertical extension provided with a valve, and a supplemental or auxiliary air-conduit extending from the outside to the inside of the pontoon.

13. A pontoon having a hold, and an ingress and egress valve, a series of coils therein adapted to contain compressed air, and a supplemental or auxiliary air-conduit extending from the outside to the inside of said pontoon.

14. A pontoon having a hold, and having also a depression, an ingress and egress valve, coils in said hold adapted to contain compressed air, said coils having a valve, means within the depression for operating both of said valves, and a supplemental or auxiliary air-conduit extending from the outside to the inside of said pontoon.

15. A pontoon having a trunk the passage through which has a vertical wall and an opposite curved wall the upper end of which latter is substantially straight; substantially as described.

16. A pontoon having a trunk extending through the hold thereof from its deck to its bottom, said trunk having a cable-passage therethrough which flares at its lower end, in combination with a grip disposed within the said passage and below the deck of the pontoon.

17. The combination with a pontoon having a hold with a trunk located therein, of a grip comprising a frame pivoted in the said trunk and carrying gripping-jaws.

18. The combination with a pontoon, of a grip comprising a frame pivoted to the pontoon and two members having a limited sliding movement in said frame.

19. The combination with a pontoon, of a grip comprising a frame pivoted to the pontoon, said frame having a socket which con-

verges from top to bottom, and two gripping members which slide freely in said socket.

20. The combination with a pontoon having a trunk with a passage for a cable, of an automatically-operating grip bodily pivoted to and carried by the trunk of said pontoon.

21. The combination with a pontoon having a hold with a valve in the bottom for admitting water, a valve in the top for exhausting gas, means carried by the pontoon for charging the latter with gas, and devices for operating both said valves and means from the outside of said pontoon.

22. The combination with a pontoon having a hold with a valve in the bottom, and also having a depression with a valve in its bottom connecting with said hold, of means located in the hold for charging the pontoon with gas and having its operating connection extending into said depression, and devices located in said depression and connecting with each of said valves and with said means for operating them.

ISAAC E. CHAPMAN.
WILLIAM L. CHAPMAN.
THOMAS KIVLIN.
EBENEZER M. STODDARD.

Witnesses:
W. T. LETHBRIDGE,
GEORGE SHEPHERD.