Feb. 28, 1933. J. REICHERT ET AL 1,899,059

SUBMARINE SALVAGER

Filed Nov. 5, 1928 3 Sheets-Sheet 1

Fig-1-

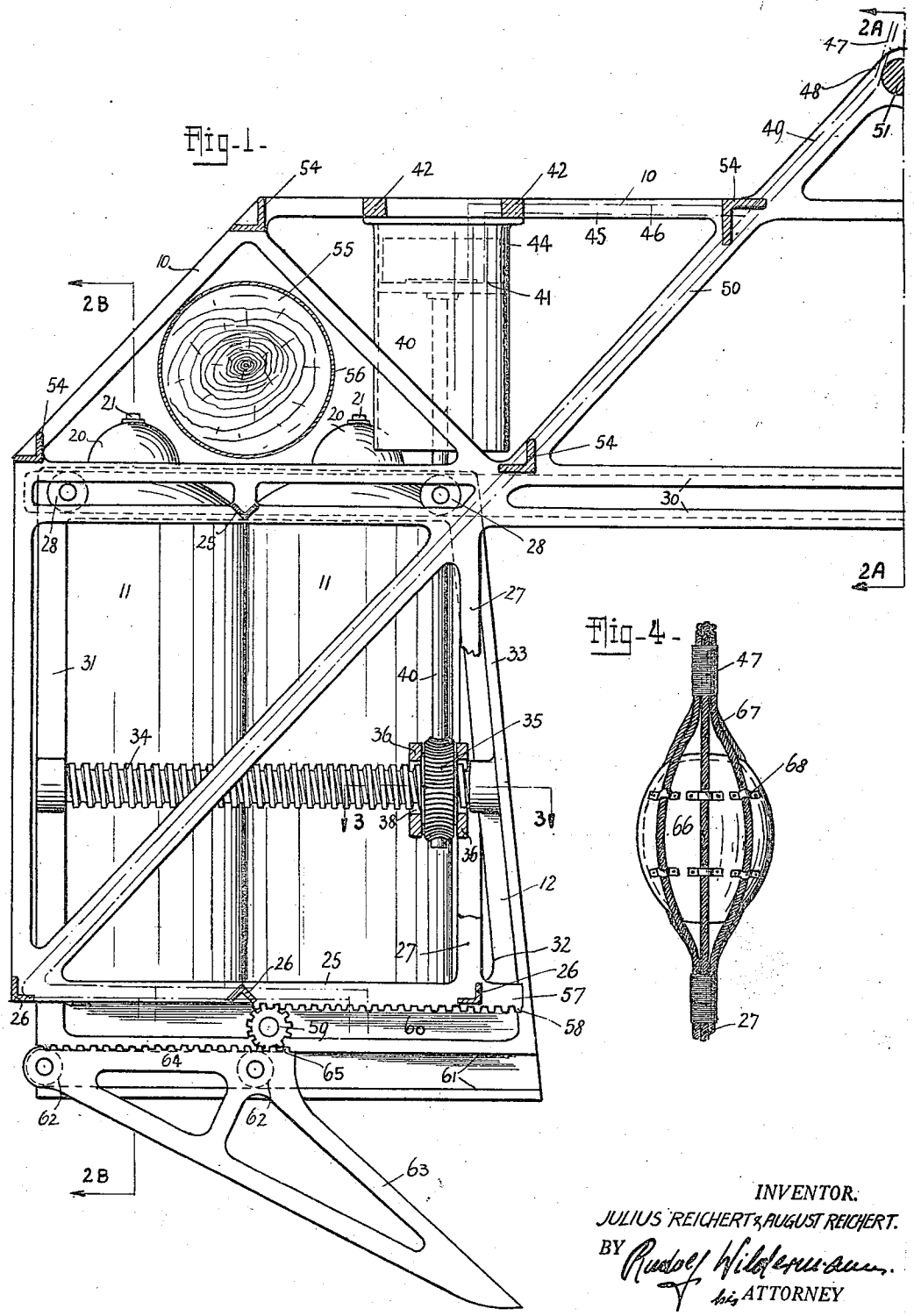



Fig-4-




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SUBMARINE SALVAGER

Filed Nov. 5, 1928 3 Sheets-Sheet 2

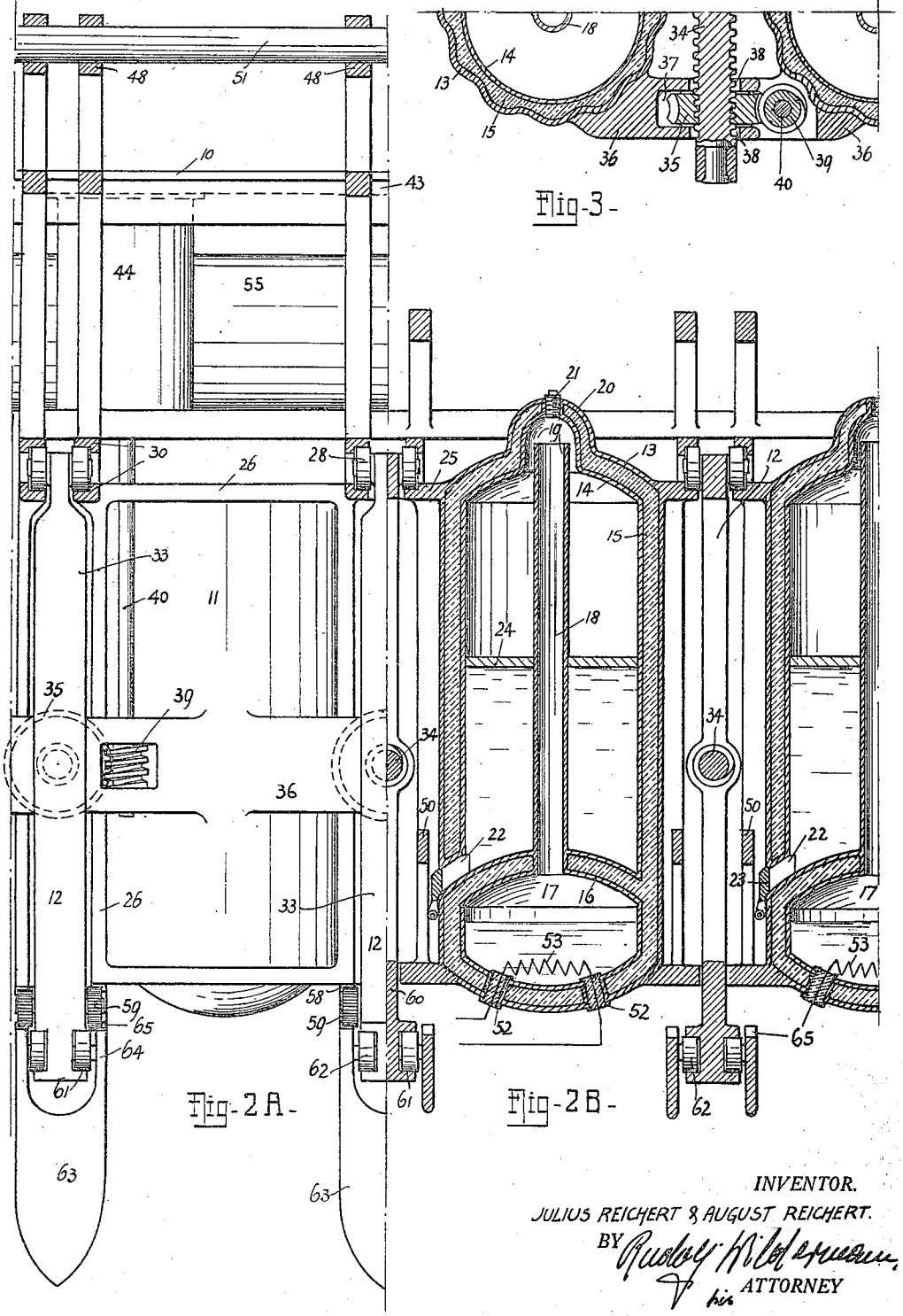



Fig-3-

Fig-2A-

Fig-2B-

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Feb. 28, 1933. J. REICHERT ET AL 1,899,059

SUBMARINE SALVAGER

Filed Nov. 5, 1928 3 Sheets-Sheet 3

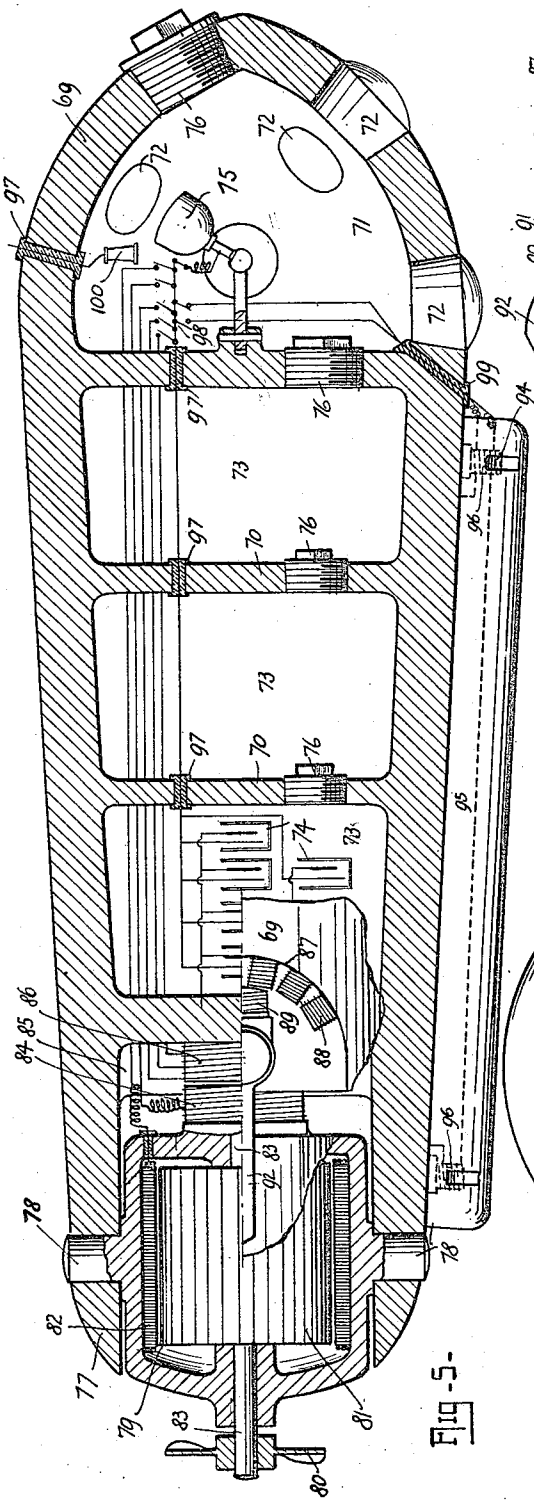


Fig-5-

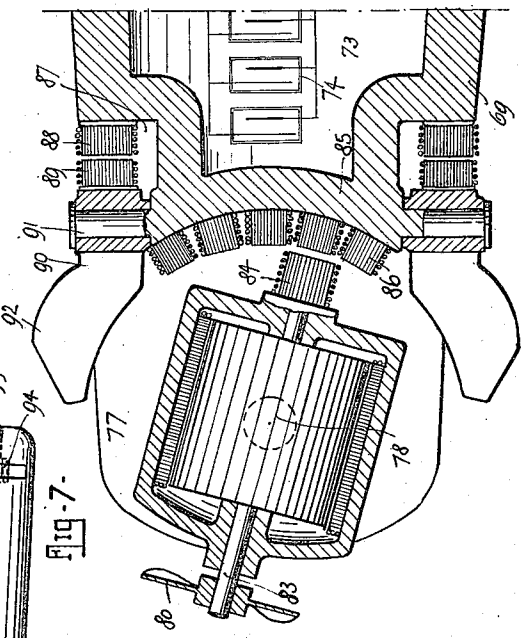


Fig-7-

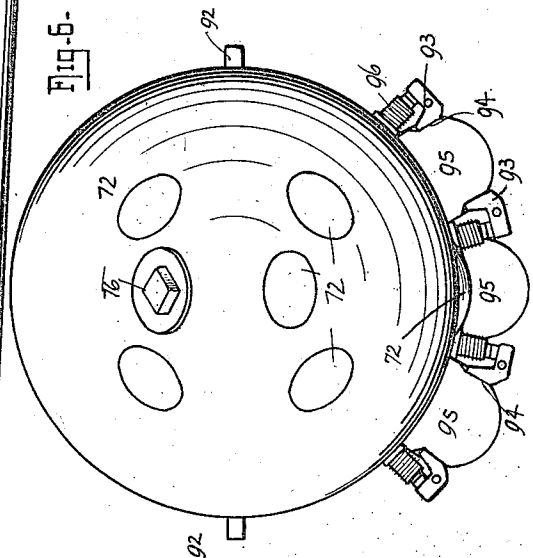


Fig-6-

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Patented Feb. 28, 1933 1,899,059

# UNITED STATES PATENT OFFICE

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## SUBMARINE SALVAGER

Application filed November 5, 1928. Serial No. 317,192.

Our invention pertains to the art of raising objects from the bottom of bodies of water and it concerns, in particular, means to approach, engage and raise to the surface of the water objects which are at a very great depth below said surface.

In the art of salvaging it has been found difficult in the past to operatively approach the bottom of the ocean at greater depths and the salvaging of wrecks and other sunken objects from the bottom of the ocean at its lowest places has been impossible due to the tremendous pressures to which everything is exposed at points many thousand feet below the water surface, due to the collossal water head at those points. Similarly research at such depths has been neglected so that today we do not even have any positive proof whether or not there are living organisms at the lowest points of the ocean.

Most of the objects of our invention have been reached in the endeavor to create means to approach any levels below the surface of the ocean and, accordingly, some of our particular objects have been to find appropriate means to, first, do away with lifting cables, chains, fluid conducting pipes and tubes, etc., connecting the salvaging apparatus with the mother ship on the surface of the ocean; second, avoid any operative mechanical connections to the surface of the water; third, avoid any unbalanced conditions of pressure; fourth, have the force of the water pressure affect said salvager in compression of solid parts only; fifth, avoid in all parts of the apparatus the enormous strain of direct opposition of atmospheric or similar pressures to the tremendous pressures to be contended with at the depth at which our device is designed to operate; sixth, create buoyancy, at the very point of salvage, to raise the salvaging means as well as the objects to be salvaged to the surface of the water; seventh, have perfect control of the buoyancy of the salvager and of the means serving to engage the objects to be salvaged; eighth, provide self-contained and self-propelled passenger carrying submarines for observation before and during the salvage; ninth, devise a passenger carrying submarine in which the atmospheric pressure on the inside is not affected by the depths, at which operations are carried on.

Some illustrations explaining our invention are given in the accompanying sheets of drawings in which,

Figure 1 shows a bi-sected end view of a substantially symmetrical half of our salvager.

Figure 2 shows in Figure 2A the corresponding side view of a section of our device whereas Figure 2B shows another side view along section line 2B in Figure 1.

Figure 3 shows the top view of part of the caissons and gears in a horizontal section (line 3, 3 in Figure 1).

Figure 4 shows buoys which may be used in connection with the cables connecting our device to the surface of the water.

Figure 5 shows a side view of a substantially bi-sected submarine we use in connection with our device.

Figure 6 shows the same from the front.

Figure 7 shows a top view of the substantially bi-sected stern of the submarine.

Similar numerals refer to similar parts throughout the various views. Talking about the width, height and length of the salvager we refer to the horizontal and vertical directions in the plane and to the direction normal to said plane of Figure 1, respectively.

The salvager comprises a super-structure 10 which extends across substantially the whole width of the device. The two sides of this structure extend downwards and in these extensions are mounted caissons 11 and slidable portions or panels 12.

The caissons have the shape of upright, essentially cylindrical tanks, closed on both ends. The walls of the caissons are heat-resisting and this characteristic is illustrated in the drawings by double walls 13 and 14 between which there is a layer of yielding insulating material 15. The partition 16 in the lower part of the caisson creates a separate chamber 17 from the top of which extends upward, in the caisson, a pipe 18, the free end 19 of which is located in a dome-like extension 20 of the enclosure of the caisson. In the top of the dome 20 there is an open-

ing which is closed by plug or valve 21. There are openings 22 in the enclosure of the caisson, just above the partition 16. The closing means on these openings are shown as doors 23 which may be locked in the closed position shown but which are normally open and swung down, when the salvager is submerged. 24 is a disc of a material lighter than water, slidable in the caisson and on pipe 18, thus forming a partition across the inside of the caisson, floating on top of the water in the caisson whatever the respective level may be.

The frame work in which the caissons are retained is formed by suitable structural members 25, 26 and 27 which extend in the direction of the length, the width, and the height of our device, respectively.

Each one of the frames formed by these structural members holds, in the direction of the width of the salvager, two caissons 11 on each side of our device, whereas they hold only one caisson in the length direction of the salvager, adjoining frames being spaced at suitable distances from each other to accommodate the slidable panels 12.

These panels 12 are substantially trapezoidal, and they carry rollers 28 on their top members 29. The rollers 28 are retained in suitable tracks 30 extending substantially across the width of our device and suitably connected into the frame work formed by the super-structure and the frames around the tanks.

Sides 31 of the trapezoids, facing the outside of the salvager are substantially vertical, whereas the opposite sides 32 are on an incline, so that the base of the trapezoid is wider than its top. The edge 33 of sides 32 is widened into a flange in the direction of the length of the salvager and a helical member 34 extends across the trapezoid, being solidly mounted at its ends in the sides 31 and 32. Meshing at its center into the threads of the helical member 34 worm wheel 35 is rotatively mounted on said member. Brackets 36 extend in the length direction of our device, between the walls of adjoining caissons. They have openings 37 into which fit the worm wheels 35 abutting in the direction of the helical member 34. The helical member passes through openings 38 in said brackets, said helical members being in no manner operatively connected to said brackets.

The thread of worm wheels 35 is engaged by worms 39; these worms are mounted in suitable openings in the brackets 36 and their shafts 40 are rotatively mounted in said brackets and extend upwards, their upper ends being directly coupled to the shafts of motors 41 mounted on suitable members 42 and 43 extending in the lengthwise and crosswise direction, respectively, of the upper structure of the salvager. The motors 41 are surrounded by inverted bells 44 which closely fit the sides and tops of said motors so that the amount of air in the bells, above the bottom of the motors, is reduced to a minimum. The substantially cylindrical shell of the bell extends downward to such a distance that it retains as much air as will be required to keep the level of the water entering upon said bell from the bottom below the bottom of the motor 41 under the highest pressures which may be encountered in the operation of our device.

The current required for the operation of the motors is delivered to them through lines 45 and 46 which connect into the cables 47 leading from the highest point 48 of our device to the surface of the water. Additional electric lines 49 lead from said cables 47 along the structural members 50,—which converge at said point 48 and are suitably tied to a round length member 51,—to the bottoms of the caissons 11. They enter said caissons through suitable bushings 52 and are connected on the inside of the chamber 17 by an electrical resistance 53.

In addition to the lengthwise stability given to our device by the structural members 26, 51 and 54, solid members 55, made of a material lighter than water and suitably shielded by walls 56 are arranged in the super-structure 10 of the salvager for buoyancy as well as balancing.

The structural members 25, below the caissons, have short extensions 57 at the ends facing the inside of our device and part of those members as well as the extensions 57 have gear teeth 58 at their bottoms, giving them the shapes of racks. Into gear teeth 58 mesh the pinions 59, rotatably mounted on the sides of the base 60 of the trapezoidal panels 12. At the bottom the base 60 is shaped to form tracks 61. The scoops or grapples 63 carry at their bifurcated upper ends 64 rollers 62 which fit into, and run in tracks 61. The upper edges of the ends 64 carry teeth 65 which give them the shapes of racks and which mesh into the pinions 59 from the bottom, thus differentially connecting the grapples 63 to the slidable panels 12.

The cable 57 carries at suitable distances inverted bells 66, the strands 67 of the cables extending around said bells, suitably spaced in a circle and held in position by clamps 68.

The wall 69 of the submarine shown in Figures 5, 6 and 7 is of the strength and thickness required to withstand the water pressures encountered at the depth at which our salvager is to be operated. The submarine is divided into a series of compartments, the partition walls 70 of which serve to additionally reinforce the structure. The front compartment 71 is larger than the other ones and is equipped as an observation chamber, accommodating the amount of oxygen required for the sustenance of the observer and the well known means for reconditioning said

air for the period of time required to make the necessary observations with this submarine.

In the heavy outside walls of the closed compartment 71 are observation ports which are closed by suitable transparent material 72 of sufficient thickness to withstand the water pressures to which the submarine is exposed. The other chambers 73 of the submarine contain electric batteries 74 which furnish the current for the operation of the submarine, for the illumination of the observation compartment and for the spot light 75 in said compartment which is suspended in such a manner that its beam of light can be directed to play through any of the observation ports. There are man-holes in the various partitions on the inside of the submarine as well as one leading out from the observation chamber, which are all provided with suitable covers, indicated in the drawings by plugs 76.

At the stern, the boat is bifurcated into ends 77 between which is mounted, on the outside of the boat, rotatable around a vertical shaft 78, the motor 79, with propeller screw 80. The motor comprises the rotor 81, the stator 82 and at its front end electro-magnet 84 is mounted on its outside, ahead of the end of shaft 83. At the point, where said electro-magnet 84 faces the outside of the submarine, the wall 85 is concave, concentric to the shafts 78 and on that concave outside of the boat are mounted the electro-magnets 86, adapted to inductively engage the electro-magnet 84 on the motor.

There are recesses 87 in the wall of the submarine on the sides at the stern, which are also concave and on which, in the manner of electro-magnets 86, there are mounted the electro-magnets 88 which inductively engage the magnets 89 on the rudders 90, rotative around horizontal studs 91 on the sides of the submarine. The rudder being intended for operation of the submarine upward and downward, its wing 92 extends in an essentially horizontal plane when the rudder is in the normal position.

Below the boat there are a series of levers 93, the catches 94 on which hold the weights 95 onto the bottom and sides of the boat, electromagnets 96 on the wall of the boat serving to inductively engage the pole pieces mounted on the free ends of the levers 93, releasing the grip of the catches on the weights 95, when said electro-magnets are de-energized.

The batteries 74 are indicated as the ordinary type of storage batteries. One pole is shown grounded for simplicity's sake, the other one is connected through suitable bushings 97 in the various partitions 70 into the observation chamber to a switchboard 98, which is schematically indicated showing separate switches connected to the spot light, the various electro-magnets retaining the weights 95 on the outside of the wall of the boat, the polarized segments of the electro-magnets on the recess on the sides and concave back of the boat, and connected by flexible conduits to the electro-magnets 89 on the vertical rudders, to the electro-magnets 84 which serve to change the direction in which the axis of the propeller is disposed, and to the motor itself. Wherever the electric lines are carried through the wall of the boat, special care is taken, not to weaken the strength of the wall at these points; the bushings used at these points may be disposed at an angle as indicated in bushing 99, the longer hole through the solid wall of the boat affording a guarantee against weakness. A telephone 100 connects, through another bushing 97, from the observation chamber to the outside of the submarine from where that line is connected by a cable, suitably buoyed by bells of the type shown in Figure 4 to the mother ship on the surface of the water. The line connecting telephone 100 to the mother ship on the surface of the water may be dispensed with if radio communication is used.

One of the foremost objects of our invention is to reduce the strength of all structural and operative parts to that normally required under atmospheric pressure and in some parts the structural strength may be even less than that which would be required above water because the submersion of the device substantially reduces the gravitational stresses. At some points in the construction it is rather difficult to avoid the exposure of parts to bending or crushing forces due to the tremendous pressures under which the salvager has to work. So for instance, the casing of the caissons, consisting of an outer wall 13, an inner wall 14 and the yielding insulating material 15 in between will be exposed to the great pressure of several hundred atmospheres on its outside and to a pressure slightly greater on its inside. Hence that casing will be crushed, in itself, unless suitable means are provided to offset the differences of pressures between the outside and inside of the casing on one side, and the pressure between the two walls 13 and 14 on the other side. Fortunately it is however not necessary to make the outer wall 13 completely solid but it may have suitable perforations which allow the water to enter upon the spaces between the walls, mix with the insulating material, the casing preserving its insulating quality since the water in itself is a fairly good heat insulator and since the insulating material in the wall prevents currents in the water in the casing which may be set up by the difference in the heat of the water near the inner and near the outer wall of the caisson. Additionally the stresses set up in the casing by heat and pressures are taken up by the yielding of the outer wall due to its corrugations on the side and its spherical shape on

the end. These corrugations may of course be placed into the inner wall 14 just as well as they are shown in the drawings in the outer wall 13; or they may be omitted altogether if the one or the other of the walls is perforated as described above.

The salvaging proceeds as follows:

When leaving the harbor, the doors 23 on the caissons are closed, the air in said caissons buoying the whole apparatus so as to keep it afloat. The submarine, in itself, is balanced in such a way that it will float, the port in wall 69, in the front compartment 71, being above the level of the water. But when the weights 95 are attached to the submarine it is very heavy and will of course not float by itself. If those weights are to be attached to the submarine, while in the harbor, it may be suitably attached to or held by the salvager, which has a tremendous buoyancy when the caissons are free of water.

The salvager and submarine are then towed by the mother ship and other necessary auxiliary vessels to the position at which the salvaging is to take place. Then the submarine is released, after its various openings have been closed by plugs 76. Due to its weight the submarine carries the observer in the front compartment to the bottom of the ocean, the observer being able to expedite the lowering of the submarine, which is impeded by increasing pressures and the increasing buoyancy at greater depth, by means of the motor driven screw 80, the boat diving down, bow first. The weight on the submarine being chosen so as to make the gravity of the submarine equal to the weight of the corresponding volume of water at the predetermined depth of intended operations, the observer will have to depend almost completely on the action of the screw in taking him down to the very bottom of the ocean where he can cruise about in search of the object or wreck to be salvaged, the rudder and the adjustability of the axis of the motor in respect to the length axis of the boat being controlled by him by energizing the electro-magnets on the rudder and on the motor and those electro-magnets on the recesses on the sides and on the concave back of the boat, which will bring the motor and rudder into the desired position. Full dirigibility of the submarine in all directions is thereby procured. After the observer has determined the exact location of the object or wreck to be salvaged, he may return to the mother ship or he may give the necessary intelligence to the mother ship by telephone or radio, so that the exact location at which the salvager is to be lowered is determined and the salvager may be towed to a position above said point.

The preparations for the lowering of the salvager and its lowering proceed as follows:

The fluid or materials to be subsequently used for the buoying of our salvager are introduced into the chambers 17 of the caissons through the valves 21 on domes 20. The doors 23 on openings 22 on the bottoms of the caissons are opened and fixed in the open position, those doors remaining open throughout the salvaging operation proper. The water will enter the caissons through said openings and the air in the caissons will be replaced by it, escaping through the valves 21, which are closed when the desired amount of water is in the caissons. The air is not driven out of the caissons completely but a suitable amount is retained, sufficient to prevent the water from rising subsequently, under increased pressure, so high as to enter upon the chamber 17 by rising over the free end 19 of pipe 18. The salvager will thereupon sink to the bottom of the ocean over the position of the object or wreck to be salvaged, the only means preserving a connection between the salvager and the mother ship being the cables 47, connecting to point 48 on the salvager, which are rolled off suitable winches on the mother ship as the salvager sinks down, bells 66 being fastened to the cable at suitable distances, offsetting the weight proper of the stretches of cable between the bells.

Reaching the bottom of the ocean the salvager settles over the object or wreck to be salvaged, the sides of the salvager extending on both sides of said object or wreck in the length direction, the pointed lower ends of grapplers 63 penetrating and sinking into the mud or soil around said object or wreck. Thereupon the panels 12 and grapplers 63 are brought to close upon the sides and below said object or wreck, respectively, by the operation of motors 41. This operation of engaging the said object or wreck proceeds as follows:

Since there are a series of units of engaging means, arranged on each side of the salvager, each one of said units comprising a motor, a panel, grapplers, and operative connections between these parts, each one of these units may be operated independently and separately, if the electric wiring connecting the motors to the mother ship provide separate wires for the control of each motor. In the practical application it will be sufficient to connect a number of such units in series or parallel; at any rate sets of said units, facing each other on the two sides of the salvager, may have a common control.

The motors are seated in the bottoms of the inverted bells 44, the sides of said bells, skirting the shaft extending from said motors downward to such a distance that the water which of course has entered upon said bells from the bottom under the increase of pressure during the descent of the salvager, has compressed the air therein and the sur-

face of the water has risen in said bell and come close to the motors proper. The length of the skirting sides of the bells, and the amount of air in the motors themselves govern the distance to which the water rises in the bells and by proper proportioning the motor may be kept dry at all times. This serves to protect the motor from deterioration by salt water but the protection by the bells is not an absolute requirement since there are many types of motors today which safely operate under water. (Commutator-type-motors are of course not advisable for such operation since the conductivity of the salt water would prevent proper functioning; but motors in which all conductors are completely insulated, polyphase induction motors for instance, will not require the protection of the bell and the inventors had that kind of motors in mind for the driving means 79 on the submarine.) The control wires of the motors permit their operation in both directions.

The worms 39 on the shafts 40 extending downward from the motors mesh into the worm wheels 35 and cause said worm wheels to rotate, the end-thrust of said worm wheels being taken up by the sides of openings 37 in the brackets 36 extending between the adjoining caissons. Rotation of the worm wheels causes the non-rotative helical members to move in the direction of their axis, the threads of said helical members being engaged by the threaded holes of said worm wheels. The helical members form solid parts of the sliding panels, the panels running along tracks 30 in the super-structure, while participating in the transverse movement of the helical members. If the sets of units facing each other on opposite sides of the salvager have a combined electrical control, the rotation of the motors or the disposition of the threads of the worms and worm wheels and of the threads of the helical members and the holes in the worm wheels will be such that units facing each other will simultaneously move either towards each other or away from each other, according to the rotation given to the motors by the respective control. The grapplers depending from the panels being differentially geared to the panels in such a way that they move at twice the speed of the panels in the direction of movement of said panels, they will join said panels in the engagement of the object or wreck to be salvaged, when the respective units move towards each other. The object or wreck to be salvaged having a changing width along the direction of the length of the salvager, different ones of said units, arranged along the length of the salvager, on both sides, will move towards each other, more or less, until they come into firm engagement with said object or wreck. The joints on the grapplers may of course not directly engage said object or wreck but may proceed to such a distance below said object or wreck as to hold it firmly below its bottom. The movement of the units being stopped by the engagement with the wreck, the electro-motive power furnished from the mother ship may be interrupted by automatic circuit breaking devices when that stop occurs; or such breaking of the circuit may be brought about manually when the curves of the current consumption of the respective motors indicate that the units have effectively engaged the said object or wreck. If the engagement is not satisfactory, reversal of all the motors or of motors on specific sets of units may be used to bring about disengagement, and the engaging operation may be successively repeated until the desired results are obtained.

Arrangement of the panels and grapplers, as well as the arrangement of the means which serve to operate them, is illustrated in an exemplary manner and we may arrange these parts differently. The operative connection between the grapplers and the panels does not have to be limited to the positive gearing shown, but the movement of said grapplers may be independently of the movement of said panels, motors being arranged on said panels, which are operatively connected to said grapplers in the same manner in which the motors on the super-structure serve to bring about the movement of the panels, the motors operating said grapplers being independently supplied with electric power from the mother ship. The operative connections between the motors and the panels or grapplers do not have to be confined to worm wheel and screw drives but any kind of gearing may be used in their place; or gearing on the motors may directly engage the panels or grapplers and thus bring about their movement. The transverse direction of travel of the units is also an arbitrary arrangement, chosen for the illustration of our device and may of course readily be replaced by movement of the respective parts in angular directions which may be more suited for the proper engagement of the object or wreck to be salvaged; or said movement may take place in a circular direction, the units representing lever arrangements fulcrumed onto the super-structure and engaging the object or wreck to be salvaged in the manner of prongs, or, if double jointed, in the manner in which the hand grasps an object. It is of course not necessary that panels and grapplers operate independently but they may be executed in single engaging means operated from the super-structure or from the sides extending downwards from said super-structure. The flanges 33 on the panels and the sides of the grapplers engaging the object or wreck to be salvaged may of course be of such width as to form almost

continuous walls in the length direction of the salvager, so that said object or wreck, however deteriorated, will not drop from the salvager through the spaces between the units later on. The arrangement of the caissons between said units is also entirely arbitrary; the caissons may readily be arranged in the super-structure, the space below the super-structure being reserved exclusively for the means which serve to engage the object or wreck to be salvaged.

The engagement of the object or wreck to be salvaged having been brought about, the caissons are buoyed to float the salvager together with said object or wreck and to bring them to the surface of the water. This operation proceeds as follows:

As mentioned above, suitable fluids or materials are introduced into the chamber 17, before the salvager is dropped to the bottom of the ocean. Fresh water may serve as such a fluid and by sending electric current from the mother ship to the resistance 53 arranged in said chambers, the fresh water in the chambers is heated up to the boiling point, and evaporates. The steam thus driven off by the water rises through the pipe 18 and, having a pressure slightly greater than the pressure of the water at the point of salvage, it will displace the salt water in the caisson, the level of said salt water in the caisson, with disc 24 floating on the top, being lowered as the steam, filling the caisson from the top, displaces the salt water. The disc 24 prevents contact between the steam and the salt water so that said steam is not readily dissolved. As soon as the steam has displaced the salt water in the caisson to such a degree that the specific gravity of the whole salvager together with the object or wreck to be salvaged is smaller than that of the water displaced by it, the salvager begins to rise and the current in the resistance elements 53 is decreased or shut-off according to the speed at which the salvager is to rise, the buoyancy of the steam in the caissons gradually decreasing as that steam cools off and condenses and allows some salt water to reenter the caissons.

The pressure of the water at the point of salvage being high,—it would be for instance 300 atmospheres at a depth of 3000 meters below the surface of the water, the fresh water in the chamber 17 must be heated to several hundred degress, before it forms steam under such pressures. A considerable amount of heat must therefore be introduced. This amount of heat may be reduced by substituting the fresh water by fluids of a greater vapor tension than water, but, of course, for this purpose, must be chosen fluids the vapors of which will not dissolve too readily in water, when they come into contact with it around the disc 24. But we do not limit the scope of our invention to vapors driven off liquid, but a variety of other methods for creating gaseous fluids and for displacing the salt water in the caissons by said gaseous fluids suggest itself.

Thus we may do without the electric resistance 53, the connections to said resistance being given the shape of electrodes, and the liquid in the chamber being electrically conductive and lending itself readily to electrolytic dissociation. If the liquid in the chamber is, for instance, salt water or acidulated water, electrolysis will create gases, hydrogen and oxygen, which readily serve to displace the salt water in the caisson.

It is however not necessary that we use the electricity directly for the production of the gaseous fluids, but we may restrict the use of electricity to setting off in the chamber chemical reactions, possibly explosions, which will create gases to such an extent as to supply a sufficient amount of gaseous fluids to bring about the necessary buoyancy of the salvager. As a simple example for this method we suggest sodium or potassium, submerged in suitable capsules under water. By electric means the capsules are partly or wholly destroyed, and the waters thus coming into contact with these metals will be decomposed, the resulting effervescence furnishing the gaseous fluids required to bring about buoyancy of the salvager.

It is of course not necessary that the chambers 17 form part of the caissons, but they may be arranged entirely separate, as long as the gaseous fluids created in the chambers are introduced into the caissons in which they displace the salt water contents, from the top downward. The creation of gases for buoyancy by electrolytic or chemical reactions may have economical advantages but control of the buoyancy caused by such gases is of course not accomplished so readily as control of the buoyancy created by vapors driven off liquids in the chambers 17 by heat.

Said vapors will naturally condense and unless by means of the electrically heated resistance 53 more vapors are furnished, the buoyancy of the salvager will decrease as the vapors condense. Convenient control of the buoyancy of the salvager is thus offered at all times.

When the salvager has reached the surface of the water, the doors 23 on the caissons are closed and the valves 21 are opened to admit air in place of the steam which gradually condenses. The caissons being arranged on the sides of the object or wreck to be salvaged, said object or wreck will be lifted to practically the surface of the water so that it may be readily inspected, taken apart or abandoned, right at the point of salvage as the circumstances may require. If the caissons are arranged in the super-structure, the work on the object or wreck to be salvaged will have

to be performed at a short distance below the water, if this is to take place at the point of salvage, or the salvager together with the object or wreck salvaged may be towed into the harbor where the salvaging work may be more conveniently finished.

The return of the submarine to the surface of the water after it has performed its work at the bottom of the ocean in connection with the salvaging operation, is brought about by release of one or more of the weights 95 retained at the bottom of the submarine by catches 94. To release the catches, the observer de-energizes the magnets 96. The operation of the submarine on the bottom of the ocean does not have to be limited to observation, but it may be used there to push the salvager into the correct position above the object or wreck to be salvaged, after the salvager has reached the vicinity of the said object or wreck. There may also be brought about suitable electrical connections between the submarine and the salvager, by means of which the motors on the panels and grapplers, and the electric units in the chambers 17 may be controlled by the observer in the submarine. We may even incorporate parts of the submarine in the salvager; thus the front compartment 71 of the submarine may be attached to the salvager at a convenient point, to offer means for shifting the salvager into the position above the object or wreck to be salvaged. (But in that case the observation compartment will not be permanently attached to the salvager, but it will be connected to it by catches electromagnetically controlled from the inside of said compartment permitting the observer to detach his observation compartment from the salvager, in case of emergency.) The salvager being lowered in the immediate vicinity of the object or wreck to be salvaged the limited shifting required for the proper positioning of the salvager may also be effected from the surface of the water, if the cables connecting the salvager to the mother ship are suitably re-inforced so that they withstand the strain of pulling the salvager from the surface of the water into the proper location.

If the caissons are built into the superstructure the buoying members 55 may be suitably rearranged, said buoying members being indicated in the drawings in merely illustrative manner, and they may be abandoned altogether if the super-structure is made of so small a weight that such buoying becomes unnecessary.

The control of the motor and the rudders on the submarine, being brought about in the above description by electromagnetic means, may be effected by smaller motors, outside of the submarine suitably geared to rotate the rudders and the propelling motor around the points at which they are pivoted to the wall of the submarine.

We claim:

1. In combination with a submerged caisson, submerged means for evaporating a fluid and applying the pressure of the gasified fluid to the interior of the said caisson, to effect an evacuation therefrom.

2. In combination with a submerged caisson, non-gaseous substances and submerged means to evaporate and thereby to convert said substances into gaseous fluids and to apply the pressure of said fluids to the interior of said caisson, to effect an evacuation therefrom.

3. In combination with a submerged caisson, non-gaseous substances, and submerged means to evaporate and thereby to convert said substances into gaseous fluids by the application of heat thereto and to apply the pressure of said fluids to the interior of said caisson, to effect an evacuation therefrom.

4. In combination with a submerged caisson, non-gaseous substances, and submerged means to evaporate and thereby to convert said substances into gaseous fluids by applying electrically generated heat thereto and to apply the pressure of said fluids to the interior of said caisson, to effect an evacuation therefrom.

5. A submersible caisson comprising a casing, openings near the bottom of said casing, means for closing said openings, an evaporating chamber, an electric heating element in said chamber, and an outlet near the top of said chamber, discharging into the space confined by said casing near the top thereof.

6. In a submarine salvager the combination of a super-structure, a series of oppositely positioned panels depending therefrom and transversely movable thereon, grappling means depending from said panels and travelling thereon, and means to effect the transverse movement of said panels and said grappling means.

7. In a submarine salvager, the combination of a super-structure, caissons carried by said super-structure, means connected to said caissons for creating and applying fluid pressure to the interior of said caisson to effect an evacuation therefrom, a series of panels movably mounted on said super-structure, grappling means movably mounted on and arranged to cooperate with said panels, and means to effect the engagement of said panels and said grappling means with the object to be salvaged.

8. In a submarine salvager, the combination of a super-structure, a series of panels movably mounted on said super-structure, grappling means arranged to cooperate with said panels, electric motors with shafts extending downward, effecting the engagement of said panels and said grappling means with the object to be salvaged, and inverted bells,

closely fitting the tops and the sides of said motors, the sides of said bells skirting said shafts of said motors downwards, so that the level of the water, entering said bells under pressure from their bottoms when the salvager is submerged, does not reach said motors.

9. A pontoon having a port through which it may be filled with, or emptied of water, and having an interiorly located means for the generation of steam to effect the expulsion of water from the pontoon through said port.

Signed at #3007 Broadway in the county of Queens and State of New York this 20th day of Oct. A. D. 1928.

JULIUS REICHERT.
AUGUST REICHERT.