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E. KULIK

1,854,906

DIVING APPARATUS

Filed Oct. 23, 1930

3 Sheets-Sheet 1

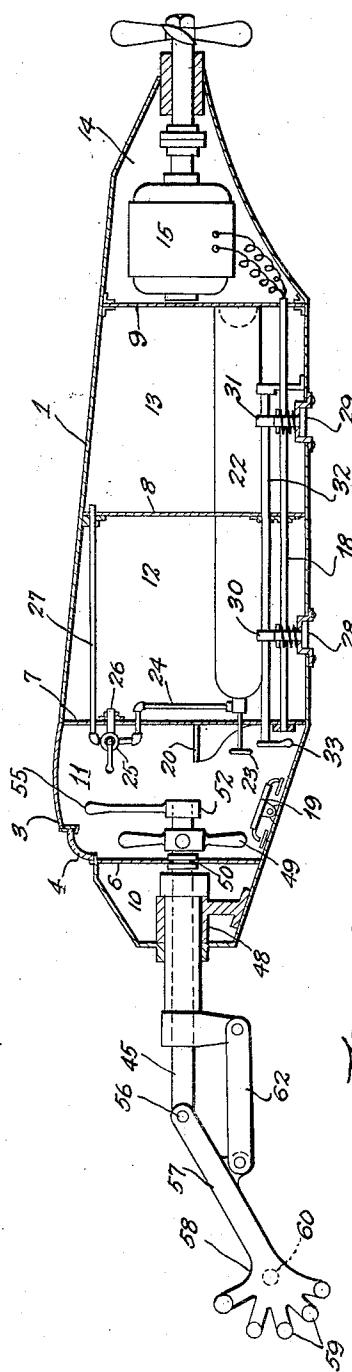
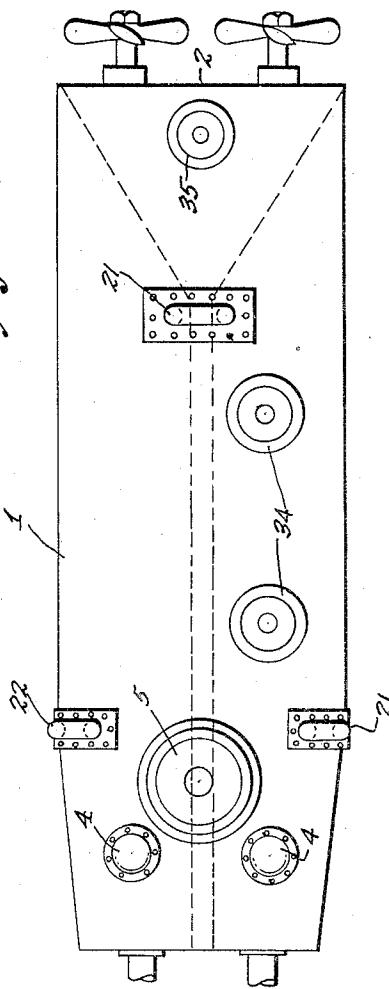


Fig. 1

Fig. 2



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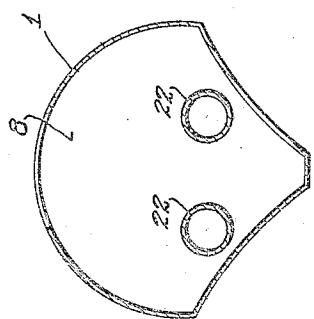
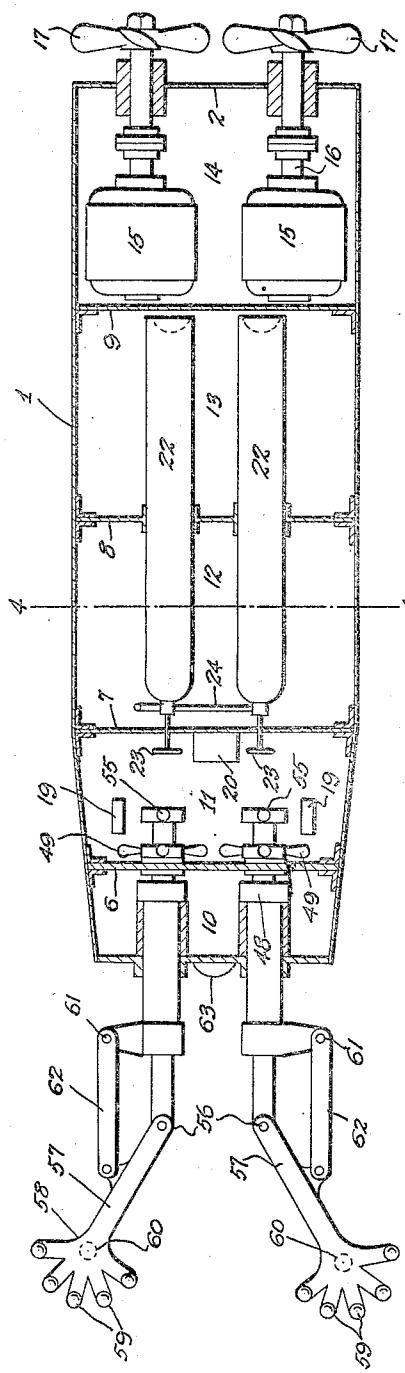
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3 Sheets-Sheet 2



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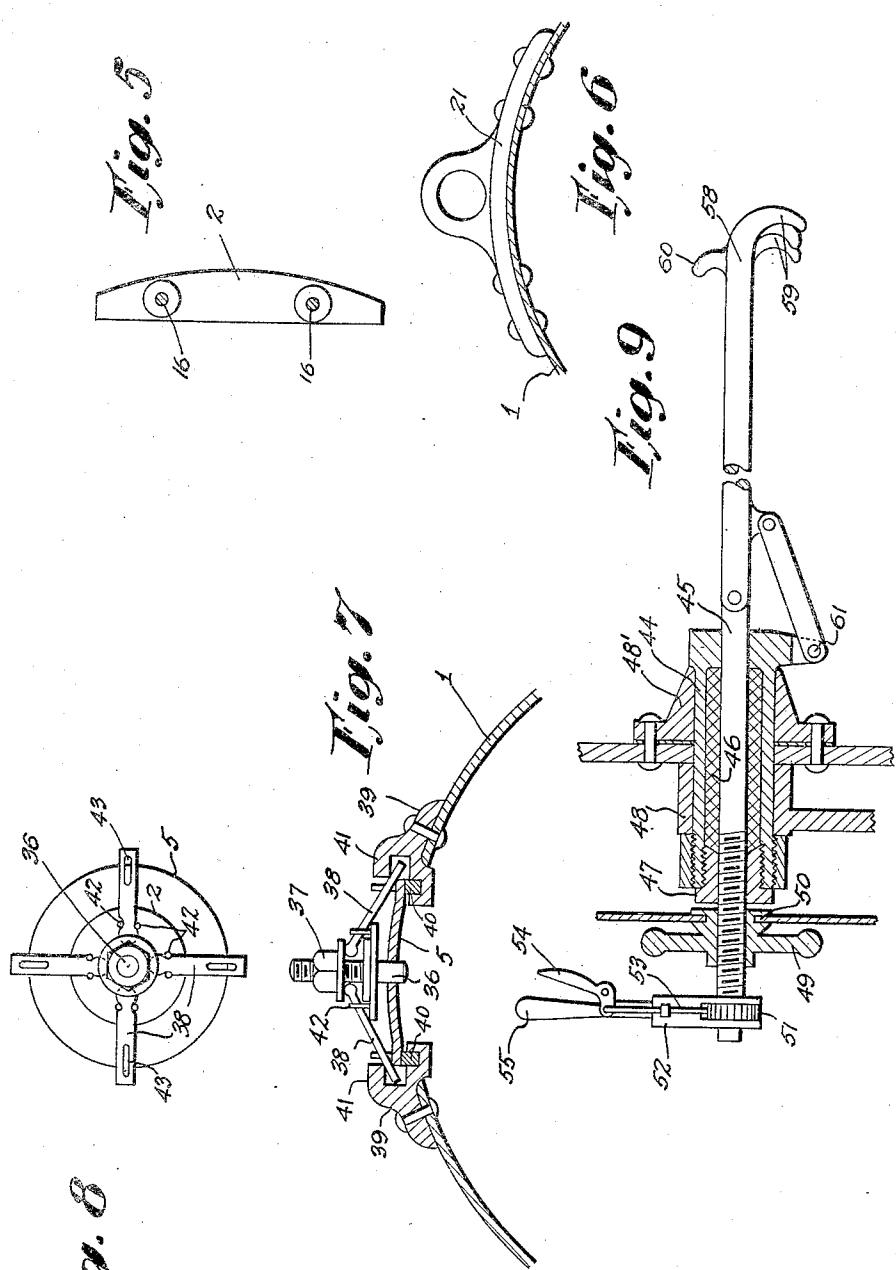
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DIVING APPARATUS

Filed Oct. 23, 1930

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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DIVING APPARATUS

Application filed October 23, 1930. Serial No. 490,601.

This invention relates to diving apparatus and is directed more particularly to improvements in devices analogous to diving bells. The invention is especially directed to an apparatus which may be lowered overboard from a salvage ship and while attached thereto by cables, chains or the like may be submerged to relatively great depths. The apparatus is such that the interior thereof is provided with a plurality of compartments through the provision of appropriate bulkheads and in these several compartments are positioned devices for controlling the buoyancy of the device's propelling mechanism whereby it may be self propelled and apparatus whereby one or more persons safely housed within the apparatus may direct its operations of undersea salvaging. It is well recognized that divers clothed in even the most modern diving suits cannot descend to any appreciable depth, whereas the device of this invention is so constructed that it can be readily made to withstand pressures at almost any depth.

An important practical feature of the present invention consists in mechanism operable from within the operator's compartment and extending to the exterior of the hull of the apparatus for efficiently carrying on salvaging operations. This means may be graphically referred to as a pair of mechanical hands supported on appropriate arms and so constructed that the operator within his compartment can move the hands and arms in all directions and can manually so coordinate their operations as to accomplish through such mechanical hands everything that can be accomplished by a diver but with even greater power and more efficiency. The said mechanical hand arrangement forms an important part of this invention and the detailed construction and operation thereof will be hereinafter more fully explained.

Another important feature of the invention

resides in the association with the hull of one or more propellers whereby the apparatus may be moved about at the will of the operator housed therein. The source of power for the propelling means may be furnished through a cable, associated with the hoisting cables or chains, from the salvage vessel or tender on the surface.

A further feature of the invention resides in what may be termed a flotation chamber comprising one of the compartments of the hull and suitably valved. Within this chamber are appropriate tanks of compressed air. When the chamber is vented a fluid valve may be opened, to flood the chamber and bring about submersion of the hull. When it is desired to come to the surface, the compressed air may be released into the chamber to expel the air therefrom, render the hull buoyant and thus cause it to raise to the surface. The flotation chamber is preferably partitioned to provide a plurality of chambers so that the hull may be "trimmed" to maintain the apparatus on an even keel.

Appropriate searchlights to facilitate operations at great depths and at night are provided as will be hereinafter more fully explained.

Features of the invention, other than those adverted to, will be apparent from the hereinafter detailed description and claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate one practical embodiment of the invention, but the construction therein shown is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a vertical longitudinal section through apparatus embodying this invention.

Figure 2 is a plan view of the apparatus.

Figure 3 is a horizontal section taken approximately on the line 3-3 of Figure 1.

Figure 4 is a section on the line 4-4 of Fig. 1.

Figure 5 is a view of the stern of the craft.

Figure 6 is an elevation of one of the brackets to which the lifting cables are attached.

Figure 7 is a section on the line 7—7 of Figure 2.

Figure 8 is a plan view of the hatch shown in Fig. 7.

Figure 9 is an enlarged detail section of one of the mechanical hands and the means for operating the same.

Referring to the drawings, 1 designates the hull of the apparatus. This hull is preferably of the shape shown in the drawings. The upper portion thereof is preferably rounded over as illustrated in Fig. 4, while the under portion thereof is substantially V shaped to produce the effect of a keel. The after under portion of the hull slopes upwardly to a transom-like stern 2 indicated in Fig. 5. The forward portion of the upper deck is shaped similar to a turret as indicated at 3 and in the forward portion of this turret are strong transparent ports 4 to permit of vision therethrough. In the top of the turret 3 is a hatch 5 which is shown in detail in Figs. 7 and 8 and which will hereinafter be more fully described. The interior of the hull is divided by partitions 6, 7, 8 and 9 into a plurality of compartments 10, 11, 12, 13 and 14. The compartment 11 may be termed the operator's room for it is herein that the operator is housed. The transparent portholes 4 are in the forward wall of this room. In the stern compartment 14 are positioned two electric motors 15 arranged respectively on starboard and port side of the medial line of the hull. These two motors are fitted with propeller shafts 16 which extend through suitable bearings and through stuffing boxes to the exterior of the hull where they are provided with twin screw propellers 17. The motors 15 are of the reversible type and the control wires thereof are fed through water-tight conduits 18 extending through the partitions 7, 8 and 9. These control wires lead to port and starboard switches 19 which are preferably mounted on the floor of the control room and are adapted to be foot controlled, so that an operator seated upon a seat 20 can place his two feet upon these two switches and by appropriately rocking them on transverse axes can tilt them front or back to control both motors selectively. The wiring is such that when a switch is tilted forwardly the associated motor will operate in one direction and when it is tilted rearwardly said motor will operate in the opposite direction. In this way, the operator may control the motors selectively and thus bring about movement of the device while submerged.

Current is fed to the switches 19 from a ship or tender on the surface through an appropriate cable which may be associated with hoisting cables or chains adapted to be at-

tached to brackets 21, one of which is shown in detail in Fig. 6.

Positioned within the two central compartments 12 and 13 are a plurality of compressed air tanks 22 having sufficient capacity to furnish compressed air to the chambers 12 and 13 in sufficient quantities and at the necessary pressure to force water from these chambers at any workable depth of submergence. These tanks are provided with appropriate control valves 23 and are connected by a pipe 24 to a three-way valve 25 positioned in the control room.

From this three-way valve extends two branch pipes 26 and 27, one of which leads into the compartment 12 and the other into the compartment 13, so that by manipulation of the valve 25, pressure may be entirely set off from the pipes 26 and 27 or may be directed into either one or both of them as desired. Positioned at or near the bases of the compartments 12 and 13 are valves 28 and 29, which are normally spring pressed into closed positions and are of the flat lift type. The stems of these valves extend upwardly and into cooperative relation with cams 30 and 31 on a cam shaft 32 which projects forwardly through the partition 7 into the control room, and is provided with an appropriate handle 33. By the manipulation of the handle 33, the valves may be opened or closed selectively as well as collectively. When the craft is at the surface and it is desired to submerge both valves 28 and 29 are opened by rocking the cam shaft 32 into an appropriate position so that the compartments 12 and 13 are flooded and the craft caused to sink. When it is desired to subsequently rise to the surface, compressed air is admitted through the three-way valve 25 into these two compartments to force out the water and render the craft buoyant. More or less water may be admitted and utilized as ballast in the proper control of the valves 25, 28 and 29 and the craft may be trimmed to maintain it on an even keel in the same way. I do not consider it necessary to describe these operations in great detail as they will be clear to anyone familiar with diving and salvaging operations.

It may be noted that the compartments 12 and 13 are provided with manholes 34 through which access may be had when the craft is on the surface for the purpose of repair or adjustment. They are normally sealed and water and air tight. The compartment 14 has a similar manhole 35 for access to the motors.

The hatch 5 to which I have referred as associated with the control room 11 is shown in detail in Fig. 8 and is provided at its center with a threaded post 36 having thereon an adjusting nut 37 to which are attached a plurality of links 38. The opening in the hull has a fitting 39 which carries a gasket 40

on which the hatch seats and this fitting also has an undercut flange 41 to be engaged by the links 38. Pins 42 on the nut 37 secure the links thereto and each link has its pin 5 and slot connection 43 with the hatch. When the nut is screwed upwardly on the post, the links are drawn inwardly and out of radial relation, so as to permit the hatch to be seated on the gasket. By then screwing down on 10 the nut, the links are moved into radial relation and forced downwardly with a fulcrumming operation which binds the hatch firmly to the gasket in a leak-proof joint.

One of the most important features of the 15 present invention consists in associating with the hull, means which has been referred to as mechanical hands. The structure is clearly shown in Figures 1, 3 and 9. By reference to these figures, it will be noted that there 20 is mounted at the very front of the hull, two stuffing boxes 44 and through each stuffing box extends a rod 45. Each stuffing box is provided with a suitable packing 46 and a packing nut 47, and this arrangement provides for a water-tight joint about each rod 25 45, while allowing for sliding movement of the rod within the gland. The inboard end of each gland may be suitably braced by a bracket 48 which forms a bearing therewith, 30 and an additional bearing 48' is also formed on the front wall of the hull. Each rod 45 extends through the partition 6 into the control room 11 and mounted on the partition 6 is a hand wheel 49, which is secured against 35 longitudinal movement in the partition in the manner indicated in Figure 9. This hand wheel, however, has a threaded connection with the rod 45, so that through operation of the hand wheel the rod may be curved longitudinally with considerable force. The inner end of the rod is provided with a toothed wheel 51 which is fixed to the rod and a yoke 52 straddles the toothed wheel and is freely 40 rotatable on the rod. A locking catch 53 is 45 associated with the yoke and has a hand operated member 54 mounted on the handle 55 of the yoke. When the locking member 53 engages the toothed wheel, the handle 55 may be manipulated to rotate the rod 45, 50 whereas rotation of the wheel 49 will impart longitudinal movement to the rod. The rod is provided at its outer end with a pivot 56 by which it is secured to an arm 57, which carries at its free end a metallic member closely 55 simulating the human hand. This metallic member designated generally by the reference character 58 has a plurality of fingers 59 bent so that the entire construction very closely simulates a human hand in the act of 60 clutching something. The ends of the fingers are hooked and the same is true of the thumb. The structure very closely resembles the human hand with the exception that at the back of the structure, it is provided with 65 a hook spur 60 which is bent upwardly and

backwardly as shown. The link 57 and the rod 45 collectively constitute what might be termed a toggle pivoted at its elbow as indicated at 56.

The front end of the gland or stuffing box 70 is provided with a bracket 61 and a link 62 is pivoted at one end to this bracket and at its other end to the arm 57. From this arrangement, it will be noted that, when the hand wheel 49 is operated to slide the rod 45 longitudinally, the arm 57 will be bent at the elbow of the toggle to move the hand across 75 axially, while rotary movement of the rod 45 will swing the hand through the arc of a circle. 80

Thus as the operator within the control room manipulates the two hand wheels and the handles 55, the hands and arms may be moved in any direction to bring the hook fingers 59 or the spur 60 into engagement 85 with submerged articles and by the simultaneous control of the foot switches 19, the craft may be moved back and forth to cause the hands to be placed in proximity to the article to be grasped and to move the article 90 while in the grasp of the hands. A strong source of illumination indicated at 61 will furnish ample light so that the operator may see what he is doing while he is manipulating 95 the hands from the interior of the control room. I attach particular importance to the use of mechanical hands as stated. They enable work to be mechanically accomplished at great depths and in a manner which has never been heretofore possible and at the same time the operator will be safely housed within the control room. 100

Oxygen or air may be supplied to the control room by tubes from the tender or salvage ship, or oxygen tanks may be provided 105 in the control room for this purpose. If oxygen tanks are used, suitable apparatus for exhausting or disposing of spent air within the control room may be provided.

It will be apparent from the foregoing detailed description that the invention embodies numerous features of novelty which render the present invention a marked advance over prior devices utilized for salvaging purposes. The structure may be built to operate at great depths and the arrangement is such that the operator may work under comfortable conditions at all times. The manual control of all working parts enables it to satisfactorily perform its functions in a thoroughly efficient manner while telephonic connections may be had through suitable cables with the tender or salvage ship at the surface. 110

The apparatus is relatively simple in structural details, and the arrangement of the parts is such that they are not apt to get out of order or become disabled. 115

The drawings show the invention in its preferred, practical form, but the invention 120

is to be understood as fully commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

5 1. A salvaging apparatus comprising a closed hull having therein a compartment, in combination with a pair of mechanical devices extending from the control compartment through the front of the hull, each of said arms comprising a rod rotatably and longitudinally slidably, an arm pivoted to the outer end of said rod and having at its free end a claw, a bearing in which said rod 10 is adapted to slide, said bearing being rotatable with the rod, a link connection between the bearing and the arm, and means within the control compartment for longitudinally sliding the rod and for rotating the same, 15 whereby said mechanical devices may be manually manipulated from within the control compartment to cause the claws thereof to grip and hold an extraneous object.

2. A salvaging apparatus comprising a 25 closed hull provided therein with an operating compartment, and a pair of mechanical hands extending in spaced apart relation from the compartment, outwardly through the hull and manually operable from within the control compartment to be moved in all 30 directions and into and out of cooperative relation with one another, each of said mechanical arms embodying a toggle, one link of which extends into the control compartment to be manually rotated and longitudinally moved, the free end of the other link 35 being provided with a rigid metallic claw, and a tie member, one end of which is pivoted to the latter arm in spaced relation to the elbow of the toggle and pivotally secured 40 at its other end against longitudinal movement.

3. A salvaging apparatus comprising a 45 closed hull provided therein with an operating compartment, and a pair of spaced apart mechanical hands extending from the compartment outwardly through the hull and manually operable from within the control compartment to be moved in all directions 50 and into and out of cooperative relation with one another, each of said mechanical arms embodying a bearing extending through the front end of the hull, a toggle, one link of which extends through the bearing into the 55 interior of the control compartment, said link being provided within the control compartment with means for rotating and axially shifting said link, and the free end of the other link being provided with a claw-like 60 metallic hand, and a tie member pivotally connecting the bearing with the latter link intermediate the ends of said link.

4. A salvaging apparatus comprising a 65 closed hull provided interiorly with a control compartment, a pair of mechanical arms

extending from the control compartment to beyond the exterior of the hull and each of which is provided at its outer end with a rigid claw like grapple comprising a plurality of relatively rigid claws facing in a rearward direction said grapples being mounted for universal movement and means within the control compartment for universally and selectively moving the arms.

70 75 In testimony whereof I have signed the foregoing specification.

EMIL KULIK.

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