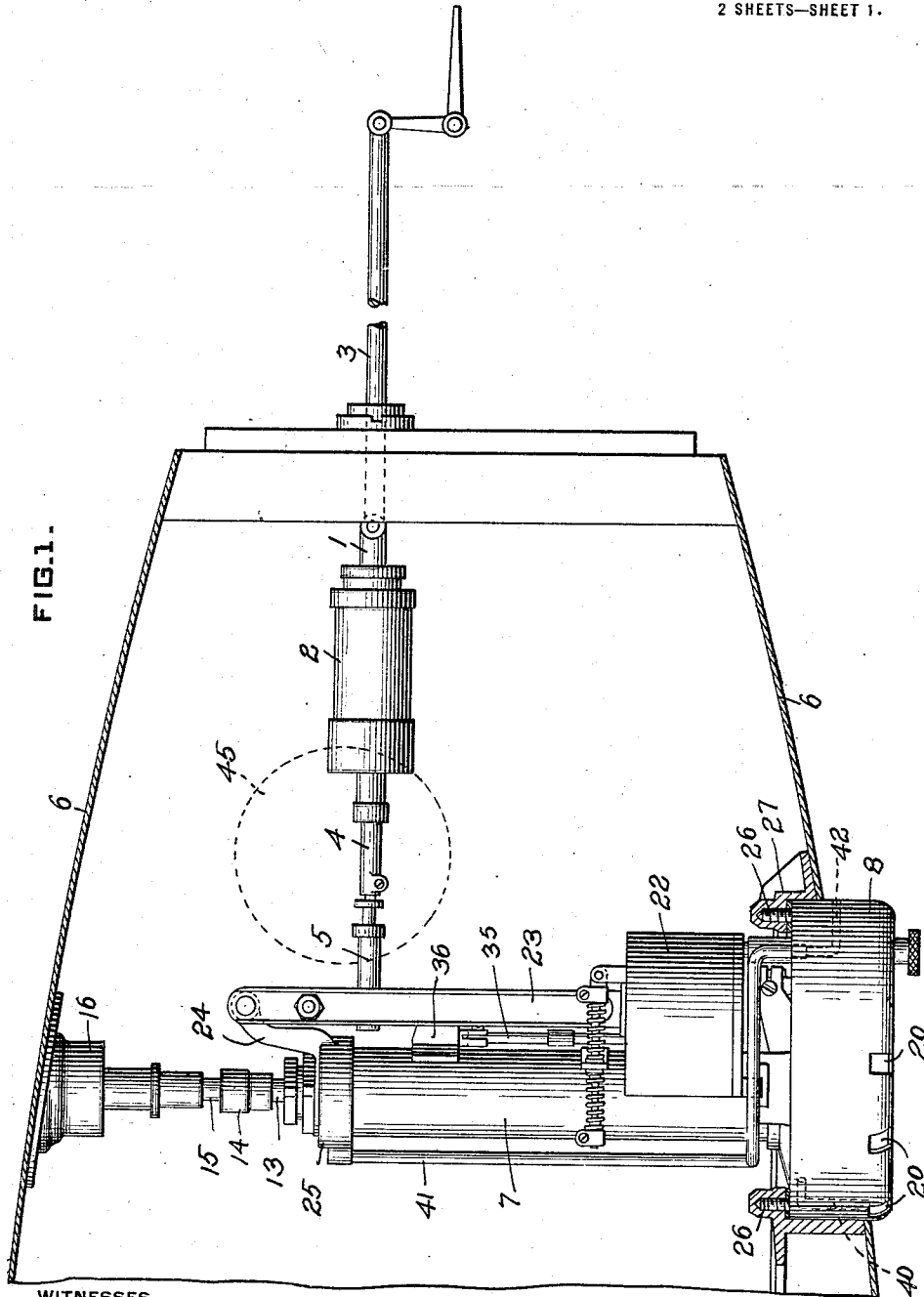


H. W. SHONNARD.
DIVING GEAR.
APPLICATION FILED JUNE 21, 1917.

1,296,332.

Patented Mar. 4, 1919.
2 SHEETS—SHEET 1.



WITNESSES

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INVENTOR

Harold W. Shonnard
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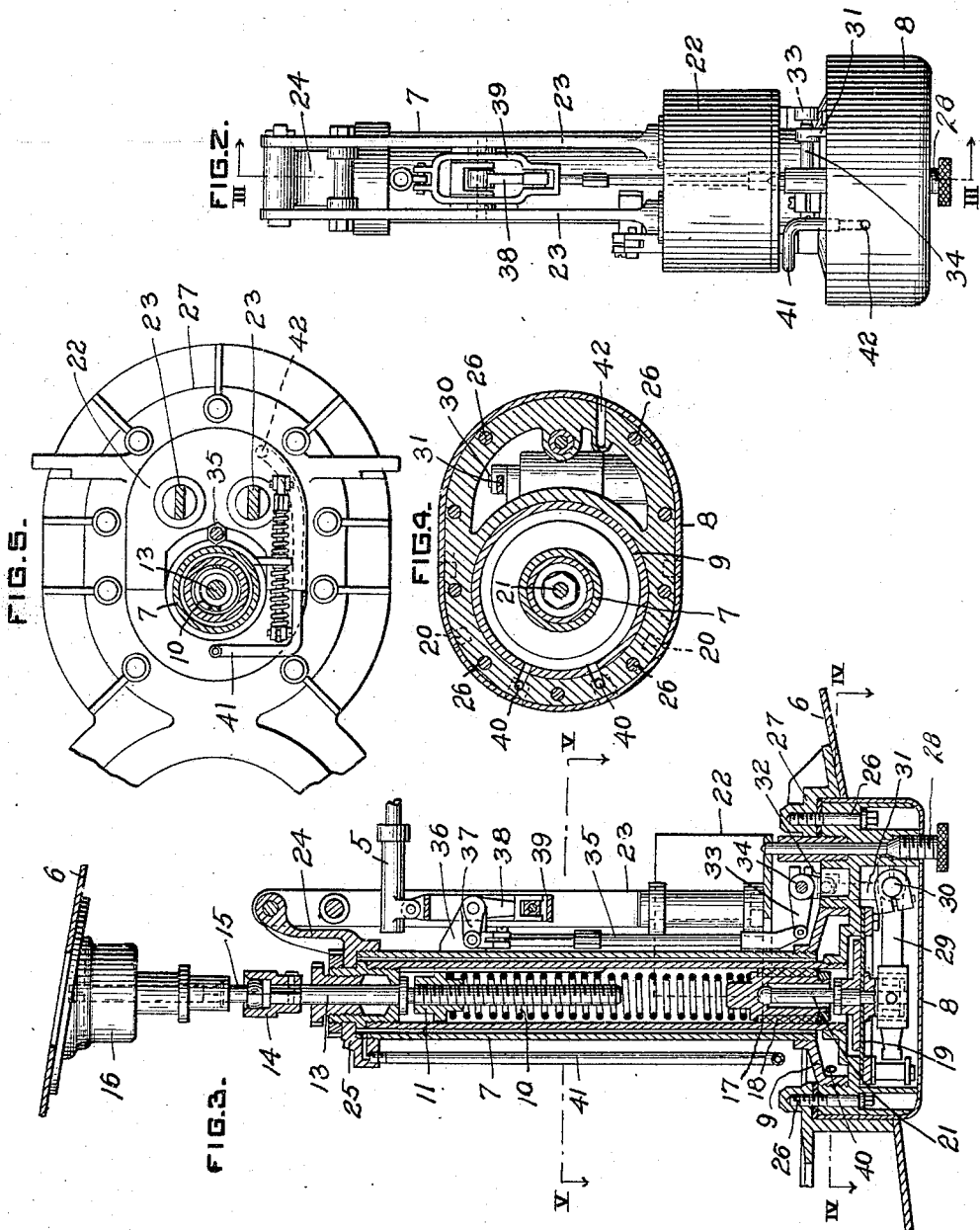
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UNITED STATES PATENT OFFICE.

HAROLD W. SHONNARD, OF UPPER MONTCLAIR, NEW JERSEY, ASSIGNOR TO CRUCIBLE
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DIVING-GEAR.

1,296,332.

Specification of Letters Patent.

Patented Mar. 4, 1919.

Application filed June 21, 1917. Serial No. 176,094.

To all whom it may concern:

Be it known that I, HAROLD W. SHONNARD, residing at Upper Montclair, in the county of Essex and State of New Jersey, a citizen of the United States, have invented or discovered certain new and useful Improvements in Diving-Gears, of which improvements the following is a specification.

My invention relates to diving gears for controlling and regulating the depth of immersion of marine automobile torpedoes. Such diving gears usually comprise a steering engine adapted to control the position of a horizontal rudder, and a hydrostat and pendulum connected, through a system of levers to the steering engine valve in such a manner that either may independently, or both may simultaneously, control such valve.

The object is to improve the general construction of the hydrostat and pendulum mechanism to the end that greater delicacy and accuracy of operation may be attained. A further object is to provide a diving gear unit in which the movable parts are protected against injury, and which, as a whole, may readily be placed within or removed from a torpedo.

In the accompanying sheets of drawings, forming part of my specification, I have illustrated the preferred embodiment of my invention. Figure 1 is a longitudinal sectional view of a torpedo hull showing the diving gear in side elevation within the torpedo; Fig. 2 a right end view of the diving gear as shown in Fig. 1; Fig. 3 a vertical sectional view taken on the line III—III, Fig. 2; and Figs. 4 and 5 sectional views taken, respectively, on the lines IV—IV and V—V, Fig. 3.

In the general arrangements of parts shown in Fig. 1, a reciprocating piston 1 of a steering engine 2 is attached to a rudder rod 3, and a reciprocable valve rod 4 of such engine is attached to a rod 5 connected to and adapted to be moved by the hydrostat or pendulum or both, the several parts being suitably mounted within a torpedo after-body hull 6, which may be provided with a suitable hand hole or opening 45 for access to the interior of the torpedo to connect the rod 5 to the rod 4. As far as my present invention is concerned the steering engine and the rudder rod connections may be of any well known or desired construction.

In the illustrative embodiment of my invention the hydrostat mechanism is contained within a casing including a cylinder 7 forming the spring compartment, and a base portion 8 forming the diaphragm compartment, these two parts being suitably connected to each other by means of a coupling collar 9. Within the cylinder 7 there is a compression spring 10 bearing at its upper end against a flanged nut 11 longitudinally movable but non-rotatable within the cylinder. This nut has screw-thread engagement with a rod 13, rotatably mounted in the upper end of the cylinder, and provided at its upper end with a socket 14 adapted to receive the lower end of an indexing rod 15, which rod in connection with other well known indexing mechanism 16, is secured to the hull 6. By turning the indexing rod 15, the rod 13 may be rotated to cause the nut 11 to move longitudinally upon the rod 13 whereby the compression of the spring 10 may be adjusted. As will be observed, the connection between the rods 14 and 15 is a slip coupling which may be made or broken by merely moving the diving gear unit inwardly of, or outwardly from, the torpedo.

The lower end of the spring 10 exerts its pressure against a piston 17, which is slidably mounted within the cylinder 7, and which, in a manner presently to be explained, is oppositely acted upon by the diaphragm. To assist in preventing a binding action due to eccentric thrusts of the spring and diaphragm, the piston 17 has an extended surface contact within the cylinder; and furthermore, that the piston may move freely, it is surrounded by a relatively hard graphite sleeve 18 which in itself affords the necessary lubrication.

The diaphragm 19 is suitably mounted in the base portion 8 of the casing, which portion is provided with a plurality of water inlet openings 20 so located at the fore and sides of the casing as to maintain within the casing, and while the torpedo is traveling on its course, the same hydrostatic pressure as that of the water at the depth at which the torpedo is submerged. Secured to the diaphragm, and projecting perpendicularly through the central portion thereof, is a rod 21 provided at its upper end with a spherical bearing face adapted to fit into a correspondingly shaped

socket formed in the upper end of a recess in the piston 17, the diameter of such recess being substantially greater than that of the rod 21. It will be observed of this construction and arrangement that the spring and diaphragm exert their respective thrusts upon the slidable piston 17 in a substantially common plane, thus largely eliminating the possibility of a binding action, between the piston and cylinder wall, due to eccentrically applied thrusts of the spring and diaphragm.

For the sake of compactness, and also that the hydrostat and pendulum may be handled as a unit, the pendulum is pivoted to the hydrostat casing. As shown in the illustrative embodiment of my invention, the pendulum comprises a weight 22 and a two-part arm 23 pivoted to a suitable bracket 24 formed integrally with the cap 25 of the cylinder 7. As will be seen, the pendulum lies above, and within the outer boundaries of the base portion 8 of the hydrostat casing, the arrangement being such that the completely assembled unit may pass through the opening in the torpedo hull provided for this purpose, and the entire construction be secured in proper position within the torpedo solely by means of bolts 26 extending through the casing 8 and engaging a frame 27 surrounding such opening. To lock the pendulum against swinging, a suitable set screw 28 may extend through the casing 8 and engage the lower end of the pendulum, as indicated in Fig. 3.

While, as far as some features of my invention are concerned, the system of levers between the hydrostat diaphragm and pendulum and the rod 5 may be variously constructed and arranged, such levers are preferably of such character and are so mounted that they may be protected by the casing and pendulum. In the illustrative embodiment of my invention, the lower end of the diaphragm rod 21 is pivoted to a horizontal arm 29, which is secured to a rock shaft 30. This shaft, as indicated in Fig. 4, projects through the water compartment wall of the casing 8, and to its outer end there is attached a vertically disposed arm 31 connected at its upper end to a second vertically disposed arm 32. The arm 32 and a horizontally disposed arm 33 are secured to a rock shaft 34, and to the outer end of the latter arm there is pivotally secured a vertically reciprocable rod 35. To the side of the casing cylinder 7, and in a position midway between the pendulum arms 23, there is secured a bracket 36, to the outer end of which a bell crank lever 37, 38 is pivoted. The lever arm 37 is pivotally connected to the upper end of the rod 35, and the lever arm 38 to the lower end of a divided or yoke-shaped equalizing lever 39. The equalizing lever is pivoted substantially at its

center to the pendulum arms 23, and at its upper end to the rod 5.

It will be observed of the system of levers just explained, that the arms 29, 31, 32 and 33 are protected by the casing 8, and that the rod 35, bell crank lever 37, 38 and equalizing lever 39 are protected by the casing cylinder 7 and the pendulum arms 23. It is essential, to the end that the diving gear be sensitive in operation, that these levers and their mountings be of relatively delicate construction; hence the desirability of protecting them against injury by reason of accident to, or rough usage of, the diving gear unit.

In my co-pending application Serial No. 165,430 there is shown and described a torpedo-steering unit provided with a water jacket so constructed as to require no special connections or parts for placing it in communication with the water of submersion, the specific steering unit shown being a gyroscope. The diving gear unit of my present application embodies essentially the same construction, the specific purpose of the water jacket being that the air in the spring compartment may not become heated by exhaust motive gases and exert pressure upon the piston 17. The cylinder 7 is of double wall construction affording a water chamber or jacket through which the water of submersion is, by the movement of the torpedo through the water, caused to circulate. By-passes 40, formed in the fore end of the casing 8, places the lower end of the water jacket in communication with the fore water-inlet openings 20 of the casing, while a conduit 41 extends from the upper end of the casing cylinder 7 to a by-pass 42 formed in the aft end of the casing 8, Fig. 1. By such construction, the movement of the torpedo through the water causes a continuous current of water to flow through the jacket, the water being impelled through the by-pass 40 to the lower end of the jacket, and being withdrawn from the upper end thereof through conduit 41 and by-pass 42. By thus cooling the walls of the spring compartment, the air in such compartment may be maintained at a substantially uniform temperature, while, in mounting the diving gear unit in the torpedo, no special connections need be made for the purpose of placing the water jacket in communication with the water of submersion.

In the operation of the diving gear, the spring pressure upon the piston 17, and hence upon the diaphragm 19, is adjusted for a desired depth of run by turning, through indexing rod 15, the rod 13. The movement of the diaphragm, under the action of either the spring 10 or the hydrostatic pressure upon the diaphragm, effects, through the protected lever system shown and described, a movement of the rod 5 to

cause the steering engine 2 to operate. However, this movement of the diaphragm may be counteracted or accentuated by the swinging of the pendulum, or the swinging of the pendulum may in itself effect a movement of the rod 5.

According to the provisions of the patent statute, I have described the principle and operation of my invention together with the construction which I now consider to represent the best embodiment thereof. However, I desire to have it understood that my invention may be practised in other forms of construction than that particularly shown and described.

I claim as my invention:

1. In a diving gear, the combination of a casing, a reciprocable piston slidably mounted within said casing and having an extended surface contact with an inner wall thereof, a spring bearing on one side of said piston, a hydrostatic diaphragm at the opposite side of said piston, and a rod connected to said diaphragm and having thrust bearing engagement with said piston in a plane substantially common with the bearing plane of said spring upon the piston.

2. In a diving gear, the combination of a casing including a tube containing a spring and a base containing a diaphragm, said base being secured to and projecting laterally from the bottom of the tube, a pendulum having two substantially parallel arms pivotally secured to the upper end of the tube, an equalizing lever pivotally mounted to and between said pendulum arms, and a system of levers extending from said diaphragm to said equalizing lever.

3. In a diving gear, the combination of a casing including a tube containing a spring

and a base containing a diaphragm, said base being secured to and projecting laterally from the bottom of the tube, a pendulum pivotally secured to the upper end of the tube, and a system of levers extending from said diaphragm to said pendulum, said levers lying in part between said tube and the arm of said pendulum and in part between the bottom of the pendulum and the bottom of the base portion of the casing.

4. In a diving gear, the combination of a casing including a tube containing a spring and a base containing a diaphragm, said base being secured to and projecting laterally from the bottom of the tube, a pendulum having two substantially parallel arms pivotally secured to the upper end of the tube, an equalizing lever pivotally mounted to and between said pendulum arms, and a system of levers extending from said diaphragm to said equalizing lever; said system of levers including a pair of rock shafts mounted in said casing base, a pair of arms secured to each shaft, a bell crank lever pivotally mounted on said tube, and a rod extending from said bell-crank lever to one of said arms.

5. In a diving gear, the combination of a casing including a closed tube containing a spring and a base containing a diaphragm, a water jacket for said tube, and inlet and outlet passages formed in said base portion of the casing and leading to and from said water jacket.

In testimony whereof I have hereunto set my hand.

HAROLD W. SHONNARD.

Witnesses:

HERMAN C. ENGELMAN,
GEO. V. JAMES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."