April 11, 1950 E. O. KOLLMORGEN 2,503,748

HYDRAULIC PERISCOPE ELEVATING SYSTEM

Filed Aug. 22, 1946

FIG. 3.

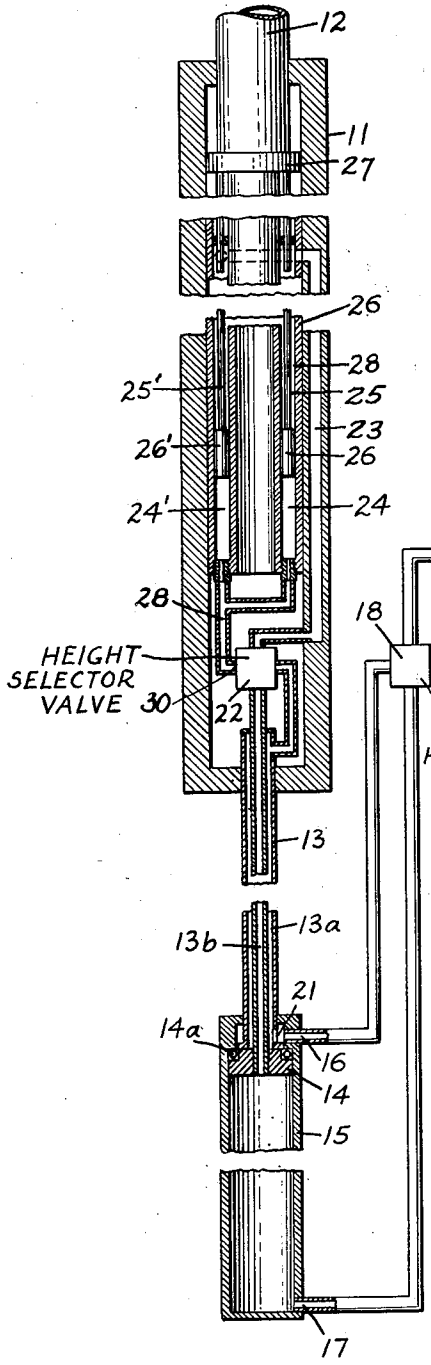


FIG. 2.

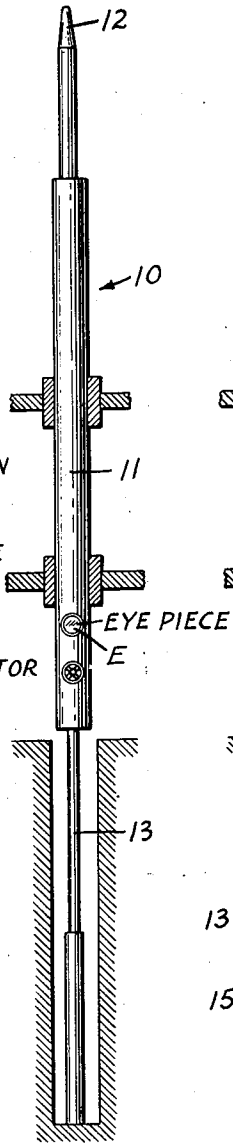
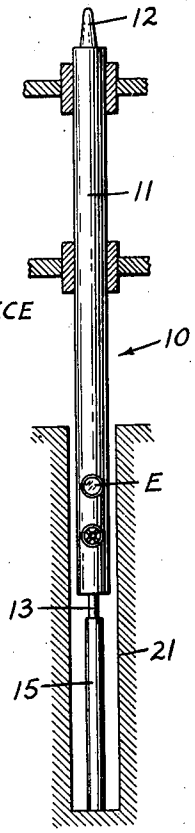


FIG. 1.



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HYDRAULIC PERISCOPE ELEVATING SYSTEM

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9 Claims. (Cl. 88—69)

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This invention relates to elevating mechanisms for submarine periscopes and it relates particularly to an improved hydraulic elevating system whereby the periscope of a submarine may be elevated or retracted and the length of the periscope varied as desired.

The periscopes of submarines are ordinarily elevated or retracted by means of a hydraulic system which usually includes a pair of hydraulic lift cylinders or jacks which are suspended overhead on opposite sides of the periscope and are connected by means of a yoke to the periscope. The yoke includes a bearing in which the periscope is mounted so that it can be rotated about its axis.

Periscopes can be constructed in a plurality of sections including a tip section which can be projected and retracted with respect to the body of the periscope. In this way, the overall length of the periscope can be varied to compensate for the height of waves and the depth of the submarine and the like.

It has been impractical to use hydraulic systems for both elevating and retracting the periscope bodily and also extending and retracting the movable section of the periscope. The reason for this is that the rotary mount for the periscope makes it difficult to provide a leak-proof joint or connection between the source of hydraulic pressure and the periscope itself, while maintaining freedom of rotation of the periscope.

In accordance with the present invention, an elevating mechanism is provided which is operable by hydraulic pressure and in which hydraulic fluid may be conducted from the lifting mechanism into the periscope for projecting and retracting the sections of the periscope without danger of leakage of hydraulic fluid and without the use of complicated leak-proof fittings or connections.

More particularly, an elevating system is provided wherein a hydraulic jack or lift cylinder is mounted co-axially with the periscope and the periscope is mounted directly on the piston rod of the jack whereby as the piston rod is projected, the periscope is elevated and, when the piston rod is retracted, the periscope is retracted. Inasmuch as the jack cylinder and the piston are circular in cross section, the periscope is freely rotatable about its longitudinal axis even though the periscope is fixed rigidly to the piston rod.

The periscope preferably is of a type having a tip section which carries the objective prism and lens and which can be projected from and retracted telescopically into the main periscope

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tube or barrel. The tip section of the periscope may be projected and retracted by means of a hydraulic jack.

Hydraulic fluid is led through the piston rod of the projecting and retracting cylinder to the jack within the periscope and may be controlled by means of a suitable selector valve. In this way, rotary connections between the periscope and the source of hydraulic pressure are eliminated without restricting the movement of the periscope in any way.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which

Figure 1 is a view in side elevation of a typical periscope and an elevating system therefor; the well for receiving the periscope being illustrated diagrammatically;

Figure 2 is a view in side elevation of the periscope disclosed in Figure 1 and with the periscope fully extended; and

Figure 3 is a view in vertical section and partly broken view of the periscope and its elevating mechanism, illustrating details of construction and showing the control valves diagrammatically.

The form of periscope 10 chosen for purposes of illustration includes a conventional optical system, which is not illustrated inasmuch as the optical system does not form a part of the present invention.

The periscope 10, as illustrated, may include a main body tube or barrel 11 of generally tubular or cylindrical form which contains the optical system and other elements to be described. The barrel 11 may be supported for axial and rotary movement in liquid-tight guides in the hull of the submarine in the usual way. The periscope 10 further includes a tip section 12 of tubular form which is mounted slidably in the barrel 11 and can be extended and retracted at will.

In accordance with the present invention, the periscope 10 is mounted on a piston rod 13 which is connected rigidly to a piston 14 that is rotatably and axially movable within the jack cylinder 15. The cylinder 15 is provided with fluid inlet and return ports 16 and 17 at its opposite ends, these ports being connected by means of a suitable four-port selector valve 18 of conventional construction to a conduit 19, which supplies hydraulic fluid under pressure, and to a suitable return conduit 20 by means of which the hydraulic fluid can be discharged from the cylinder. The selector valve 18 may be of the rotary valve type or of the four valve poppet type which is so arranged that when the valve control han-

dle is moved to one position, the pressure line 19 is connected to the conduit 17, and the conduit 16 is connected to the return conduit 20. The position of the valve can be reversed so that the pressure line 19 can be connected to the conduit 16 while the conduit 17 is connected to the return line 20. The valve, when allowed to move to an intermediate position, disconnects the pressure line 19 and the return line 20 from the conduits 16 and 17 and from each other so that the liquid present in the cylinder 15 is trapped on opposite sides of the piston 14, thereby locking the piston in the position it has assumed in the cylinder. When the selector valve 18 is actuated to supply hydraulic fluid from conduit 19 to the inlet port 17, the piston 14 is forced upwardly, thereby elevating the periscope 10 while any fluid present in the cylinder above the piston 14 is discharged through the port 16, and through the selector valve 18, to the return conduit 20. An anti-friction bearing 14a may be mounted in the cylinder 15 or on the piston 14, as shown in Figure 3, to facilitate rotation of the periscope when it is elevated.

In order to lower the periscope 10, the selector valve 18 may be actuated to connect the port 16 with the fluid supply conduit 19 and the port 17 to the return conduit 20, whereby the piston 14 is forced downwardly, retracting the periscope into the periscope well 21 which is formed within the hull and keel of the submarine.

It will be understood that different types of hydraulic lift cylinders may be used than that disclosed in the drawings and described above and, if desired, a cylinder may be provided with a piston lock to lock the piston against axial movement at the upper end of its stroke, as is conventional in many different types of hydraulic jacks and lift cylinders now produced.

The piston rod 13 preferably is formed of concentric tubes 13a and 13b. The inner tube 13b extends entirely through the piston 14 and communicates with the cylinder below the piston 14. The outer tube 13a is provided with a port 21 which communicates with the interior of the cylinder 15 above the piston 14. The inner and outer tubes 13a and 13b are connected to a four-port selector valve 22, like the valve 18 described above, mounted within the periscope barrel 11 and having a control handle which is operable from the exterior of the barrel 11. The valve 22 has a port which is connected by means of a conduit 23 to the upper ends of the cylinders 24 and 24' which are used for projecting and retracting the tip section 12. The lower end of the tip section 12 is connected by means of piston rods 25 and 25' to the pistons 26 and 26' which are slidable in the cylinders 24 and 24'. The tip section 12 is guided and retained against tilting in the barrel 11 by means of a flange 27 at its lower end. Hydraulic fluid is supplied to the cylinders 24 and 24' below the pistons 26 and 26' through the conduit 28 that is connected to the port 30 of the selector valve 22.

The above-described hydraulic system permits fluid under pressure to be supplied either to the space above the pistons 26 and 26' to retract the tip section 12 or to the space below the pistons 26 and 26' to project or elevate the tip section 12. Thus, when hydraulic fluid is supplied to the inlet 17 of the cylinder 15, the piston 14 and the periscope 10 are lifted simultaneously. At the same time hydraulic fluid under pressure is delivered through the tube 13b to the selector valve 22. After the periscope 10 has been elevated completely with the tip section 12 retracted, the tip section 12 can be projected either completely to the top of the barrel 11 or to any intermediate position with respect to the barrel 11. Any fluid present above the pistons 26 and 26' is discharged through the conduit 23, the selector valve 22, the outer tube 13a to the return port 16 of the cylinder.

If the tip section 12 has been projected too far, the selector valve 22 may be actuated to direct the fluid from the tube 13b into the cylinders 24 and 24' the pistons 26 and 26', thereby forcing the tip section 12 downwardly to a desired position. With the selector valve 22 in a neutral position with all ports closed, the tip section is retained in position because of the presence of fluid trapped on opposite sides of the pistons 26 and 26'.

In order to prevent the piston 14 from dropping in the cylinder 15 as the tip section 12 is projected or retracted, the piston lock referred to above may be provided, or the size of the cylinders 15 and 24 and 24' may be so proportioned that flow of fluid into the latter cylinders will not lower the pressure in the cylinder 15 sufficiently to permit the periscope 10 to drop bodily.

It will be apparent from the preceding description that an elevating mechanism has been provided which permits elevation and retraction of the entire periscope 10, and also independent adjustment of the tip section 12 with respect to the barrel 11. In this way, the elevation of the periscope, necessary to permit proper vision, can be obtained without extending the periscope too far above the water where it might be detected.

It will be understood, of course, that the periscope may be of any desired type and can be modified substantially without departing from the invention.

Moreover, the selector valve mechanisms and the type of hydraulic jacks or lift cylinders used for extending the periscope or for controlling the movement of the tip section can be modified substantially. Therefore, the form of the invention described above should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A periscope elevating system comprising a periscope having a lower housing and an extension therein movable longitudinally of said housing, a reversible hydraulic motor mounted in said housing for projecting said extension and retracting it relatively to said housing, a hydraulic jack for elevating and retracting said periscope, said jack having a hollow piston rod fixedly connected to said housing in axial alignment therewith for supplying fluid from the interior of said jack to said hydraulic motor and supporting said periscope, and valve means carried by said housing for controlling the supply of fluid from said jack to said hydraulic motor to project and retract said extension.

2. A periscope elevating system comprising a periscope having a lower housing and a relatively longitudinally movable extension, a reversible hydraulic motor for projecting said extension and retracting it relatively to said housing, a hydraulic jack below said housing, said jack having a cylinder, a piston and a hollow piston rod coaxial with and fixed to said periscope for elevating and lowering said periscope bodily, said rod having passages therein communicating with said cylinder on opposite sides of said piston for supplying fluid from said cylinder to said hydraulic motor

and returning fluid from said hydraulic motor to said cylinder, and valve means movable with said housing for controlling the flow of fluid between said hydraulic motor and the cylinder of said second jack to project and retract said extension.

3. A periscope elevating system comprising a hydraulic jack having a cylinder, a piston and a piston rod, said rod having a first passage therein communicating with the interior of said cylinder on one side of said piston and a second passage therein communicating with the interior of said cylinder on the opposite side of said piston, means at opposite ends of said cylinder for supplying hydraulic fluid to and withdrawing it from said cylinder and passages, a periscope mounted on said piston rod for movement therewith, said periscope having an axially movable extension, a second hydraulic jack in said periscope to move said extension axially, ports in said second jack to introduce and discharge fluid to actuate the jack to move said extension in either direction, and means including a valve for selectively connecting one of said passages to one of said ports and the other passage to another of said ports to actuate said second jack in one direction, and to reverse the connection between said ports and passages to actuate the second jack in the opposite direction.

4. An elevating system for a periscope having an outer tubular housing and a telescopically related and relatively movable extension, comprising an elongated hollow cylinder, a piston slidably mounted in said cylinder for reciprocating and rotary movement, a piston rod nonrotatably connecting said piston and said housing for elevating and retracting said periscope and communicating with said cylinder, said piston rod having passages therein connected with said cylinder at opposite sides of said piston, a reversible hydraulic motor in said housing connected with said passages, and valve means interposed between said hydraulic motor and said passages for connecting, disconnecting and reversing the connections between said motor and said passages for controlling said hydraulic means to elevate, stop and retract said extension.

5. A periscope elevating system comprising a hydraulic jack having a cylinder, and a piston and piston rod movable axially of and rotatable relative to said cylinder, means for selectively supplying hydraulic fluid to and discharging it from said cylinder on opposite sides of said piston to move said piston and piston rod axially of said cylinder, a periscope fixed to said piston rod for bodily movement therewith, said periscope having an axially movable extension, a reversible hydraulic motor for moving said extension axially, separate passages in said system rod communicating with said cylinder on opposite sides of said piston, and fixed connections, including a selector valve for starting, stopping and reversing the motor, interposed between said passages and said motor for supplying hydraulic fluid from said cylinder to said reversible motor.

6. A periscope elevating system comprising a hydraulic jack having a cylinder, and a piston and piston rod movable axially of and rotatable relative to said cylinder, valve means for selectively supplying liquid to and discharging liquid from said cylinder at either side of said piston to move said piston and piston rod axially of said cylinder, a periscope fixed to said piston rod in axial alignment therewith, said periscope having an axially movable telescoping extension and reversible hydraulic means for moving said extension axially in either direction, passages extending through said piston rod for supplying liquid from said cylinder at one side of said piston to said hydraulic means and discharging liquid from said hydraulic means to said cylinder at the other side of said piston, and valve means interposed between said passages and said hydraulic means for controlling the direction of operation of and to stop said hydraulic means to move said extension axially and to retain it in axially moved position.

7. A periscope elevating system comprising a hydraulic jack having a cylinder, and a piston and piston rod movable axially of and rotatable relative to said cylinder, valve means for selectively supplying liquid to said cylinder to move said piston and piston rod axially of said cylinder, a periscope fixed to said piston rod in axial alignment therewith, said periscope being rotatable with said piston and said piston rod relative to said cylinder, said periscope having an axially movable telescoping extension and hydraulic means for moving said extension axially between projected and retracted positions, passages in said piston rod for supplying liquid from said cylinder at one side of said piston and withdrawing it from said hydraulic means to the cylinder at the opposite side of said piston, and a selector valve for controlling the supply of liquid to and discharge of liquid from said hydraulic means to move said extension axially and retain said extension in any desired axially moved position.

8. In an elevating system for a periscope having a lower tubular housing, a tubular extension telescopically mounted in said housing for axial movement relative to said housing and means supporting said housing for axial and rotary movement; the combination of a first hydraulic jack having a cylinder, a piston reciprocable and rotatable in said cylinder, means for supplying liquid under pressure selectively to the cylinder of the first hydraulic jack on one side of piston and discharging liquid from the cylinder on the other side of said piston to move said piston in either direction, a piston rod fixed at one end to said piston and at its other end to said housing, whereby said housing, piston and piston rod are fixedly connected and reciprocable and rotatable as a unit relative to said cylinder, separate passages in said piston rod communicating with the interior of said cylinder on opposite sides of said piston, a second hydraulic jack in said housing having relatively movable piston and cylinder elements connected to said housing and said extension for moving the extension axially relative to said housing in either direction, a selector valve on said housing, and fixed conduits connecting said passages to said selector valve and the latter to said second jack to supply fluid pressure from the cylinder of said first jack to the second jack under the control of said selector valve.

9. An elevating system for a periscope having a lower tubular housing, means supporting said housing for axial and rotary movement, and a tubular extension telescopically mounted in said housing for axial movement relative to said housing; the combination of a reversible hydraulic motor mounted in said housing and having a driven element connected to said extension for moving said extension axially, ports in said motor for receiving liquid under pressure and discharging liquid to drive said element selectively in either direction, a selector valve connected to said ports for controlling supply of

liquid to and discharge of liquid from said ports to control the direction of movement of said element and said extension, a hydraulic jack having a cylinder and a relatively rotatable and axially movable piston and piston rod, means fixedly connecting said housing to the outer end of said piston rod in axial alignment therewith, a pair of passages in said piston rod, one of said passages communicating with the cylinder on one side of said piston and the other passage communicating with the cylinder on the opposite side of said piston, means for supplying fluid selectively to the cylinder on one side of the piston and discharging liquid from the cylinder at the other side of said piston to project and retract said piston rod and said housing, and connections between said passages and said selector

valve to supply liquid from said cylinder to actuate said hydraulic motor in either direction under the control of said selector valve.

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