Oct. 14, 1958 G. AUGER 2,855,755

HYDRAULIC STEERING MECHANISM

Filed March 10, 1954 4 Sheets-Sheet 1

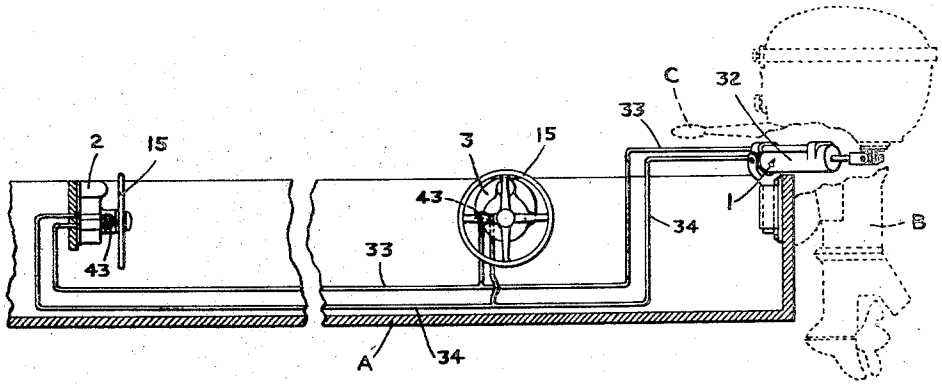

FIG. 1

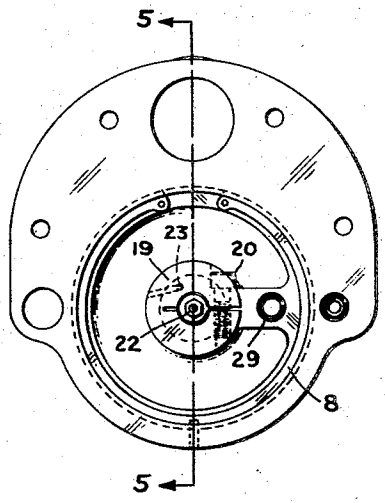

FIG. 3

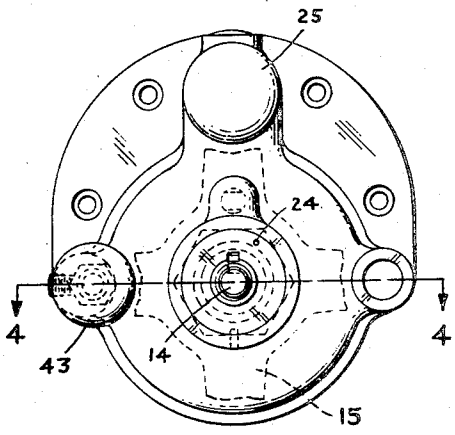

FIG. 2

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HYDRAULIC STEERING MECHANISM

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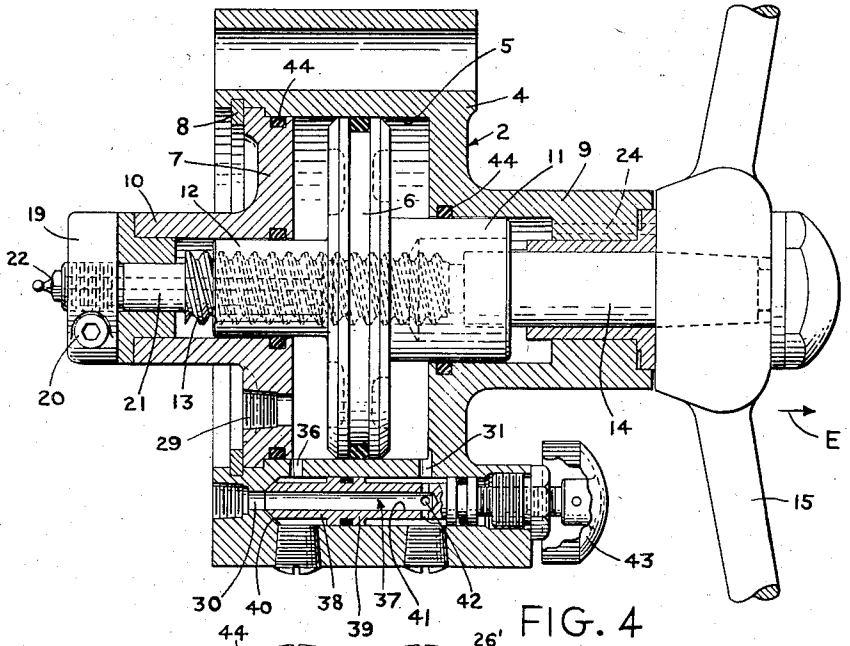

FIG. 4

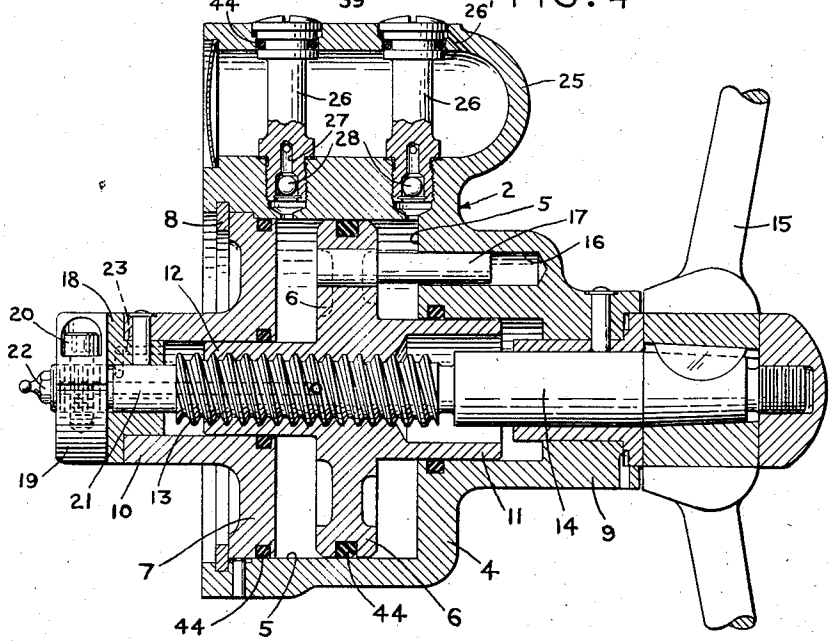

FIG. 5

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HYDRAULIC STEERING MECHANISM

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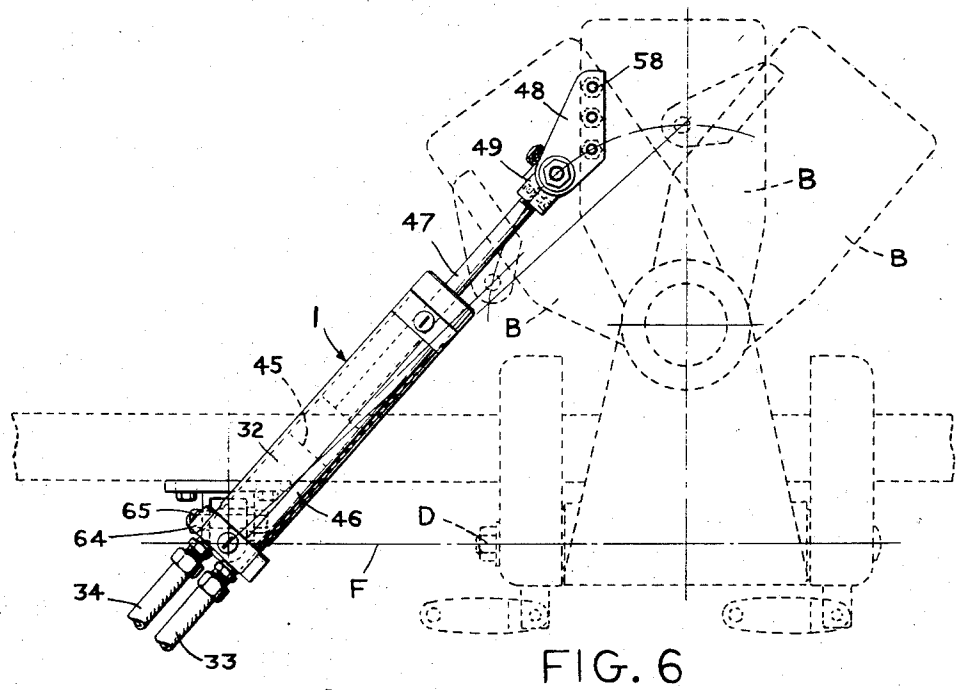

FIG. 6

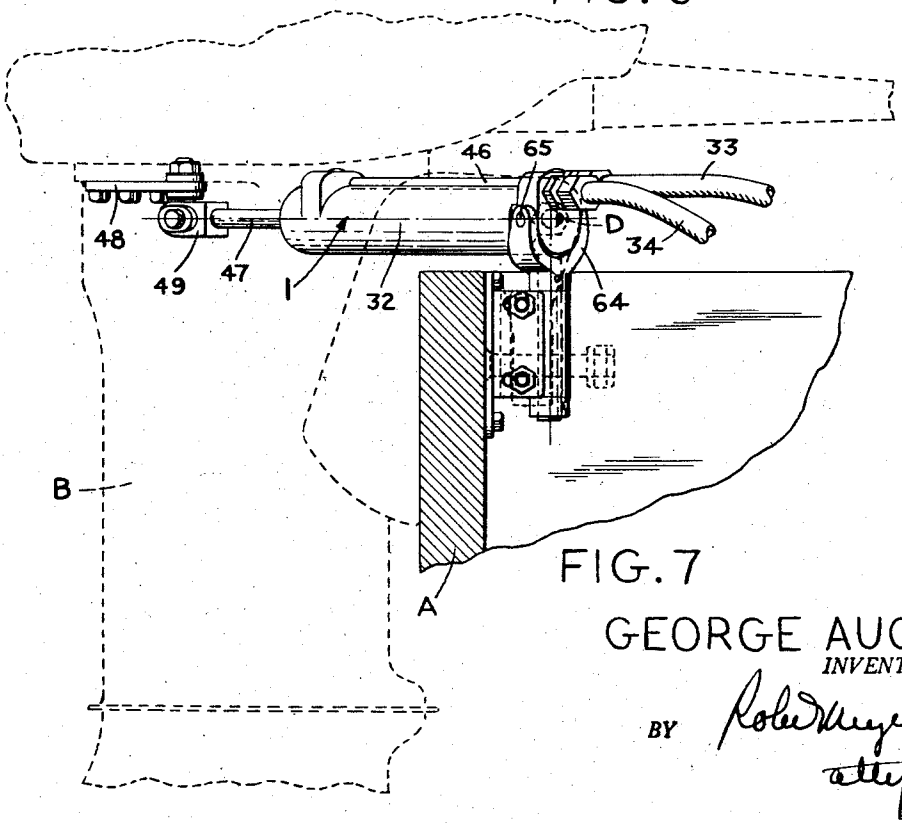

FIG. 7

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HYDRAULIC STEERING MECHANISM

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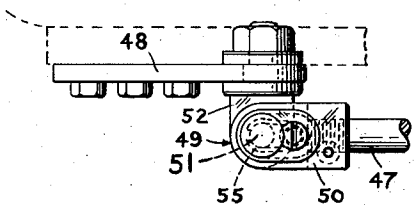

FIG. 8

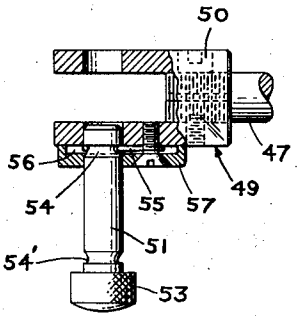

FIG. 9

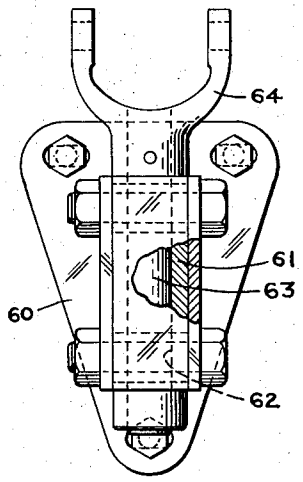

FIG. 10

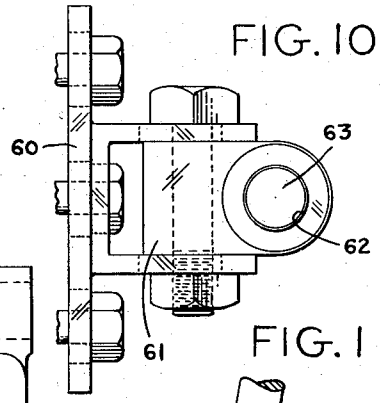

FIG. 11

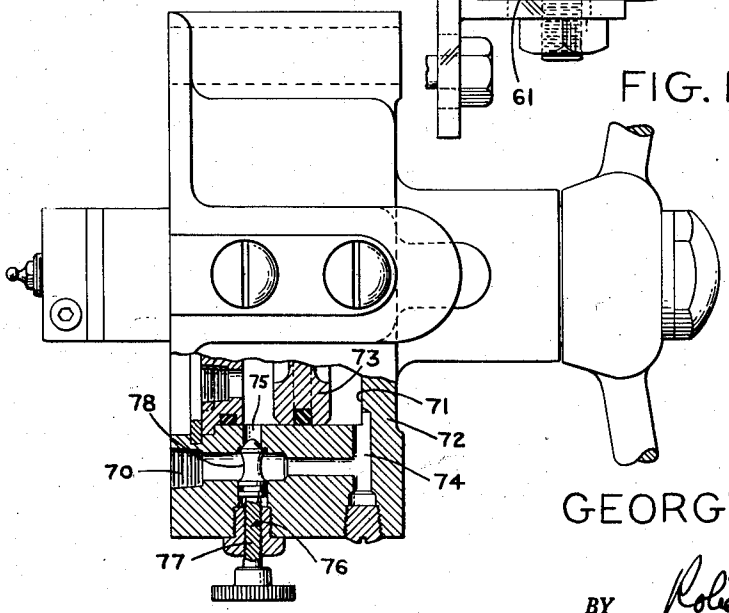

FIG. 12

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United States Patent Office

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HYDRAULIC STEERING MECHANISM

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Application March 10, 1954, Serial No. 415,287

2 Claims. (Cl. 60—54.5)

This invention relates to hydraulic steering mechanisms and more particularly to such a mechanism primarily for use in steering boats powered by outboard motors.

In the use of outboard motors for propelling small boats, the motor is removably attached to the stern of the boat, and since the propeller of such motor is rigid relative to the motor except for its rotational movement the entire motor is swung on a vertical axis for the purpose of steering the boat. Such steering movement of the motor is manually accomplished by means of a steering handle attached to the motor making it necessary for the boatman to sit in the stern of the boat to steer it. This has many disadvantages and the object of the present invention is to provide a steering mechanism for attachment to outboard motors which will permit steering movement of the motor from remote points such as the bow of the boat or from any other desirable location in the boat.

Also, outboard motors are so constructed as to be movable out of the water by movement on a horizontal pivot, to permit beaching of the boat, drifting, etc., and for removing the propeller and below surface parts of the motor out of the water when desirable.

Another object of the present invention is to provide a steering mechanism for such outboard motor-driven boats which will permit such lifting or tilting of the outboard motor without requiring disconnection of the steering mechanism from the motor.

The present invention comprises a hydraulic steering system or mechanism manually operated through the medium of a steering wheel whereby the motor-moving mechanism may be operatively disconnected from the actuating part of the steering mechanism through the medium of a bypass valve which unloads the actuating mechanism. Such unloading operation permits steering movement of the outboard motor by the usual steering handle attached to the motor.

Two or more units may be placed at different points on a boat and steering of the boat may be accomplished by any one of such units without companionable movement of the other actuating unit or units. All of the actuating units are connected in parallel in the system and, therefore, to permit steering of the boat by the usual steering handle on the outboard motor only one of the actuating units need be unloaded to neutralize all of the actuating units.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a hydraulic steering mechanism of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a view showing the improved hydraulic steering mechanism attached to a boat.

Figure 2 is a front end view of the actuating unit of the steering mechanism with the steering wheel removed.

Figure 3 is a rear view of the actuating unit with the steering wheel removed.

Figure 4 is a longitudinal section taken on the line 4—4 of Figure 2.

Figure 5 is a longitudinal section taken on the line 5—5 of Figure 3.

Figure 6 is a top plan view of the actuated unit of the mechanism or system showing an outoard motor in dotted lines.

Figure 7 is a side elevation of the actuated unit.

Figure 8 is a detail plan view of part of the mechanism for connecting the actuated unit to the outboard motor.

Figure 9 is a detail section of part of the mechanism for connecting the actuated unit to the outboard motor.

Figure 10 is a front view of a universal mounting for attaching the actuated unit to a boat.

Figure 11 is a top plan of the universal mounting.

Figure 12 is a sectional view similar to the section shown in Figure 4 of the drawings but showing a modified form of the unloading bypass mechanism.

While the improved hydraulic steering mechanism is shown and hereinafter described as being particularly adaptable for use in connection with outboard motors and for steering boats driven by outboard motors, it is to be understood that with slight modifications of the actuating unit the hydraulic steering mechanism may be employed for steering inboard motor boats by connecting the steering mechanism to the rudder of the boat instead of to an outboard motor.

Referring particularly to Figure 1 of the drawings, A indicates a fragment of a boat which is driven or propelled by an outboard motor B of any approved type or construction. Such outboard motors are not provided with a movable rudder and, as a consequence thereof the boat to which thhey are applied is steered by moving the outboard motor on a vertical axis through the medium of a steering handle indicated at C in Figure 1 of the drawings. Also such outboard motors are pivotally connected on a horizontal axis, indicated at D, in Figure 6 of the drawings, to permit the motors to be tilted or pivotally moved out of the water and into a substantially horizontal position.

With the approved types of outboard motors now on the market it is necessary for the boatman to sit in the stern of the boat and steer the boat through movement of the outboard motor by means of a steering handle C. This is sometimes undersirable, particularly in connection with the high powered late design of outboard motor used for the propelling of larger sized boats adaptable for carrying a number of people and also the boatman often desires to sit at points in the boat other than the stern and the present invention embodies a hydraulic steering mechanism the actuating unit of which may be placed at any suitable point on the boat and the outboard motor moved in steering operation from such remote position.

As shown in Figure 1 of the drawings, an actuated unit 1 is attached directly to the outboard motor B and an actuating unit 2 is attached to the boat near the bow thereof with a second actuating unit 3 attached at a different location in the boat A. The two actuating units 2 and 3 are connected in a closed hydraulic circuit with the actuated unit 1 in a manner hereinafter specifically set out.

The actuating units 2 and 3 are identical in construction and are shown in Figures 2, 3, 4 and 5 of the drawings. The actuating units include a cylinder 4 having a cylinder bore 5 in which a piston 6 is mounted for reciprocatory movement. One end of the cylinder 4 is closed by a closure head 7 securely held in place by the clamping ring 8 of any approved construction. The cylinder 2 and the head 7 have aligning hubs 9 and 10 formed thereon bored to receive the hub extensions 11 and 12 respectively of

the piston 6. The piston 6 and the hub extension 12 are internally screw-threaded and a screw-threaded shaft 13 extends through the threaded bore of the piston 6 and the hub 12. The shaft 13 has a smooth surface portion 14 extending through the hub 9 to which a steering wheel 15 is keyed and attached in any suitable manner to permit manual rotation of the shaft 13 for reciprocating the piston 6 in the cylinder bore 5. The hub 9 has a recess 16 therein which slidably receives a pin 17 carried by the piston 6 so as to prevent rotation of the piston in the cylinder bore 5. The end of the shaft 13 which extends into the hub 10 of the head 8 is rotatably mounted in a suitable bearing 18 and the shaft is held against longitudinal movement by means of a split clamping adjustment nut 19 and clamping bolt 20, as clearly shown in Figures 3, 4 and 5 of the drawings. The adjustment clamping nut 19 absorbs end thrust of the shaft 13 and by adjustment of the nut 19 any play between the shaft 13 and piston 6, occasioned by wear or usage of the device may be taken up or eliminated. The shaft is provided with an axial bore 21 opening out through the lateral ports in the screw threaded portion of the shaft to permit lubrication of the gear threads and the outer end of this lubricating passage is fitted with a suitable grease fitting 22 of any approved construction. Pressure relieving passages 23 and 24 (shown in dotted lines in Figures 4 and 5 of the drawings) are provided for relieving pressure in the ends of the bores of the hubs 9 and 10 beyond the ends of the hub extensions of the piston 6.

The cylinder 4 has a reservoir 25 formed thereon which opens into the cylinder bore 5 on opposite sides of the piston 6 through check valve structures 26. The check valve structures 26 are threaded into the cylinder and may be removed, either one or both of them, to permit filling of the reservoir and the system with a hydraulic fluid employed in the system. The check valve structures 26 have passages 27 therein opening laterally into the reservoir and axially into the cylinder bore. Ball check valves 28 are positioned in these passages to permit hydraulic fluid to flow from the reservoir into the cylinder for make-up purposes, that is, to make up or compensate for any slight leakage of hydraulic fluid from the system. The valves 28 are so arranged as to prevent hydraulic fluid from flowing from the cylinder bore 5 back into the reservoir 25. In the event variations in ambient temperature about the actuating unit cause expansion or contraction of the metallic parts of the unit, thus resulting in a variation in pressure of the fluid in the system, such pressure variations will be compensated for through the reservoir 25 due to the ability of the check valve structure 26 to allow fluid to flow into or from the reservoir 25 upon such pressure variances. The portion of the reservoir above the liquid level therein is vented to atmosphere through a suitable vent 26'.

The head 7 has a port 29 formed therein which opens into the cylinder bore 5 at one side of the piston 6 and it has a passageway 30 formed therein which opens through a port 31 into the cylinder bore on the opposite side of the piston 6 from the port 29. The passage 30 and the port 29 are connected to opposite ends of the cylinder 32 of the actuated mechanism 1 by means of suitable pipes or conduits 33 and 34 respectively so that as the piston 6 is moved in the cylinder 4 by means of the steering wheel 15 hydraulic fluid will be forced either through the passage 30 and its connection 33 or the passage 29 and its connection 34 into the cylinder 32 of the actuated mechanism 1 for actuating said mechanism depending upon the direction of movement of the piston. When hydraulic fluid is forced into one end of the cylinder 32 it will be forced out of the other end in a reverse direction back to the cylinder 4 on the opposite side of the piston 6 from that which is exerting the hydraulic fluid forcing pressure and thus a closed hydraulic circuit is provided. Any amount of force applied to the actuated unit 1 cannot cause movement of the piston 6 in the cylinder 4 of the actuating unit or units 2 and 3, due to the construction thereof and any shock or force that the motor and actuated unit 1 may be subjected to will not be transmitted to the actuating unit or units and will not be felt on the steering wheel 15 by the operator.

For the purpose of permitting the outboard motor B to be moved in steering movement by the steering handle C, means are provided in the actuating unit to permit unloading of such unit to permit the outboard motor B to be actuated by the steering handle C without effecting any motion of the piston of the actuating unit. This is accomplished by means of providing a manually controlled bypass or unloading arrangement on the actuating units. To provide this unloading of the actuating unit a port 36 is provided between the cylinder bore and the passage 30 at the side of the piston 6 opposite to the side on which the port 31 is arranged and a valve structure 37 is mounted in the passageway 30. The valve structure 37 includes a plunger 38 held spaced from the walls of the passage 30 by circumferentially spaced lands 39 and mounted for reciprocatory movement in the passage 30. The passage 30 has a valve seat 40 formed therein against which one end of the valve plunger 38 seats during normal operation of the actuating unit. The valve plunger 38 is provided with a longitudinal bore 41 which has communication with the interior of the cylinder or the cylinder bore 5 through the port 31 by means of a plurality of circumferentially spaced ports 42 so that when the valve plunger 38 is seated against the valve seat 40 and the piston 6 is moved in the direction of the arrow E the hydraulic fluid will be forced through the port 31 to port 42 and longitudinally through the valve plunger 38 outwardly through the passage 30 and the conduit 33 to one end of the cylinder 32, and when the piston 6 is moved in the opposite direction oil from one end of the cylinder 32 will return to the cylinder 4 in the same manner only in a reverse direction. The valve plunger 38 has an operating button 43 connected thereto to permit it to be moved longitudinally to move its valve end off the valve seat 40 and at such time the hydraulic fluid will flow through the port 31 and the bypass port 36 and the enlarged portion of the passage 30 about the outside of the valve plunger 38, as well as through its bore 41 permitting the hydraulic fluid to merely "churn" back and forth from the cylinder bore 5 without effecting operation of the actuated mechanism 1.

Since all of the actuating units 2 and 3 are connected in parallel in the hydraulic system the unloading of one of the actuating units will neutralize all of the units in the system and thus the system may be converted to manual steering operation by movement of the motor B by the steering handle C with the unloading of only one of the actuating units in the system.

All of the joints or points in the actuating mechanism 2 which are subject to leakage of hydraulic fluid are packed with suitable packing such as O-rings as shown at 44.

The actuated mechanism 1 includes the cylinder 32 in which a piston 45 (shown in dotted lines in Figure 6 of the drawings) is mounted, and this piston is reciprocated in the cylinder 32 by the hydraulic fluid as it is forced into one end or the other of the cylinder 32 from the actuating unit through the conduits 33 and 34. The cylinder 32 has a conduit 46 formed thereon which conducts hydraulic fluid from the conduit 33 to the piston rod end of the cylinder 32. The piston 45 has a piston rod 47 connected thereto which projects out of the cylinder 32 and is connected to the attaching bracket 48 by a novel type of coupling unit 49 shown specifically in Figures 8 and 9 of the drawings.

The coupling unit 49 includes a yoke 50 which is rigidly attached to the end of the piston rod 47 and is pivotally connected to the bracket 48 through the medium of a pin 51 and a second yoke structure 52. The pin 51 is specially constructed so as to permit quick and easy connection to the yokes 50 and 52 and prevent loss

of the pin when such disconnection is made. The pin has a knurled head 53 to facilitate its manual movement and it is provided with two circular grooves 54 one near its end remote from the knurled head and the other adjacent to its knurled head. A U-shaped spring 55 is mounted in a recess 56 in the spring retaining plate 57. The recess 56 is of sufficient depth and width to permit springing movement of the spring 55 to permit forced movement of the pin 51 but when the pin 51 is withdrawn into the position as shown in Figure 9 of the drawings the spring engages in the groove 54 and prevents accidental removal of the pin 51 from its connection with the yoke 50 while when the pin is in its normal position the spring engages in the groove 54' and prevents accidental displacement of the pin.

The bracket 48 is rigidly attached to the outboard motor B by a plurality of bolts shown at 58 which are a part of the outboard motor structure and normally used to connect one part of the motor housing to another part thereof.

To permit the outboard motor to be swung on its horizontal axis into a horizontal position out of the water a universal joint support is provided for the actuated unit 1. This support, which is shown in Figures 6, 7, 10 and 11 of the drawings includes an attaching bracket 60 which is attached to the boat A and which has a yoke supporting block 61 adjustably connected thereto. The yoke supporting block 61 is provided with a vertical bore 62 which receives therein the stem 63 of the yoke 64. The yoke 64 is pivotally connected to the cylinder 32 by trunnions 65 the axis of which are located in the same plane as the horizontal pivotal axis D and the axis of rotation of the pin 63 in the block 61 is in alignment with the horizontal axis D of horizontal pivotal movement of the outboard motor B as clearly shown by the dash lines F in Figure 6 of the drawings, and thus the outboard motor B may be moved on its horizontal pivotal axis without disconnecting the actuated unit 1 from the outboard motor, without tilting of its vertical axis.

The hub 11 on the piston 6 has a greater cross-sectional area than the hub 12 on the piston which reduces the effective cross-sectional area of the side of the piston which exerts pressure on the hydraulic fluid through the conduit 34 to the end of the piston 32 opposite to the piston rod end of the cylinder. Thus differential areas of the piston 45 are compensated for to insure effective and proper reciprocation of the piston 45 and prevent "locking" of the system as would be the case if both sides of the piston 6 had equal effective cross-sectional areas while the sides of the piston 45 had unequal effective cross-sectional areas.

By simple alteration of the attaching bracket 48 the piston rod 47 can be attached to the rudder of an inboard motor driven boat so that the hydraulic system hereinabove described and shown in the drawings may be utilized for steering an inboard motor boat.

Figure 12 of the drawings shows a modified form of the bypass structure and in this modified form the passage 70 which corresponds to the passage 30 in the preferred form of the invention is open to the bore 71 of the cylinder 72 on each side of the piston 73 through ports 74 and 75, and a valve structure 76 is provided for cutting off communication between the passage 70 and the cylinder bore through the port 75 during normal operation of the steering mechanism and when it is desired to unload the actuating unit the valve 76 is operated to open the passage 70 to the cylinder bore 71 through the port 75. The valve 76 is movable transversely of the axis of the passage 70 in contradistinction to being moved longitudinally of the axis as in the form of the invention shown in Figures 4 and 5 of the drawings. The valve stem 77 has a reduced portion 78 which registers with the passage 70 when the port 75 is closed by the valve thus permitting the flow of hydraulic fluid through the passage 70 in the normal manner.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a hydraulic steering system, in combination, an actuated unit, an actuating unit, and conduits connecting said units in a closed hydraulic system, said actuating unit including a cylinder, a piston in said cylinder, manually operated means for reciprocating said piston to force fluid from the actuating unit into and through said actuated unit, said cylinder provided with a first port opening into the cylinder bore on one side of the piston and communicating with one of said conduits, said cylinder provided with a passageway communicating with another conduit connecting said units and further provided with a pair of transverse ports opening into the cylinder bore one on each side of the piston and into said passageway, a valve in said passageway and provided with an internal bore opening out through one end of the valve into said passageway, said valve provided with one or more ports establishing communication between the valve bore and the transverse port at the side of the piston remote from said first port, said valve movable to open said transverse ports one to the other through the bore of the valve whereby fluid will be passed back and forth through the cylinder without effecting operation of the actuated unit and further movable to connect the cylinder bore at the side remote from said first port to said passageway to effect operation of said actuated unit.

2. A hydraulic steering system as claimed in claim 1 including a plurality of actuating units connected in parallel in the hydraulic system whereby when one of the actuating units is rendered inactive by movement of said valve to render it ineffective to operate the actuated unit all of the actuating units will be rendered ineffective to operate the actuated unit.

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