Sept. 3, 1968 C. E. HAMMOND ETAL 3,399,417

VALVE CONTROL MEANS

Filed Jan. 16, 1967 3 Sheets-Sheet 1

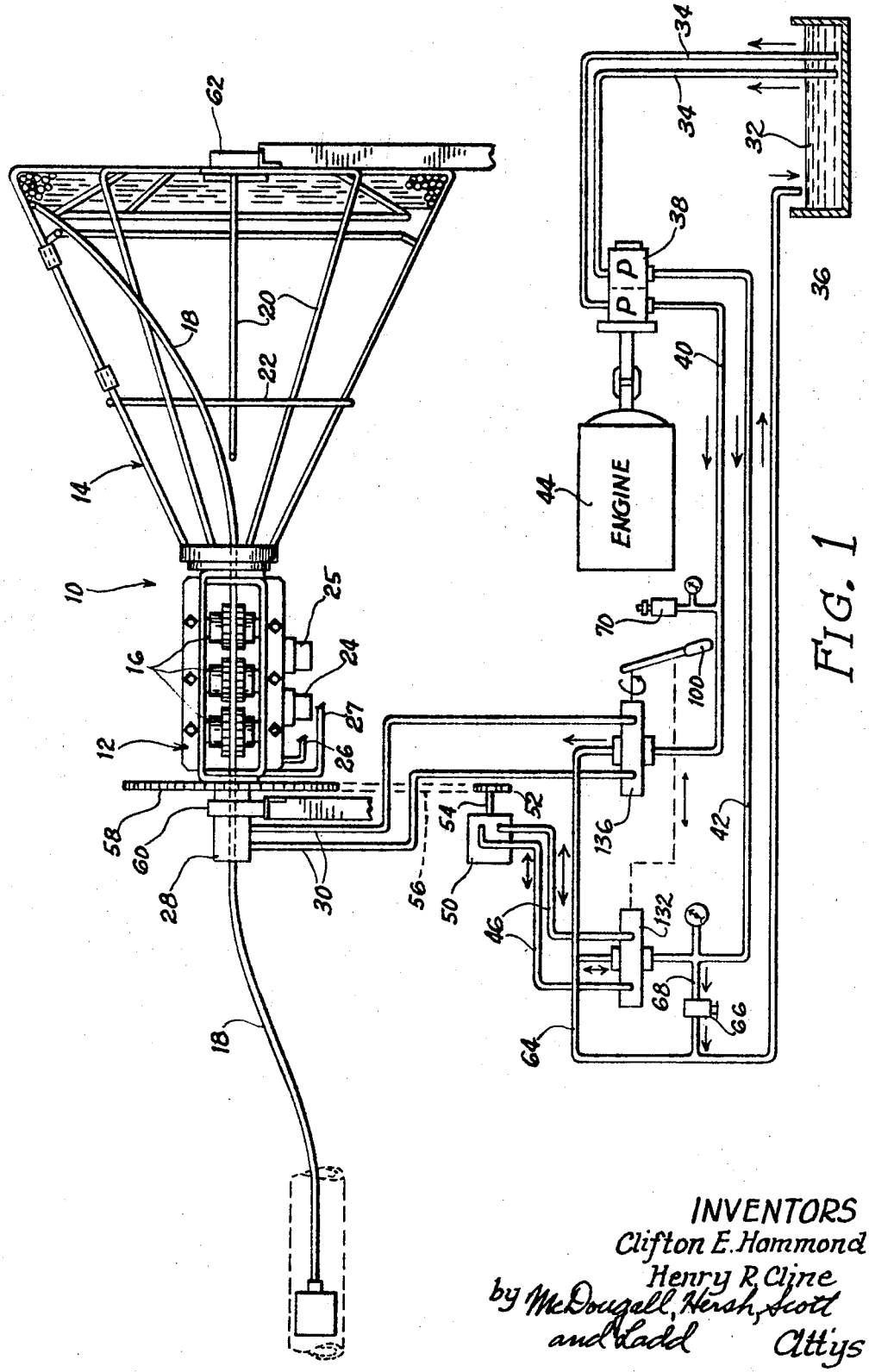


FIG. 1

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Sept. 3, 1968 C. E. HAMMOND ETAL 3,399,417

VALVE CONTROL MEANS

Filed Jan. 16, 1967 3 Sheets-Sheet 2

FIG. 2

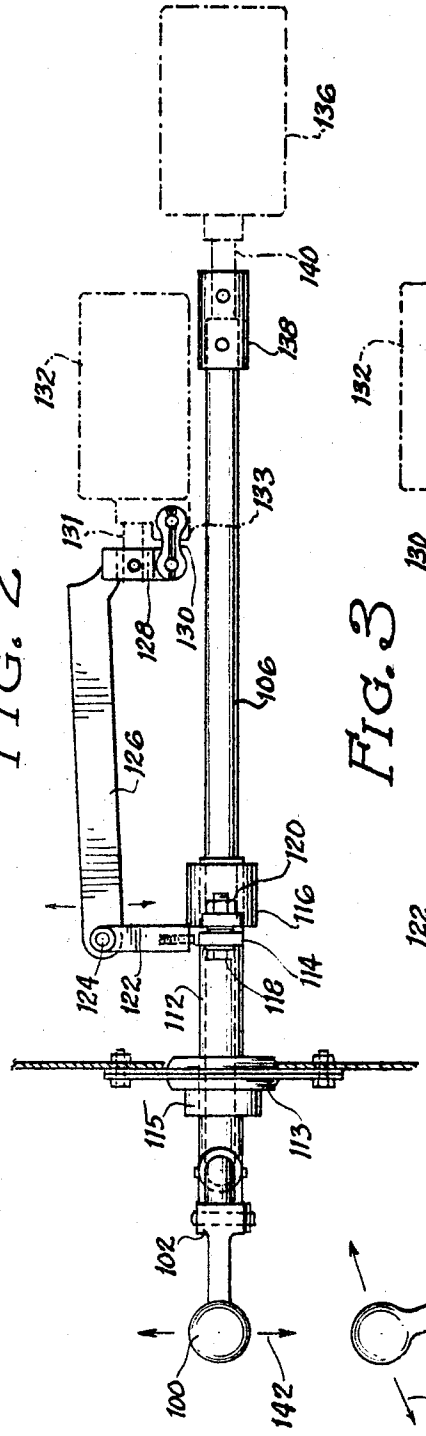
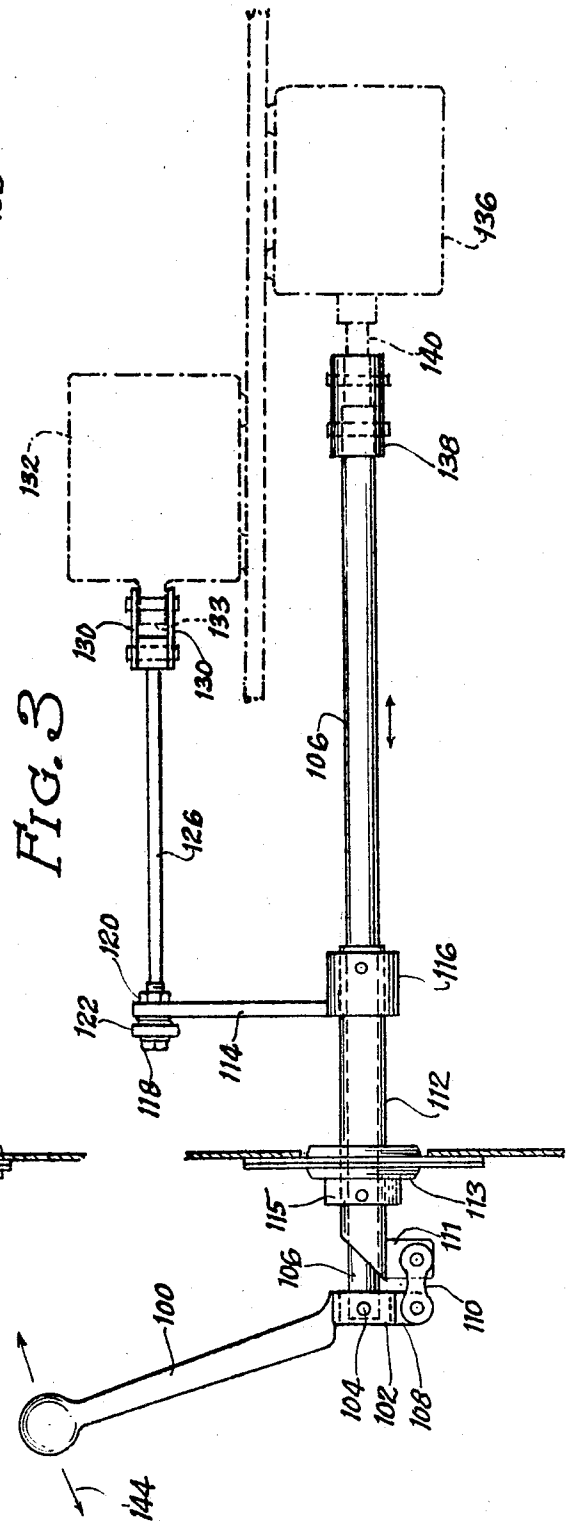


FIG. 3



Sept. 3, 1968 C. E. HAMMOND ETAL 3,399,417

VALVE CONTROL MEANS

Filed Jan. 16, 1967 3 Sheets-Sheet 3

FIG. 4

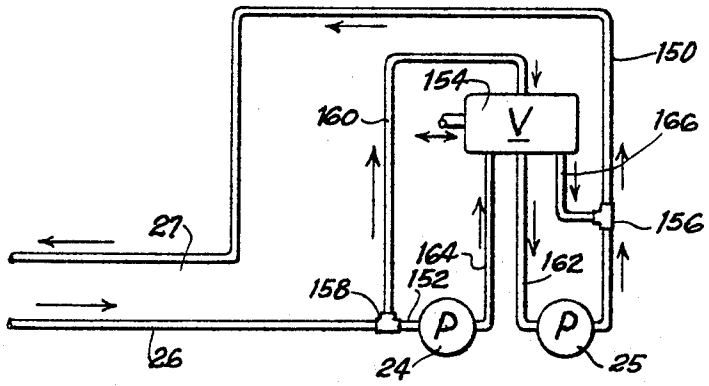


FIG. 5

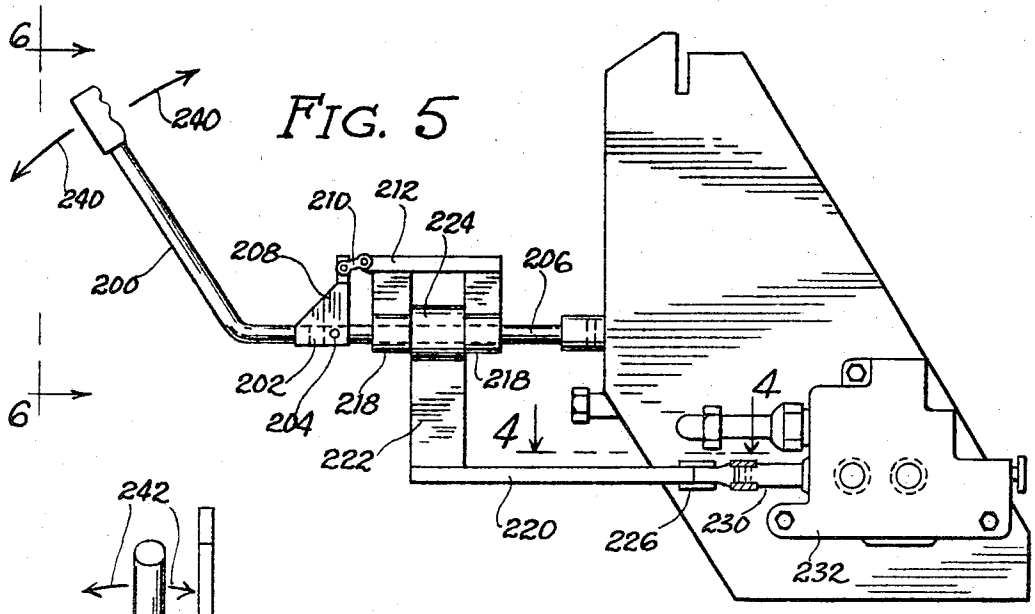


FIG. 6

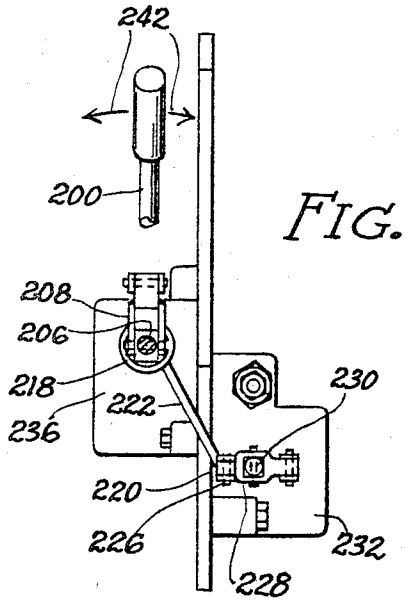
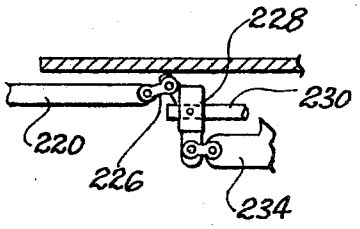


FIG. 7



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3,399,417

VALVE CONTROL MEANS

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Continuation-in-part of application Ser. No. 524,734, Feb. 3, 1966. This application Jan. 16, 1967, Ser. No. 609,387

11 Claims. (Cl. 15—104.3)

ABSTRACT OF THE DISCLOSURE

A rodder construction having separate hydraulic motors for respectively imparting axial and rotary movement to the rod. A single control lever is connected to valve means for the respective motors to provide for the operation of the motors. The linkage for the control lever is such that the natural hand movements of the operator imparts corresponding movement to the rod.

This application is a continuation-in-part of applicants' copending application Ser. No. 524,734, filed Feb. 3, 1966, and now abandoned, which is a continuation-in-part of applicants' application Ser. No. 427,287, filed Jan. 22, 1965, and now abandoned.

Powder rodder constructions have been characterized by certain difficulties with respect to the operation of drive means employed in the constructions. In various prior art constructions where rotary and axial movement of the rod are to be independently controlled, it has been found necessary to utilize separate control levers or the like. This arrangement places burdens on the operator of the equipment to the extent that high proficiency is required for efficient operation. Improper operation due to the inability of an operator to control the device can often lead to breaking of a rod resulting in loss of an expensive rod or substantial delays.

In applicants' copending applications, reference is made to a single lever control which is uniquely suitable for providing a highly efficient means for controlling rodder operation. With the single lever control, the axial and rotary movement of the rodder can be accomplished by one operator, and it has been found that with such controls, the skill necessary for effectively operating the rodder is materially reduced.

It is a general object of this invention to provide a valve control means which is characterized by a single operating lever.

It is a more particular object of this invention to provide a valve control means which is capable of actuating the controls for two separate motors even though only a single operator and a single control lever are employed.

It is a still further object of this invention to provide a valve control means which is uniquely suitable for association with a power rodder whereby axial and rotary drive can be imparted to a rod by means of a single control lever.

It is a further object of this invention to provide improved valve means for use in conjunction with the hydraulic motors operated by the valve control means whereby maximum advantage can be achieved in the use of the hydraulic motors.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of this invention are shown in the accompanying drawings in which:

FIGURE 1 is a combination of a side elevational view of a power rodder and a circuit diagram illustrating suitable drive means for the rodder;

FIGURE 2 is a plan view illustrating single lever control means employed in the rodder construction;

FIGURE 3 is a side elevational view of the control means shown in FIGURE 2;

FIGURE 4 is a perspective view of the hydraulic circuitry affected by the control means including additional valve means for controlling operation of the hydraulic motors;

FIGURE 5 is a detail view illustrating an alternative single lever control means employed in the rodder construction;

FIGURE 6 is an end view of the control means taken about the line **6—6** of FIGURE 5; and,

FIGURE 7 is a detail sectional view taken about the **7—7** of FIGURE 2.

The control means of this invention are generally useful in combination with constructions which include separate fluid operated drive means. The control means includes a single control lever. A valve is associated with each of the drive means, and link means are interposed between the valve and the control lever. The link means are such that the control lever can be moved in one plane to achieve operation of one drive means and in a different plane to achieve operation of the other drive means. When the lever is moved in a path somewhere between the planes referred to, operation of each of the motors will result. The relative speeds and directions of the respective motors will depend upon the particular path of movement of the lever.

As indicated, the control means of this invention will be described with reference to its use in conjunction with a power rodder construction. Such constructions include a continuous length of rod which is to be wound in a rotatable reel associated with the rodder. The reel and drive mechanisms of the construction are associated in an assembly conprising a trailer or the like whereby the entire unit can be moved from place to place. The reel is of the type adapted to supply rod during feeding of the rod into a sewer, and the rod is adapted to be wound onto the reel during retracting from the sewer. The rodders are also employed for running cables through conduits, such as in telephone operations, and for other purposes.

As noted in the aforementioned copending application, drive means for axial movement are located adjacent the entrance end of the reel. The drive means are situated on mounting means which are attached to the reel whereby the mounting means and the reel are rotatable in unison. With the arrangement described, bearing means need be located only at the opposite ends of the assembly comprising the drive means and the reel.

Hydraulic motors are preferably utilized for rotating the reel and associated mounting means, and for operating the drive means which move the rod into and out of the construction. FIGURE 1 illustrates an assembly **10** of the type described including a mounting means **12** and a reel **14**. The mounting means carries rotatable roller members **16**, and these members are provided for controlling the movement of rod **18** into and out of the reel **14**. The reel comprises a cone-shaped cage which includes bars **20** extending from the narrow end to the wide end of the cone. A reinforcing ring **22** is provided centrally of the cage.

Hydraulic motors **24** and **25** are attached to the side of the mounting means **12** for purposes of driving the rollers **16**. Hydraulic lines **26** and **27** provide for feeding of hydraulic fluid to the motors **24**. These hydraulic lines are connected through rotary coupling **28** to hydraulic lines **30**. The hydraulic lines **30** extend to valve **136**.

Hydraulic fluid **32** is supplied through lines **34** from reservoir **36**. A double pump construction **38** passes the fluid through lines **40** and **42** to valves **136** and **132**, re-

spectively. An engine 44 functions to deliver the hydraulic fluid in accordance with the needs of the system.

The valve 132 is connected by means of lines 46 to the hydraulic motor 50. A drive gear 52 is mounted on the shaft 54 of this motor, and this drive gear imparts driving movement through chain 56 to sprocket 58. The sprocket 58 is connected to the mounting means 12 whereby rotary movement is provided to the entire assembly mounted between bearings 60 and 62.

The valve 132 is a three-position valve whereby either of the lines 46 can be utilized to effect movement of the motor 50 in either direction. The third position of the valve permits by-passing of the valve through line 64 to the reservoir 36. Obviously, in this condition, the motor 50 will not be in operation. A safety relief valve 66 is included in line 68 whereby any tendency of the motor 50 to resist operation will result in a by-pass.

The valve 136 also comprises a three-position valve whereby the motors 24 and 25 can be operated through either of the lines 30 and through either of the corresponding lines 26. The third position of the valve 136 is connected to line 64 to provide for a by-pass. A safety valve 70 is included in the line 40.

FIGURES 2 through 4 illustrate in detail a preferred form of a single lever control construction for valves 132 and 136. The operating handle 100 includes lower end 102, which is pivotally connected by means of pin 104 to the rod 106. An extension 108 of the handle is attached by means of link 110 to projection 111 formed on sleeve 112. The sleeve extends through bearing 113 and lock collar 115. The lock collar prevents any longitudinal shifting of the sleeve 112, however, the sleeve is rotatable within the bearing.

An arm 114 is fixed to a collar 116 which is attached at the end of the sleeve 112. A nut 118 and bolt 120 are provided for securing a link 122 to an outer end of the arm 114. The link 122 is pivotally connected at 124 to lever 126. This lever includes an end portion 128 having one end of an element 130 pivotally connected thereto. The element 130 is a floating pivot having its opposite end connected to projection 133 formed on the face of the housing of valve 132. The piston 131 of valve 132 is connected to the lever portion 128.

The rod 106 is secured to sleeve coupling 138. The piston 140 of the valve 134 is secured at the other end of the coupling 138. It will be apparent that operation of the valves 132 and 134 is dependent upon movements imparted to the respective pistons of these valves by the lever 126 and rod 106, respectively.

The rod 106 is adapted to slide back and forth within the sleeve 112, and the rod is shifted longitudinally when the handle 100 is moved in the direction of the arrows 144 shown in FIGURE 3. This movement of the handle imparts corresponding shifting movement to the piston 140.

The piston 131 is operated when the handle 100 has a component of movement in the plane represented by the arrows 142 shown in FIGURE 2. Movement in this plane causes the end of the handle to rotate the sleeve 112 whereby movement is imparted to link 122. This moves lever 126 which then acts to shift piston 131. The linkage associated with the end of lever 126 is the same as that associated with handle 100.

The single lever arrangement shown in FIGURES 2 and 3 employs valves 132 and 136 which have pistons shifting back and forth longitudinally. The arrangement of FIGURES 5, 6 and 7 comprises an embodiment wherein one of the valves has a longitudinally movable piston while the other valve has a rotatably movable piston.

In FIGURES 5, 6 and 7, the valves 232 and 236 correspond respectively with the valves 132 and 136 insofar as operation of the motors 50, 24 and 25 are concerned.

In this alternative arrangement, the operating handle 200 is rigidly attached to triangular member 202, and this member is pivotally connected at 204 to the rod 206. The upper end 208 of this member is attached by means of link 110 to sliding element 212. The element 212 includes legs 218 which receive the rod 206 and are adapted to rotate with respect to this rod as well as to slide axially thereof.

A second rod 220 carries an extension 222, and the bored end 224 of this extension receives the rod 206. As noted, the legs 218 straddle this end 224 whereby axial movement of the member 212 will shift the extension 222 with respect to the rod 206. Rotary movement of the member 212 will, however, have no effect on the extension 222.

The rod 220 is connected by means of the link 226 and element 228 to the piston 230 of valve 232. The element 228 is linked to a post 234 whereby axial movement of the rod 220 will result in corresponding axial movement of the piston 230.

The rod 206 is connected to the second valve 236. This valve is of the type which includes a rotary piston for purposes of opening and closing the passages therein. The valve 232 obviously comprises a reciprocal piston type.

When applied to the operation of a sewer rodder, the arrangement illustrated provides an extremely efficient means for achieving rotary and axial movement alone or in infinite number of combinations of such movements within the limits of the respective drive means. In the disclosed arrangement, the valve 232 is connected to the drive motor 50 which provides for rotary movement of the carriage while the valve 236 provides for the operation of the motors 24 to achieve axial movement.

When applied to the operation of rodders, the arrangements illustrated provide an extremely efficient means for achieving rotary and axial movement alone or an infinite number of combinations of such movements within the limits of the respective drive means. In the disclosed arrangements, the valves 132 and 232 are connected to the drive motor 50 which provides for rotary movement of the carriage while the valves 136 and 236 provide for the operation of the motors 24 and 25 to achieve axial movement.

When the operator moves the handle 100 in the plane of the arrows 142 (FIGURE 2), the piston 131 of the valve 132 is shifted whereby the operation of motor 50 is controlled. Obviously, the direction and amount of movement of the handle will determine the speed and direction of rotation.

Movement of the handle in the plane represented by the arrows 144 (FIGURE 3) will provide for actuation of the motors 24 and 25. Again, the degree of movement of the handle and the direction of this movement determines the operating speed of the motors whereby the direction and speed of axial movement of the rod 18 can be controlled.

The handle 200 operates in the same manner with respect to valves 232 and 236. In either arrangement, when the handle is moved at an angle with respect to the planes referred to, both of the valves will be affected whereby a combination of rotary and axial movement will result. It will be noted in this connection that the movements which result from the handle operation correspond to the natural instincts of the operator. Thus, the handle is located at the side of a rodder construction, and movements in the direction of the arrows 142 correspond with forward and retracting movements of the rod. Likewise, movements in the direction of the arrows 144 result in rotation of the cage in the same direction. With this feature, the rodder can be very efficiently operated even though the operator may not be particularly skilled.

FIGURE 4 illustrates a hydraulic arrangement which can be advantageously used in a construction of the type contemplated by this invention. In the embodiment illustrated, the hydraulic lines 26 and 27 are directed to hydraulic lines 150 and 152. A conventional three-way, spool-type valve 154 is connected to these lines through T's 156 and 158, respectively.

The valve **154** is operated whereby the motors **24** and **25** will operate in parallel or in series. In the first condition, fluid entering through line **26** separates at T **158** with a portion driving the motor **24**. The motor **25** is driven in unison with the motor **24** by the remaining fluid from the T **158** which passes from line **160**, through valve **154** and line **162** through the motor, and then to T **156** through line **150** to line **27**. Fluid from motor **24** passes through line **164**, through valve **154**, and then to T **156** through line **166**.

In order to drive the motors in series, the position of valve **154** is changed so that flow from T **158** and to T **156** is blocked. Accordingly, all fluid from line **26** flows through motor **24** through valve **154** to motor **25** and then to line **27** through line **150**. Reverse operation of the motors takes place in the same way but with the flow in each line reversed.

An arrangement of this type is highly desirable in a rodder construction. When the motors **24** and **25** are driven in parallel, the drive rollers connected to these motors will operate at high torque since full pressure is applied to each motor and maximum driving force is imparted to the drive rod.

When the motors operate in series, maximum speed will be developed in the system since the amount of hydraulic fluid fed to each motor is the same. The torque imparted to the rod will be reduced to about one-half the torque produced where the motors are driven in parallel. It will be appreciated that the high speed operation will be most desirable when feeding or retracting the sewer rod. On the other hand, the high torque operation is desirable when obstructions are encountered.

Since the valve **154** is located on the rotating frame, it may be necessary to stop the rotation of the frame in order to change the state of the valve positions. Thus, manual controls may be provided on the frame, and these could not be operated while the frame is rotating. It is contemplated, however, that automatic operation of the valve means could readily be accomplished, for example by providing the control means on the stationary frame with the actual valve operating means being mounted on the rotating frame. Commutator rings could be provided between the stationary and rotating sections of the rodder whereby the valves could be operated by electrical signal. On the other hand, automatic operation of the valves could be initiated by means adapted to sense the amount of pressure exerted by the rod at any particular stage of the operation.

It will be appreciated that the instant invention does not require the use of valves of the specific types disclosed since various combinations of rotary and reciprocal movement are possible. Furthermore, it will be apparent that the planes within which the lever operates to achieve the separate movements need not be situated exactly 90° with respect to each other.

It will be understood that various changes and modifications may be made in the above described construction which provide the characteristics of this invention without departing from the spirit thereof, particularly as defined in the following claims.

That which is claimed is:

1. In a power rodder apparatus including separate hydraulic drive systems adapted to impart simultaneous driving movement to a rod carried by the apparatus, each of said drive systems including a hydraulic motor with one of said drive systems being adapted to impart axial movement to said rod and wherein the other of said drive systems is adapted to impart rotary movement to said rod whereby either of said movements as well as combined axial and rotary movement can be achieved, the improvement comprising a single control lever for said drive systems, a valve means included in each of said drive systems, means connecting said lever to each of said valve means whereby movement of said connecting means is adapted to control the speed and direction of each of said drive systems, said single lever being pivotally mounted for movement in separate planes and for movement to an infinite number of positions between said planes, and said connecting means comprising links between said valves and said lever with one of said valves being operated when said lever is moved in either of said planes and with both of said valves being operated when said lever is moved to any of said positions between said planes, one of said planes being situated substantially perpendicular to the axis of said rod as it is moved longitudinally, and the other of said planes being situated substantially parallel to the rod as it is moved longitudinally, said lever being movable in said one plane to effect rotary movement of said rod, and said lever being movable in said other plane to effect longitudinal movement of said rod, the respective movements of said lever thereby involving natural hand movements for achieving the corresponding rod movements.

2. An apparatus in accordance with claim **1** wherein a first valve in the system for controlling said axial movement includes a rotatably mounted piston and wherein a second valve in the system for controlling said rotary movement includes a reciprocally mounted piston.

3. An apparatus in accordance with claim **2** wherein the connecting means between said lever and the piston of said first valve comprises a first rod tied to said lever whereby pivoting of said lever to either side of the axes of said rod results in rotation of the rod and corresponding rotation of the piston of said one valve.

4. An apparatus in accordance with claim **2** wherein the connecting means between said lever and the piston of said second valve comprises a pivotal member, means linking said pivotal member to a sliding member whereby movement of said pivotal member moves said sliding member, and a second rod connecting said sliding member to the piston of said second valve.

5. An apparatus in accordance with claim **4** wherein said sliding member is positioned for sliding movement on said first rod.

6. An apparatus in accordance with claim **1** wherein each of said valves includes a reciprocally mounted piston.

7. An apparatus in accordance with claim **6** wherein the connecting means between said single lever and the piston of said first valve comprises a rotatable sleeve, and link means connecting said sleeve with a lever arm, pivotal movement of said lever arm resulting in reciprocal movement of the piston of said first valve.

8. An apparatus in accordance with claim **7** wherein the connecting means between said single lever and the piston of said second valve comprises a rod reciprocally movable within said sleeve, and means securing one end of said rod to said single lever and the other end of said rod to the piston of said second valve.

9. An apparatus in accordance with claim **1** wherein the drive system for imparting axial movement to said rod includes a pair of hydraulic motors, and including valve means associated with hydraulic feed lines for said motor, said last mentioned valve means being adapted to alternatively drive said pair of motors in parallel and in series.

10. In a power rodder apparatus including separate hydraulic drive systems adapted to impart simultaneous driving movement to a rod carried by the apparatus, each of said drive systems including a hydraulic motor with one of said drive systems being adapted to impart axial movement to said rod and wherein the other of said drive systems is adapted to impart rotary movement to said rod whereby either of said movements as well as combined axial and rotary movement can be achieved, the improvement wherein the drive system for imparting said axial movement includes a pair of hydraulic motors, and including valve means associated with hydraulic feed lines for said motors, the operation

of said valve means being adapted to alternatively drive said pair of motors in parallel and in series.

11. An apparatus in accordance with claim **10** wherein said rod is stored in a rotatably mounted carrying means whereby rotation of the carrying means by the other hydraulic drive system imparts said rotary movement to the rod, and wherein said pair of hydraulic motors is mounted for rotation with said carrying means.

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EDWARD L. ROBERTS, *Primary Examiner.*