W. G. STOWELL.

HYDRAULIC MOTOR.

APPLICATION FILED OCT. 26, 1908.

**944,220.** Patented Dec. 21, 1909.

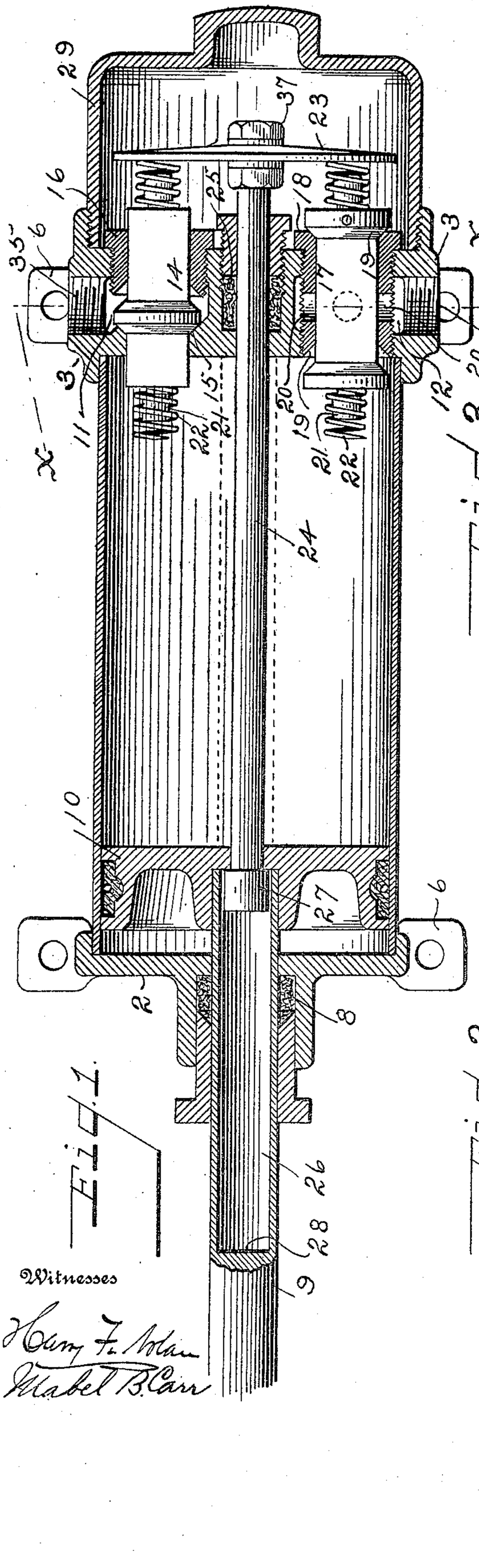

Fig. 1.

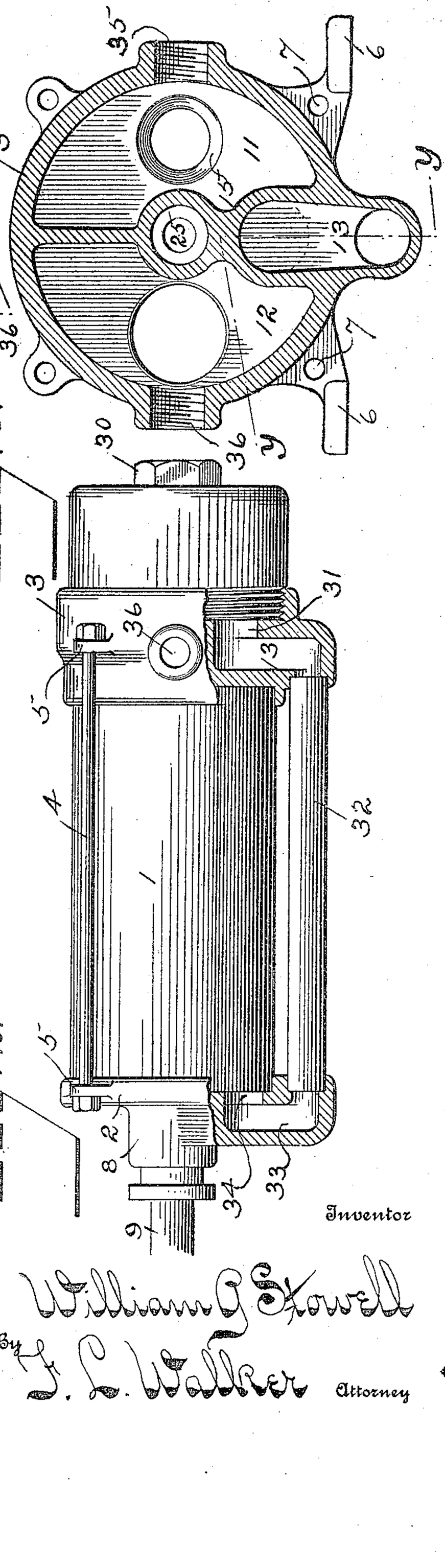

Fig. 3.



Fig. 2.

Witnesses

Harry F. Adam

Mabel B. Carr

Inventor

William G. Stowell

By F. L. Walker Attorney

# UNITED STATES PATENT OFFICE.

WILLIAM G. STOWELL, OF DAYTON, OHIO, ASSIGNOR TO THE W. G. STOWELL CO., OF DAYTON, OHIO, A CORPORATION OF OHIO.

## HYDRAULIC MOTOR.

944,220. Specification of Letters Patent. Patented Dec. 21, 1909.

Application filed October 26, 1908. Serial No. 459,487.

*To all whom it may concern:*

Be it known that I, WILLIAM G. STOWELL, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Hydraulic Motors, of which the following is a specification.

My invention relates to power motors and particularly to hydraulic motors of the reciprocating type.

The object of the invention is to provide in such type of motor a construction which enables access to be had to the interior operating parts of the motor, particularly the valves with the least possible effort and without dismembering the structure.

Referring to the drawings, Figure 1 is a horizontal longitudinal sectional view through the assembled motor. Fig. 2 is a side elevation of the assembled motor partly broken away as indicated by line *y y* of Fig. 3. Fig. 3 is a transverse sectional view through the valve housing on line *x x* of Fig. 1.

Like parts are indicated by similar characters of reference throughout the several views.

The invention relates to that type of water motors which comprises the cylinder having a reciprocating piston therein and a stationary valve housing in which are located inlet and outlet valves with means for reversing the positions of the valves at either limit of the piston stroke to discharge the water or other fluid alternately on opposite sides of the reciprocating piston.

In the drawings, 1 represents the cylinder which may be of tubing of suitable size. The cylinder 1 is inclosed between a cylinder head 2 and a valve housing 3, each of which are recessed to receive the ends of the cylinder 1, the structure being retained in position by tie-rods 4 engaging ears 5 of the head 2 and the valve housing respectively. The head 2 and valve housing 3 are also provided with supporting feet or lugs 6 having openings 7 therein for additional tie-rods 4. The head 2 is provided with a stuffing-box 8 through which projects a piston rod 9 attached to the piston head 10 which reciprocates within the cylinder 1. The valve housing 3 is divided into three non-communicating chambers, 11, 12, and 13. Located in the chamber 11 is a reciprocating inlet valve 14, one valve seat for which is formed in the inner side of the chamber 11 as at 15, the opposite valve seat being on the extremity of a bushing 16, screw threaded into the valve housing 3. The external diameter of the bushing 16 is such that when said bushing is removed from the valve housing 3, the valve 14 and its springs 22 may be readily withdrawn from the chamber 11.

Located in the chamber 12 is a reciprocating outlet valve 17. The outlet valve 17 is mounted in a bushing 18 screw threaded into the housing 3. Valve seats 19 are provided on the opposite ends of the bushing 18 for the outlet valve 17. The bushing 18 is further provided with a plurality of transverse openings 20 communicating with the chamber 12. The external diameter of the bushing 18 is equal to or greater than the diameter of the heads of the valve 17. By unscrewing the valve bushing 18 from the valve housing 3 the outlet valve 17 and its springs 22 will be removed therewith.

Both the inlet valve 14 and the outlet valve 17 are provided with valve stems 21 projecting in opposite directions beyond the valve housing 3 and are further provided with helical springs 22 projecting somewhat beyond the extremity of the valve stems 21. The valves 14 and 17 are adapted to be moved in one direction, that is, to the right in Fig. 1, by the contact of the piston head 10 upon the springs 22 and valve stem 21, as the piston head 10 approaches the limit of its stroke or contacts the springs 22 carried on the stems of the respective valves and compresses said springs 22 until the piston head contacts the valve stems 21. A slight further movement of the piston 10 will unseat the respective inlet and outlet valves. After being unseated the expansion of the helical springs 22 will complete the movement of the valves, causing them to be completey reversed and seated on the opposite valve seats. Other means must be provided for tripping the inlet and outlet valves when the piston 10 reaches the opposite limit of its stroke. This valve tripping mechanism comprises a disk 23 carried on the extremity of the reciprocating rod 24 mounted in bearings in the valve housing 3 and piston head 10. A stuffing-box 25 is provided in the valve housing 3 through which the rod 24 projects. The opposite

end of the rod 24 projects through the piston head 10 and into a central bore 26 in the piston rod 9. Within the bore 26 the rod 24 is provided with a head 27 which limits the relative movement of the piston rod 9 and rod 24. The depth of the bore 26 in the piston rod 9 is such that prior to the contact of the piston head 10 with the valve springs 22 the bottom or end 28 of the bore 26 will contact the head 27 of the rod 24 and cause the rod 24 and disk 23 to move away from the valves 14 and 17 in unison with the movement of the piston. Thus the valve tripping disk 23 will have moved entirely out of the path of the valves and will allow said valves free movement under the action of the springs 22 after they are tripped by the contact of the piston head 10. Upon the reverse movement of the piston as it approaches the limit of its stroke, the piston head 10 will engage the head 27 of the rod 24 and draw the rod 24 in the direction of movement of the piston, causing the disk 23 to engage the valve springs 22 on the opposite side of the valve housing 3 and compresses said springs until the disk 23 engages the valve stems 21, when by additional movement of the parts by the piston, the disk will be caused to unseat the valves, after which the springs 22, by their expansion, will cause a complete reversal of said valves.

From the above description it will be apparent that the piston 10 moves independent of the rod 24 and disk 23 throughout the greater portion of its stroke and engages said rod 24 only as it approaches the limit of its stroke in either direction. As it approaches the limit of its stroke to the right in Fig. 1, it engages the rod 24 to move the disk 23 away from the valves to allow the valves free action, when reversed by the contact of the piston. As it approaches the limit of its stroke to the left in Fig. 1 it engages the head 27 of the rod 24 to move the disk 23 into engagement with the valve stems and springs and cause the reversal of the valves.

Screw threaded into the valve housing 3 on the side opposite the cylinder 1 is a cylinder extension 29 which may be removed from the engagement with the housing to expose the valves and valve bushings and disk 23 without disturbing any of said parts. In order that the extension 29 may be readily removed and replaced, a hexagon projection 30 is provided to be engaged by a wrench or spanner. The chamber 13 in the valve housing 3 communicates with the interior of the cylinder extension 29 through the orifice 31. A pipe or conduit 32 connects the chamber 13 with the conduit or passage 33 in the cylinder head 2 which communicates with the interior of the cylinder 1 through an orifice 34. A water inlet orifice 35 is provided in the chamber 11 and a water outlet orifice 36 is likewise provided in the outlet chamber 12.

The operation of the device is as follows: With the parts arranged as shown in Fig. 1, the water or other fluid supply enters through the inlet orifice 35 to the chamber 11 thence, through the opening controlled by the inlet valve 14 to the cylinder extension 29; and thence, through the orifice 31 to the chamber 13; from which it is carried by the pipe or conduit 32 to the passage 33 in the head 2; and thence, through the orifice 34 into the cylinder 1 and discharged against the rear side of the piston head 10. The fluid thus entering the cylinder 1 between the piston 10 and the head 2, forces the piston 10 in its movement to the right. The exhaust water from the cylinder 1 and in advance of the piston head 10 passes through the outlet in the valve housing controlled by the valve 17 and through the transverse openings 20 in the bushing 18 to the interior of the discharge chamber 12; and thence, through the outlet 36. Upon the reversal of the parts after the piston head 10 has engaged and operated the respective valves, the inlet supply will enter through the chamber 11 directly into the cylinder 1 at the right of the piston head 10, while the exhaust from the cylinder 1 at the left of the piston head will travel through the reverse course through the orifice 34, the passage 33, the conduit 32, and the chamber 13; thence, to the cylinder extension 29 from which it will flow into the discharge chamber 23 through the opening controlled by the outlet valve 17 and then through the outlet orifice 36. By unscrewing the cylinder extension 29, the valves, bushings, and springs are readily removable, without disconnecting the tie-rods 4 or disturbing any other parts of the motor. When the cylinder extension 29 is removed and the piston 10 is forced to the right hand end of the cylinder 1, the disk 23 which is secured upon the rod 24 by nuts 37, can readily be pulled away from the proximity of the valves to allow them to be removed. The bushing 16 may be unscrewed from the valve housing 3 which will permit the valve 14 with its springs 22 to be withdrawn from the chamber 11. The valve 17 being mounted within the bushing 18 which forms the valve seats for said valve 17 may be removed with its springs 22 by unscrewing the bushing 18 from the valve housing 3.

In motors of this type it is the valves and springs which give the most trouble and require the most attention. In the structure described, the valves and springs may be readily and easily removed or replaced without disturbing the other parts of the motor.

From the above description it will be apparent that there is thus produced a motor of the character described, possessing the

particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportion, detail construction, and arrangement of parts, without departing from the principle involved, or sacrificing any of its advantages.

Having thus described my invention I claim:

1. In a motor of the type specified, a cylinder inclosed at one end by a head united to a supporting base, a housing having inlet and outlet chambers inclosing the other end of said cylinder, a cap detachably secured to said housing and forming a continuation of the cylinder beyond said housing, bushings detachably connected within the chambers of said housing and providing valve seats, said bushings being detachable in the direction of the said cap, and one of said bushings having a series of ports at points intermediate the valve seats, double puppet inlet and double puppet exhaust valves mounted in said bushings and removable therewith, a piston within the cylinder, a hollow piston rod connected to said piston and extending in one direction therefrom, the hollow portion of said piston rod being of a length less than the effective stroke of the piston, a piston rod extension or trip rod extending into the hollow portion of the piston rod and through the axis of the valve housing, said trip rod having a head upon the end thereof which extends into the hollow piston rod, and a disk detachably secured to the other end of said trip rod and lying between the valve housing and the detachable cap, substantially as specified.

2. In a reciprocating water motor, a cylinder, a piston within said cylinder, a valve housing inclosing one end of said cylinder, a detachable cap secured to said valve housing and forming a continuation of the cylinder, said valve housing having inlet and exhaust chambers adapted to communicate with the chambers on each side of said housing, detachable bushings mounted in said chambers and providing one of the seats for the inlet valve and the two seats for the exhaust valve, the bushing providing the seats for the exhaust valve having a series of ports between said seats, the bushings and the valves being removable together from the housing, a piston rod connected to the piston and provided with a cavity therein, a reciprocating trip rod having a head extended into the cavity in the piston rod and adapted to alternately engage the piston and the terminal wall of the cavity in the piston rod, and to thus be actuated, said trip rod extending through the axis of the valve housing, and a disk mounted upon the end of said trip rod between the valve housing and the removable cap, substantially as specified.

In testimony whereof, I have hereunto set my hand this 20th day of October A. D. 1908.

WILLIAM G. STOWELL.

Witnesses:
F. L. WALKER,
HARRY F. NOLAN.