

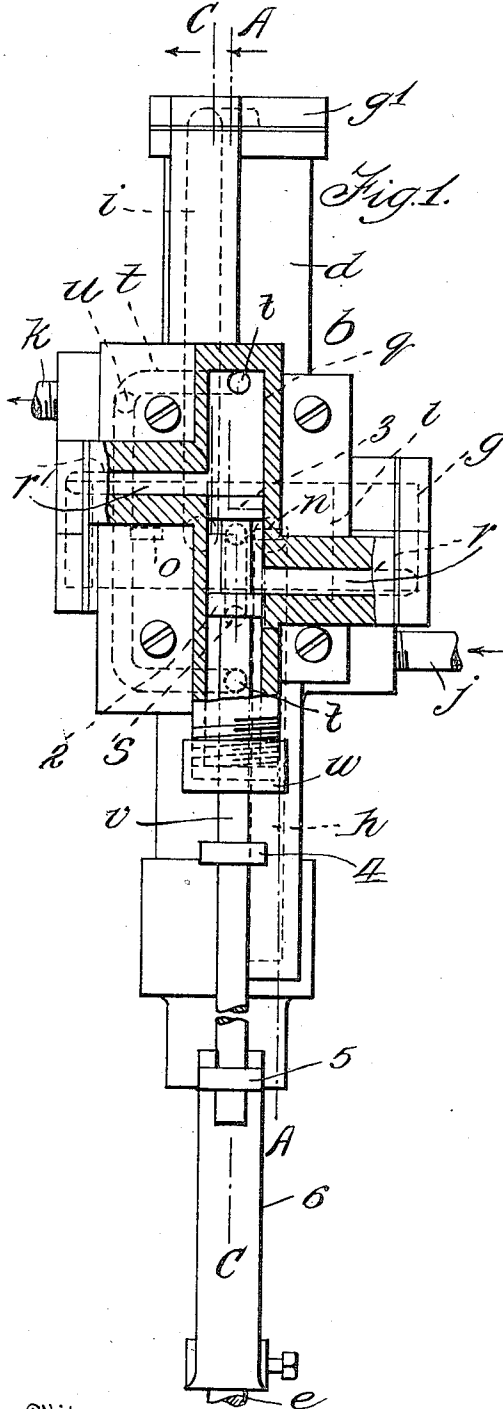
J. E. FEE.
HYDRAULIC MOTOR.

APPLICATION FILED JUNE 5, 1911.

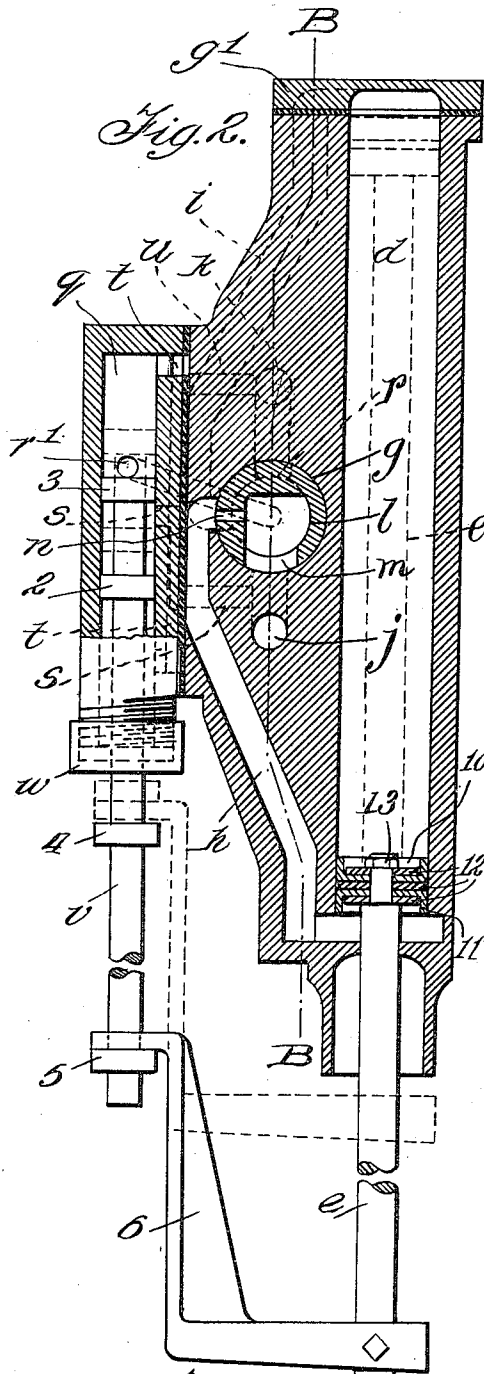
Patented Oct. 29, 1912.

1,042,420.

4 SHEETS-SHEET 1.



Witnesses
Richard Batchelor
John E. Fee



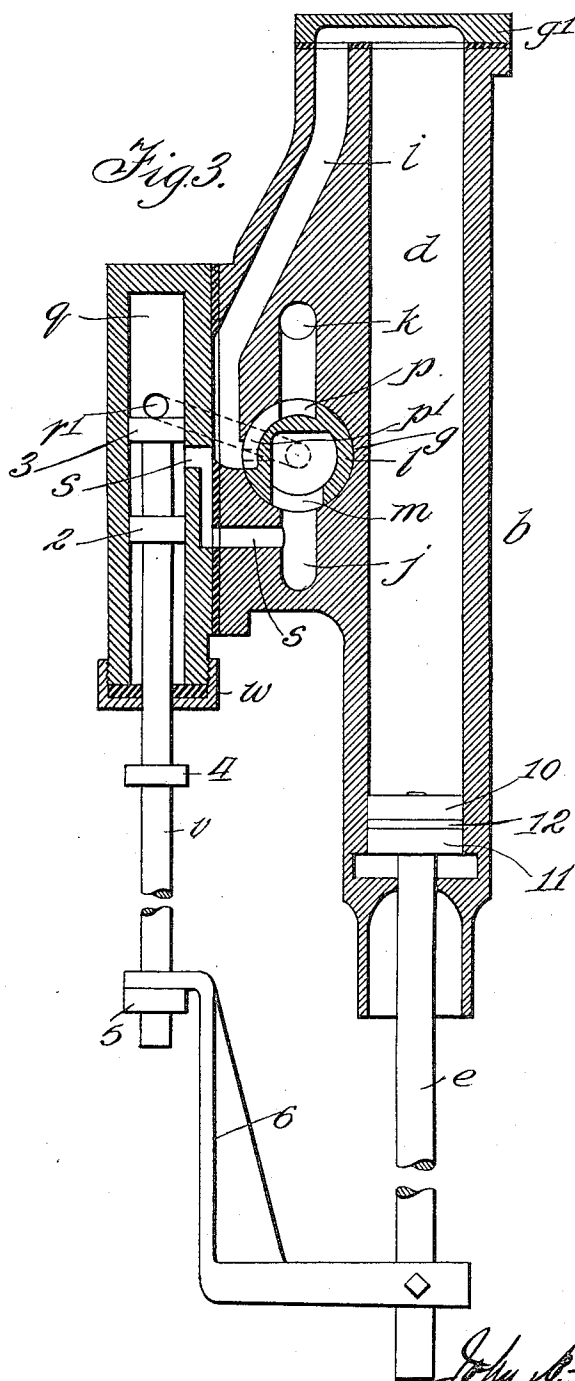
John E. Fee
Inventor
By Attorney
John N. Warr

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4 SHEETS—SHEET 2.



Witnesses
Arthur Batchelor
John E. Fee

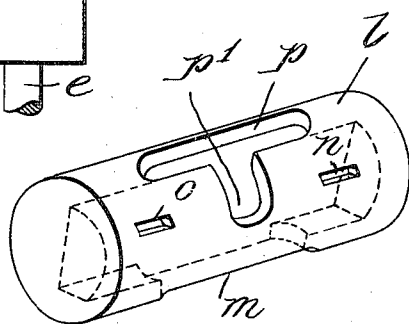
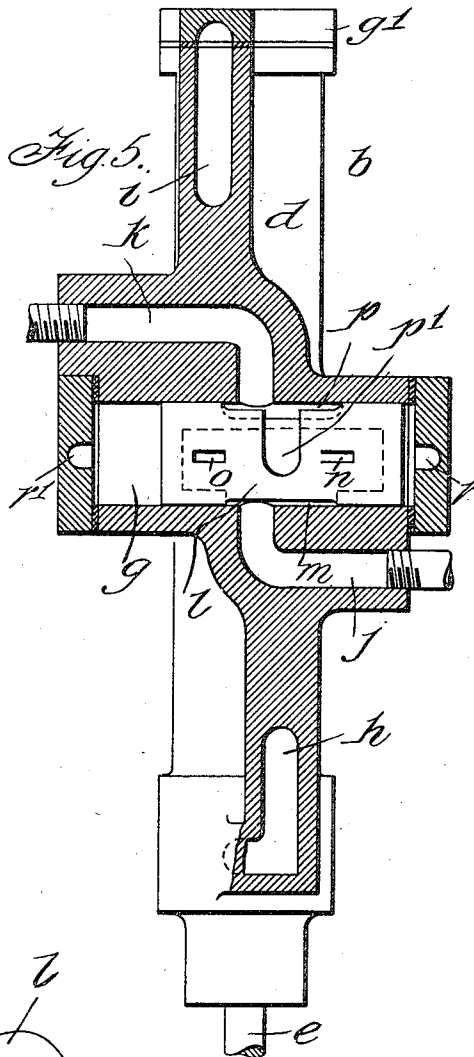
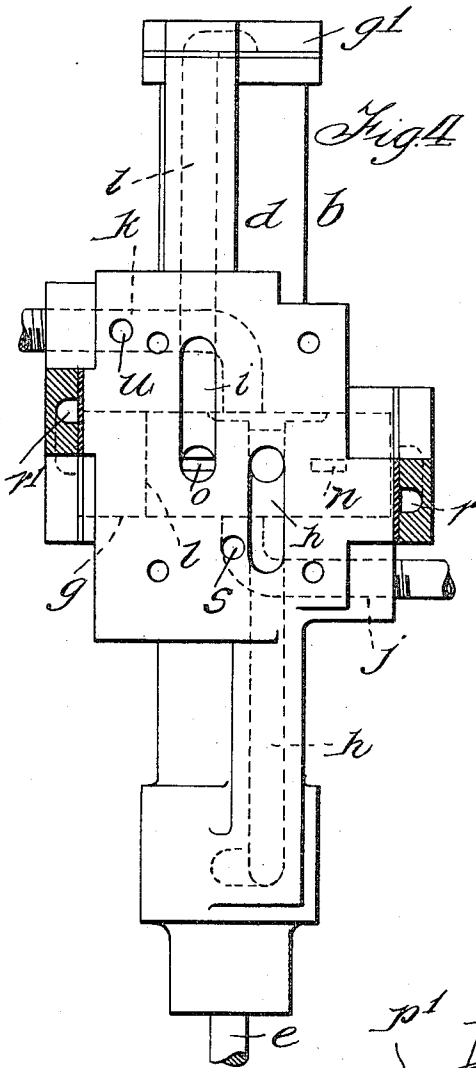
John E. Fee
Inventor
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John W. Swan

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4 SHEETS—SHEET 3.



Witnesses
Alvin Batcher
Wm. H. Brown

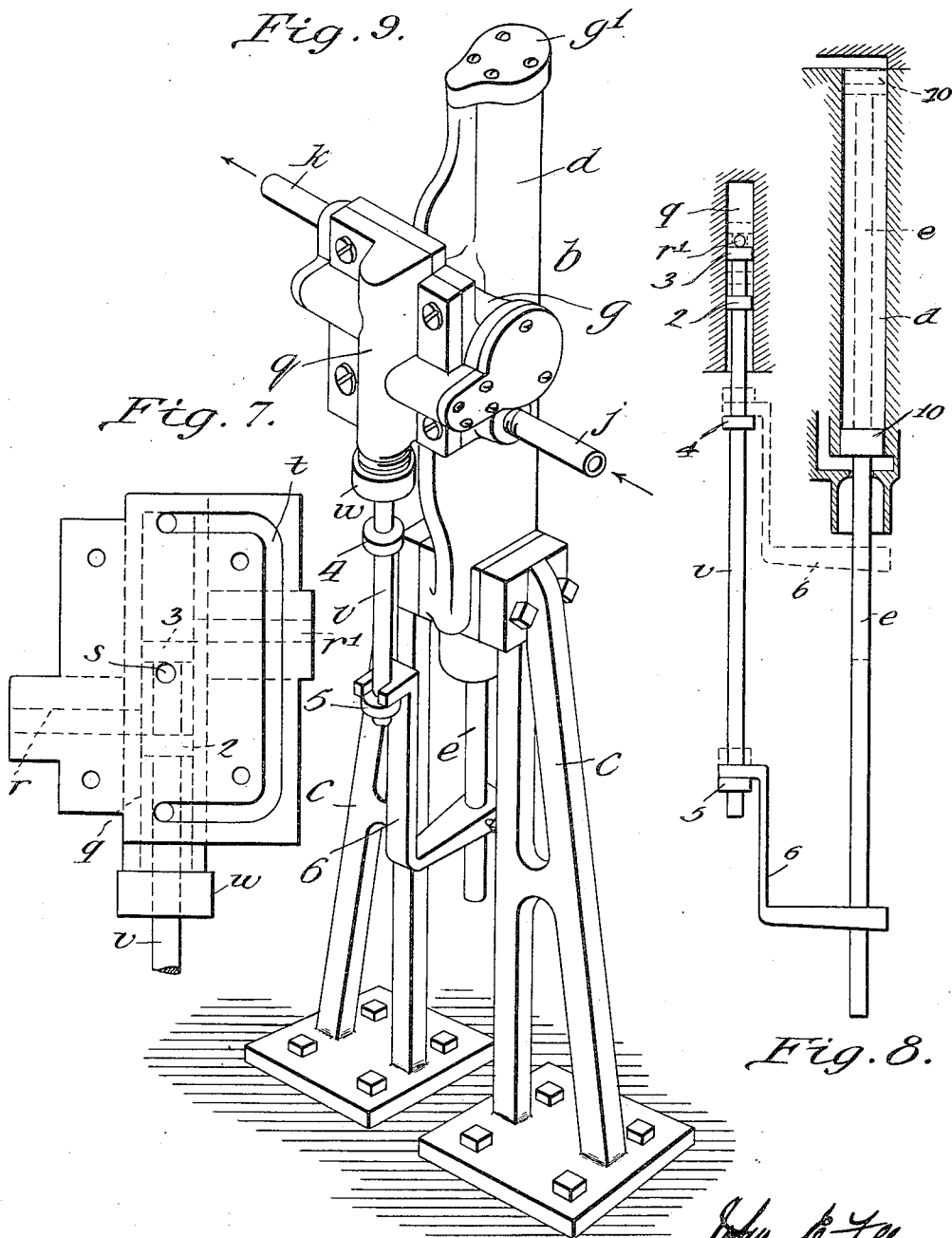
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4 SHEETS—SHEET 4.



Witnesses
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UNITED STATES PATENT OFFICE.

JOHN EVERETT FEE, OF MONTREAL, QUEBEC, CANADA.

HYDRAULIC MOTOR.

1,042,420.

Specification of Letters Patent.

Patented Oct. 29, 1912.

Application filed June 5, 1911. Serial No. 631,387.

To all whom it may concern:

Be it known that I, JOHN EVERETT FEE, of the city of Montreal, in the Province of Quebec, Canada, have invented certain new and useful Improvements in Hydraulic Motors; and I do hereby declare that the following is a full, clear, and exact description of the same.

This invention relates to that type of fluid motor wherein the motive fluid is first directed to one end of the piston cylinder to move the piston in one direction and automatically shut off and directed to the opposite end of the cylinder to reverse the movement of the piston.

One of the objects of the present invention is to provide a pair of coöperating devices, preferably valve mechanisms, one of which directs a portion of the motive fluid and causes it to act upon the other to move and alternately direct the main volume of the motive fluid to each end of the piston cylinder to reciprocate the piston while at the same time disposing of the exhaust on the reversal of the stroke of the piston.

A further object is to so form the fluid controlling valve that the direction of flow of the motive fluid is reversed gradually and without any sudden jar or jerk thus increasing the life and usefulness of the motor.

A still further object is to so form the entire motor that the cost of manufacture is comparatively slight for the reason that very little machining is required and the parts are easily and quickly assembled.

For full comprehension, however of my invention reference must be had to the accompanying drawings, forming a part of this specification, in which similar reference characters indicate the same parts and wherein—

Figure 1 is a front elevation of my improved motor, partly broken away. Fig. 2 is a longitudinal vertical sectional view taken on line A A Fig. 1 and looking in the direction of the arrow; Fig. 3 is a similar view to Fig. 2 taken on line C C Fig. 1 and looking in the direction of the arrow; Fig. 4 is a longitudinal vertical section with the front portion of the pump removed; Fig. 5 is a similar view to Fig. 4 and taken on line B B Fig. 2; Fig. 6 is a perspective view of the main valve; Fig. 7 is a bottom plan of the auxiliary valve and casing; Fig. 8 is a diagrammatical view of the connection between the piston and the auxiliary valve;

and Fig. 9 is a perspective view of the complete motor set up.

Briefly this invention comprises a cylinder within which is the piston, a main motive fluid controlling valve and an auxiliary valve operatively connected to the piston, such auxiliary valve directing a portion of the motive fluid to the main valve for the purpose of reversing the flow of the main body of motive fluid from one end of the piston cylinder to the other, and to connect the opposite end of the cylinder with the exhaust, this being automatically accomplished by means of the connection between the piston and the auxiliary valve.

Referring now to the drawings *b* indicates a casting which to facilitate manufacturing is made up of several parts bolted together and insulated as will be apparent from the drawings.

The motor when in operation is preferably set upright and suitably supported by standards *c* as shown in Fig. 9, the standards being so situated with relation to the piston cylinder *d* that the reciprocation of the piston is not interfered with so that the movement of the latter may be readily utilized for any suitable purpose. The cylinder *d* is closed at its upper end by a cap *g'* the lower end having an opening therein to accommodate the piston rod *e*, such hole being suitably packed. The piston is preferably formed by reducing and screw-threading the inner end of the piston rod and mounting a pair of oppositely facing cup-like resilient washers 10 and 11, secured in place by flat metallic washers 12 between and on opposite sides thereof and held firmly upon the shoulder, formed by the reduced portion, by a nut 13.

Situated preferably at one side of and at right angles to the cylinder *d* is the main valve casing *g* communicating with the ends of the cylinder by conduits *h* and *i* respectively, which latter extend from the ends of the said cylinder to the top of the main valve casing at distinct points in the longitudinal line of the latter, for a purpose which will be apparent from the following description. The motive fluid supply passage *j* communicates with one side of the main valve casing while the exhaust passage *k* communicates with the opposite side.

Main valve.—To direct the motive fluid to one end of the cylinder *d* and simultaneously lead the exhaust from the opposite

end of the cylinder to the exhaust passage k , I employ a hollow valve or plunger l see Fig. 6 situated within the casing g and milled to fit perfectly therein. In the side of the plunger adjacent to the supply passage j is formed a longitudinally extended aperture m connecting the passage j with the interior of the plunger, while at the top of the plunger near its ends are formed longitudinally disposed slots n and o of less extent vertically than the openings of the conduits h and i ; the side of the plunger adjacent to the exhaust passage k has an angular groove formed therein, preferably of T-form and having one portion p extending longitudinally of the plunger and communicating with the exhaust k , the other portion p' being disposed circumferentially of the plunger and extends to the top of the latter midway between the slots n and o . The plunger l is of less length than the interior of its casing g and is adapted to slide from one end to the other of the same, and when in the position shown in Figs. 1 and 2, the slot n brings the conduit h into communication with the interior of the plunger and so with the supply, the slot o being closed by the top of the casing g while the conduit i is connected with the exhaust by the portions p' and p of the groove in the plunger.

From the foregoing it will be seen that the motive fluid will be directed to the lower end of the cylinder d and when the plunger is moved to the opposite end of the casing g where it abuts against the adjacent end of the casing (see Figs. 4 and 5) the slot n will be moved out of line with the conduit and the slot o simultaneously brought to register with the conduit i , the grooves p and p' moving along into communication with the conduit h and the flow of the motive fluid directed to the upper end of the cylinder, the lower end of the same now being in communication with the exhaust. The length of the aperture m and portion p of the T-groove being sufficient to always maintain their communication with the supply and exhaust respectively while the plunger is at either end of the casing.

Auxiliary valve.—To cause the plunger to slide from one end of its casing to the other and so reverse the flow of the motive fluid I provide auxiliary valve mechanism comprising a casing q situated parallel to the cylinder d and on the opposite side of the main valve to the latter. This auxiliary valve casing communicates with the ends of the main valve casing g by conduits r and r' opening into opposite sides of the interior of casing q at longitudinally offset points. A passage s leads from the supply passage, between the intake and the main valve casing, to the casing q between the offset openings r and r' while a passage t leads from the ends of the said auxiliary valve casing to a duct u

leading to the exhaust passage k . The top of the auxiliary valve casing is closed, the bottom being open to permit the insertion of a valve rod v carrying two valve disks 2 and 3 separated a distance equal to the distance between the offset openings r and r' , the open end being then closed by a gland nut w and suitable packing. The rod v extends outside the casing q and has rigidly secured along its length collars 4 and 5 by means of which and a rigid arm 6, carried by the piston rod e , the arm being forked at its free end to straddle the valve rod v between the collars 4 and 5 and engage the same as the piston nears the end of its stroke in either direction, the valve disks 2 and 3 are moved to alternately open the passages r and r' to the supply passage s and the exhaust t at the ends of the casing q . For instance, the disks when in the position shown in Figs. 1 and 2 direct the flow from s to the passage r and connect the passage r' with the upper end of the exhaust passage t and upon movement of the disks to the position shown in dotted lines Fig. 2, the passage r' will receive the flow from s while the passage r will be in communication with the lower end of the exhaust passage t .

Operation: The piston and valves of the pump being in the positions shown in Figs. 1 and 2 the motive fluid under head or pressure is conducted through the passage j and aperture m to the interior of the plunger l from where it passes through slot n and conduit h to the lower end of the cylinder d , forcing the piston up. A portion of the motive fluid is conveyed by passage s to the auxiliary valve casing q from where it passes through passage r to the opposite end of the main valve casing to which the plunger l is situated (the right hand end as seen in Fig. 1) where it tends to maintain the plunger in such position with its end abutting against the end of the casing.

Reversal.—As the piston nears the end of its upward stroke the forked arm 6 engages the collar 4 and imparts the movement of the piston to the disks 2 and 3 so that when the end of the stroke of the piston is reached the disks will have been moved to the position shown in dotted lines Fig. 2 thereby directing the flow from s through the passage r' to the opposite or left hand side of the main valve casing g , cutting off the supply from the right hand end and bringing the latter end into communication with the exhaust through the passages r and t . As will be apparent the disks 2 and 3 gradually close one passage to the flow from s simultaneously with the opening of the other passage so that the flow is directed from one passage to the other without a sudden jerk. The flow, being reversed as just described, slides the plunger to the position shown in Figs. 4 and 5 (the exhaust being forced

back through passage *r* and to the exhaust passage *h* with which it is now in communication through the passage *t* and duct *u*) thus moving the slot *n* out of line with the conduit *h* and simultaneously causing the heretofore closed slot *o* to register with the conduit *i*, the exhaust groove now assuming a position in line with the conduit *h* so that when the motive fluid is directed through conduit *i* to the upper end of the cylinder and forces the piston upon its downward stroke, the exhaust from the lower end of the cylinder will be forced back through conduit *h* and so to the exhaust passage *h*.

The small extent vertically of the slots *n* and *o* relatively to the conduits *h* and *i* and the manner (the slots *n* and *o* being disposed longitudinally of the plunger) in which they gradually come into line with each other prevent any sudden jerk when the flow is reversed. As the required movement of the disks 2 and 3 is less than that of the piston, the difference is taken up by so spacing the collars 4 and 5 along the rod *v* that the forked arm 6 travels freely therebetween until the piston approaches the end of its stroke at which time the arm 6 engages one of the said collars, the remaining movement of the piston being sufficient to operate the disks 2 and 3. This operation is illustrated in diagram in Fig. 8.

What I claim is as follows:

In a fluid motor the combination with a cylinder, a piston rod and a piston fixed thereto, a motive fluid supply for reciprocating the piston rod, and an exhaust,—of a

chamber situated at the side and between the ends of the cylinder and closed at its ends, the supply and exhaust opening therein at opposite sides, a pair of conduits longitudinally placed relatively to the cylinder and leading from the ends of the latter to the said chamber, a hollow plunger slidable in the chamber and having an aperture therein communicating with the supply, slots in the plunger adapted to alternately bring the said conduits into communication with the interior of the latter, and a T-groove upon the exterior of the plunger in communication with the exhaust and adapted to alternately register with the said conduits, a valve casing parallel with and separated from the cylinder by the plunger chamber, a conduit leading from the supply to the center of the valve casing, passages leading from the ends of the plunger casing and opening into the valve casing on opposite sides of the centrally placed conduit, a valve stem, a pair of valve disks carried by the valve stem, an arm operatively connecting the valve stem to the piston rod for the purpose of alternately bringing the said passages into communication with the said central conduit, and passages from the ends of the valve casing to the exhaust.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN EVERETT FEE.

Witnesses:

STANLEY C. KING,
JAMES FRASER.