G. F. MOORS.

ROTARY PUMP AND ENGINE.

APPLICATION FILED NOV. 24, 1919.

1,408,381.

Patented Feb. 28, 1922.

3 SHEETS—SHEET 1.

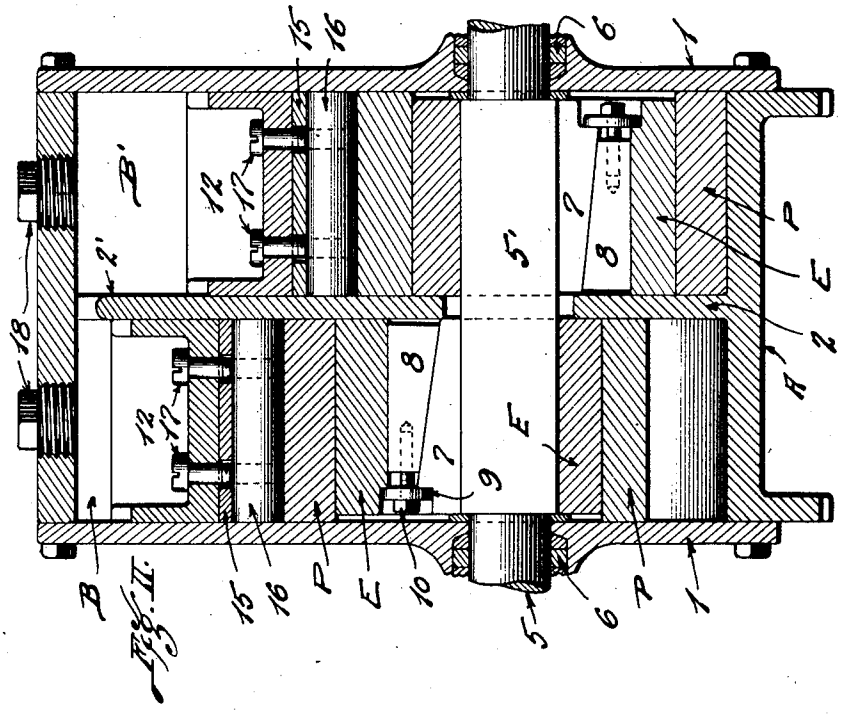


Fig. II.

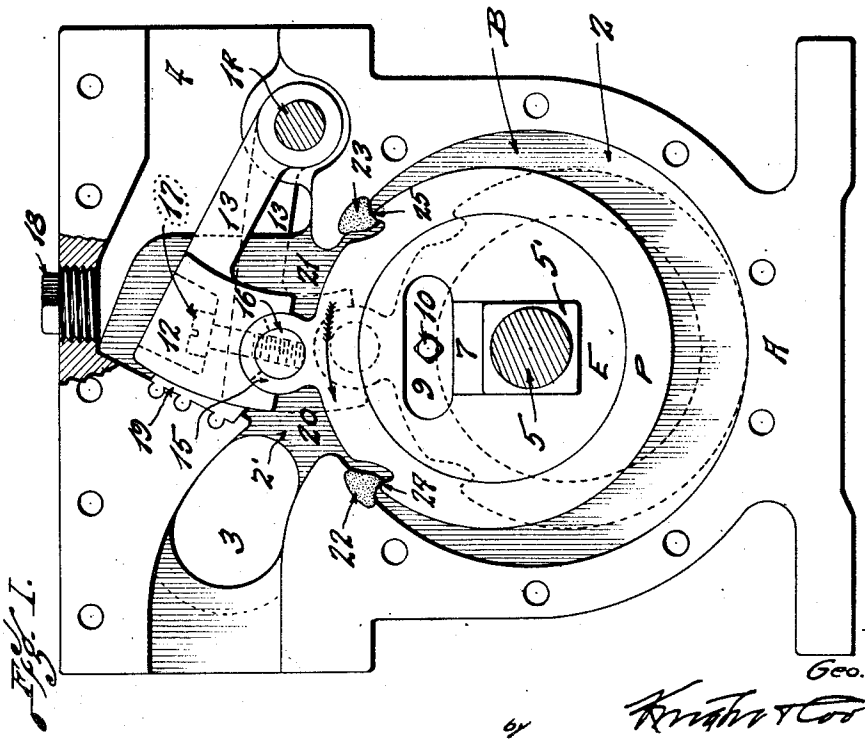


Fig. I.

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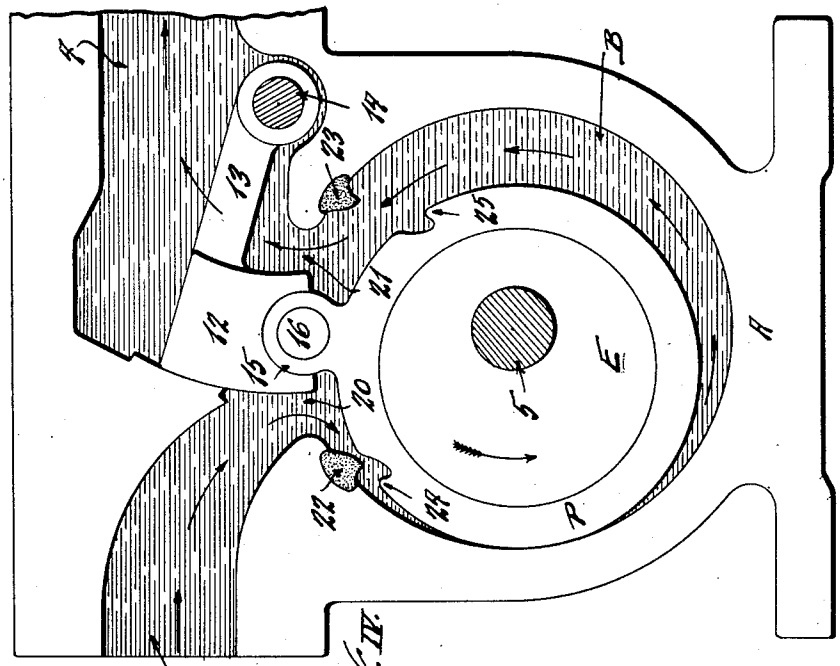


Fig. III.

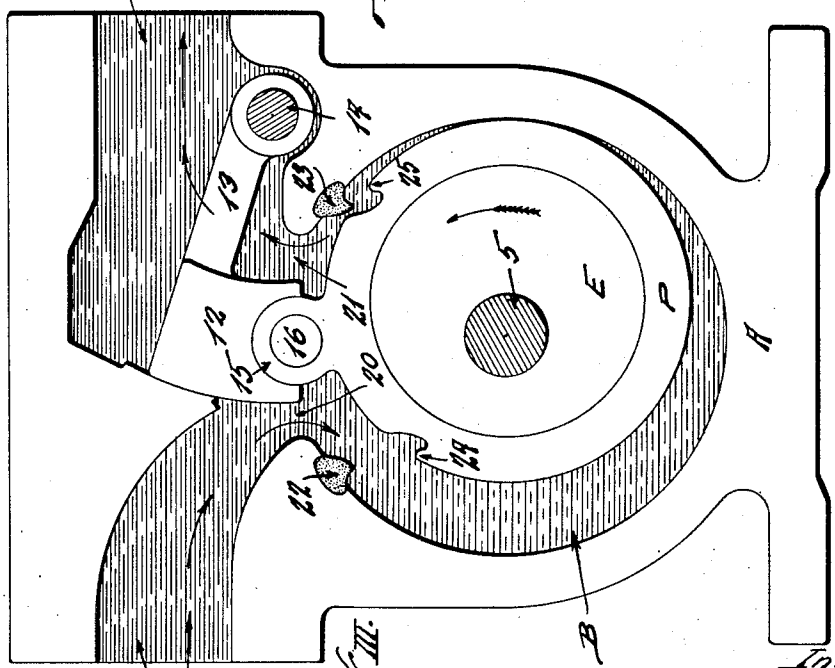


Fig. III.

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3 SHEETS—SHEET 3.

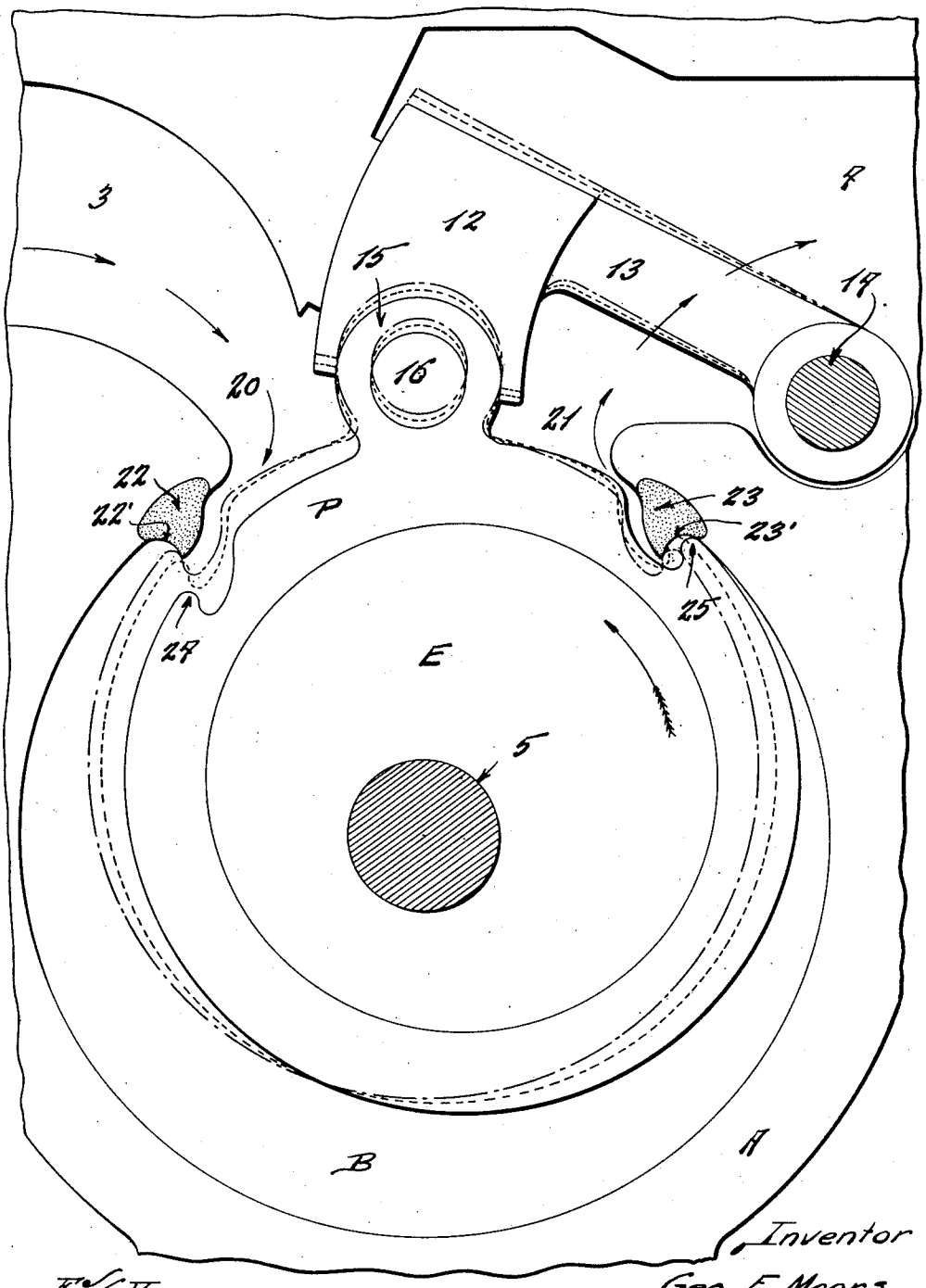


Fig. V.

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UNITED STATES PATENT OFFICE.

GEORGE F. MOORS, OF ST. LOUIS, MISSOURI, ASSIGNOR TO RECIP-ROTO ENGINE COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF DELAWARE.

ROTARY PUMP AND ENGINE.

1,408,381. Specification of Letters Patent. Patented Feb. 28, 1922.

Application filed November 24, 1919. Serial No. 340,179.

To all whom it may concern:

Be it known that I, GEORGE F. MOORS, a citizen of the United States of America, a resident of the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Rotary Pumps and Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to improvements in rotary pumps and engines, and more particularly to a rotary machine of this kind provided with means for controlling the admission and discharge of fluid. The structure herein disclosed comprises a cylinder having inlet and outlet ports, and an eccentrically mounted piston movable in the cylinder. The main object of the invention is to produce a very simple and highly efficient means for controlling the flow of fluid through the cylinder. In the preferred form of the invention, at least one valve element is carried by the eccentrically mounted piston, and in response to the peculiar movements of the piston, this valve element cooperates with another valve element to control the flow of fluid through one of the ports. More specifically stated, the structure about to be described comprises an eccentrically mounted piston and a pivot from which the piston oscillates in the cylinder. This piston moves away from the inlet port and toward the outlet port to provide for the admission and discharge of the fluid, and owing to the peculiar manner in which it is mounted in the cylinder, the piston also moves from an extreme position near the outlet port to an initial position near the inlet port. During this last mentioned movement of the piston, said piston is separated from the circular inner face of the cylinder, and at least one of the ports should be closed to prevent free communication between the ports. Therefore, the cylinder is preferably provided with inlet and outlet valve elements and corresponding valve elements are preferably carried by the eccentrically mounted piston, said valve elements being arranged to properly cooperate with each other while the piston is moving from its extreme position to its initial position. The main features of novelty lie in the combination and arrangement of valve elements whereby the ports are properly opened and closed in response to the movements of the eccentrically mounted piston.

Fig. I is a side elevation, partly in section, illustrating a rotary pump constructed in accordance with the invention, one of the cylinder heads being removed.

Fig. II is a vertical section taken approximately through the center of the pump shown in Fig. I.

Fig. III is a diagrammatical view showing the piston in the position it occupies immediately before all of the outgoing fluid is expelled through the outlet port.

Fig. IV is a view similar to Fig. III, showing the piston in a different position.

Fig. V is an enlarged diagrammatical view illustrating the manner in which the valve elements cooperate with each other.

To illustrate the invention I have shown a duplex pump comprising a cylinder A provided with heads 1 and also having a partition 2 (Figs. I and II), whereby it is divided into two compartments designated B and B′. The partition 2 has an extension 2′ which lies between an intake chamber 3 and a discharge chamber 4. Each of these chambers is adapted to communicate with the cylinder compartments on opposite sides of the partition 2—2′.

A rotary power shaft 5, located at the center of the double cylinder, is provided with a square portion 5′ which lies within the cylinder compartments, and with round portions which extend through stuffing boxes 6 (Fig. II) in the cylinder heads. This rotary shaft extends through the partition 2, as shown in Fig. II.

Each compartment of the double cylinder is provided with a piston and with certain other elements which I will now describe. Each piston P is an annular member mounted on an eccentric E, and each eccentric is rigidly secured to the square portion of the rotary power shaft. Each eccentric E is recessed to receive a fixed wedge 7 engaging one of the flat faces of the power shaft and an adjustable wedge 8 cooperating with said fixed wedge. The adjustable wedge 8, as shown in Fig. II, is interposed between the fixed wedge 7 and a portion of the eccentric E. 9 designates a bridge plate engaging shoulders on the eccentric and wedge 7, respectively, and 10 is an adjusting screw passing through the bridge plate and screwed into the wedge 8. By adjusting

the screws 10 the wedges may be tightened to firmly secure the eccentrics to the power shaft.

The flat side faces of each annular piston P contact with the oppositely disposed flat faces of the cylindrical compartment in which it is mounted, and to prevent leakage above the piston the latter is connected to an abutment head 12 fixed to an arm 13, the latter being pivotally supported by a rod or shaft 14. Each pivotally mounted abutment head 12 is equal in width to the adjacent piston P. In other words, the abutment head and piston are co-extensive relative to the axis of the power shaft 5. The abutment head, therefore, contacts with a cylinder head 1 and the partition 2—2′, so as to prevent free communication between the intake chamber 3 and the discharge chamber 4.

The means for forming a fluid-tight pivotal connection between the piston P and abutment head 12 (Figs. I and II) preferably comprises a tubular member 15 extending from the top of the piston, a pivot rod 16 mounted in said tubular member, and screws 17 connecting the abutment head to said pivot rod. These connecting screws pass through slots in the tubular member 15, as shown in Figs. I and II, so as to allow the piston to oscillate about the axis of the pivot rod 16. The bottom face of each abutment head 12 conforms to the curvature of the adjacent tubular member 15, and the desired fluid-tight joint can be obtained by tightening screws 17, thereby forcing the abutment head into engagement with the tubular member 15. Plugs 18, located above the abutment heads, may be removed to permit the application of an adjusting tool to the heads of the screws 17. Each abutment head 12 oscillates about the axis of the pivotal connection 14, and preferably contacts with a stationary body of anti-friction metal 19, such as Babbitt metal, secured adjacent to the intake compartment 3, as shown in Fig. I. The contacting faces of the abutment head and Babbitt metal are concentric with the pivotal connection 14.

20 and 21 designate inlet and outlet ports formed at opposite sides of the abutment head 12. These ports may be closed by valve elements on the piston and cylinder, as shown in Fig. I, and they may be opened to provide for the admission and discharge of fluid as shown in Figs. III and IV. In the structure I have shown to illustrate the invention, the ports are opened and closed by means of fixed inlet and outlet valve elements 22 and 23, respectively, which project into the cylinder at points adjacent to the ports, said ports being formed between the valve elements. The annular piston is provided with valve elements 24 and 25 adapted to cooperate with the valve elements 22 and 23. The valve elements 24 and 25 may be formed within the circumferential line of the piston.

Each eccentric E turns with the power shaft as indicated by curved arrows in Figs. I, III, and IV, the eccentric movement being about the axis of the power shaft. The annular piston P oscillates about the axis of the pivot 16 and it also moves away from the inlet port and toward the outlet port to provide for the admission and discharge of fluid. When the parts occupy the positions shown by full lines in Fig. I, both ports are closed, and a continued movement of the eccentric will locate the annular piston in the position shown by Fig. IV, wherein both ports are open and the piston contacts with the left side of the cylinder at a point near the inlet port. As the eccentric continues its rotary movement, the annular piston will remain in contact with the cylinder, and the point of contact will gradually approach the outlet port. Fluid at the righthand side of the piston is thus expelled through the outlet port, and at the same time fluid is admitted through the inlet port 20 as indicated by arrows in Figs. III and IV. When the piston reaches the position shown by Fig. III there will be very little fluid between the piston and the outlet port 21, while a very large body of fluid will lie at the left side of the piston. A continued movement of the eccentric will locate the annular piston in its highest position (Fig. I) wherein the inlet and outlet ports are closed by the lapping valve elements 22, 23, 24 and 25, while the piston is moving to the left so as to displace the body of fluid in the cylinder. It is important to observe that at least one of the ports should be closed at this time, for the annular piston is in a "dead" or neutral position and its peripheral face does not contact with the cylinder. If both ports 20—21 were open during this "dead" or neutral period, the back pressure of the fluid in the outlet chamber 4 would cause the fluid to flow backwardly through the cylinder. Even a momentary flow of this kind would result in a loss of power, and a shock or jar would occur when the backward flow is suddenly stopped by the subsequent engagement of the piston and cylinder.

Immediately after the piston occupies the neutral position shown by Fig. I, it again reaches the position shown by Fig. IV and continues in motion to discharge the fluid through the outlet port.

I will now describe the peculiar manner in which the valve elements cooperate with each other to open and close the ports. Fig. III shows the positions of the parts immediately before the outlet valve 23, 25 closes, and Fig. V is a diagram showing the movable outlet valve element 25 in three differ-

ent positions, wherein it cooperates with valve element 23 to close the outlet. It will be important to observe that the valve face 23′ (Fig. V) of valve element 23 conforms to the contour of a line described by the moving valve element 25 on the piston, so the valve elements will cooperate to close communication between the inlet and outlet while the piston is separated from the circular inner face of the cylinder. When the piston occupies the position shown by full lines in Fig. V, the valve elements 23, 25 cooperate with each other and such cooperation is continued until the valve element 25 passes from the lower portion of valve element 23. During this period a very peculiar motion is imparted to the piston and its valve element 25. The piston P is driven by the eccentric E and said piston also moves on the axis of its pivotal connection 16. When in the position shown by full lines in Fig. V, the piston is rising in response to the movement of eccentric E, but it is also moving to the left on the axis of pivot 16. As a consequence, the valve element 25 rises a slight distance while it moves to the left. Immediately thereafter, as the eccentric moves toward the dead center shown by Fig. I, the piston will quickly swing to the left, and this piston movement on the axis of pivot 16 will cause the valve element 25 to move downwardly, as suggested by dotted lines in Fig. V. The valve face 23′ conforms to a line described by valve element 25. In actual practice, I have accomplished this by first forming the valve element 25 on the piston, and then driving the piston in a cylinder as herein shown, using the valve element 25 to describe a line conforming to the required contour of valve face 23′. After this precise contour has been determined, a mold for the valve element 23 can be made, and if this mold is properly applied to the cylinder, the valve element 23 can be cast into the cylinder as shown in the drawings. The valve element 23 is thus rigidly secured to the cylinder, and its molded face 23′ will conform to a line described by the valve element 25. The inlet valve element 22 may be likewise molded and cast into the cylinder, so as to make its face 22′ (Fig. V) conform to a line described by valve element 24.

By making the rigid valve elements as herein shown, I prevent free communication between the inlet and outlet ports when the piston is separated from the circular inner face of the cylinder. The differently shaped faces of the outlet valve elements 23, 25 cooperate with each other, as suggested by Fig. V, to expel all of the outgoing liquid before the inlet valve closes, so there is no liability of trapping the outgoing liquid between the outlet valve elements. When the piston swings to the left from the position shown by Fig. I, the outlet valve 23, 25 will be opened while the inlet valve elements 22, 24 cooperate with each other until the piston reaches the circular inner face of the cylinder.

I claim:

1. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to cooperate with the circular inner face of said cylinder, an abutment extending from the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, and valve elements on said piston and cylinder having valve faces which cooperate with each other to open and close one of said ports, one of said valve elements being a rigidly anchored casting molded with a valve face conforming to movements of the eccentrically mounted piston, so as to close the last mentioned port while the piston is separated from the circular inner face of the cylinder.

2. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to cooperate with the circular inner face of said cylinder, an abutment extending from the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, and valve elements on said piston and cylinder having valve faces which cooperate with each other to open and close one of said ports, said valve elements being rigidly held on said piston and cylinder respectively, one of said valve elements being a casting molded into the member whereby it is rigidly held, and said casting being molded with a valve face conforming to movements of the eccentrically mounted piston, so as to close the last mentioned part while the piston is separated from said circular face of the cylinder.

3. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to contact with the circular inner face of the cylinder, an abutment extending from said piston, a pivotal connection uniting said abutment and the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, said eccentrically mounted piston being movable away from said inlet port and toward said outlet port to provide for the admission and discharge of fluid, said eccentrically mounted piston being also movable on the axis of said pivotal connection from an extreme position adjacent said outlet port to an initial posi-

tion adjacent said inlet port, and means for closing said ports during the last mentioned movement of said piston, said means comprising a pair of valve elements carried by said piston and located at opposite sides of said abutment, and said cylinder being provided with a pair of valve elements which cooperate with the aforesaid valve elements while the piston is moving on said pivotal connection from the extreme position to the initial position, the valve elements on said cylinder being provided with valve faces conforming to lines described by the valve elements on said eccentrically mounted piston, and the contour of the valve faces on the piston being different from the contour of the valve faces on the cylinder.

4. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to cooperate with the circular inner face of said cylinder, an abutment extending from the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, the eccentrically mounted piston being provided with valve elements at opposite sides of said abutment, and means cooperating with said valve elements to open and close said ports.

5. The combination of a cylinder, a piston is said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to cooperate with the circular inner face of said cylinder, an abutment extending from the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, and a valve element carried by said eccentrically mounted piston to open and close one of said ports, said valve element being substantially within the circumferential line of said eccentrically mounted piston.

6. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to cooperate with the circular inner face of said cylinder, an abutment extending from the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, a valve element extending inwardly from said cylinder at a point adjacent to one of said ports, and a valve element carried by said eccentrically mounted piston and cooperating with the aforesaid valve element to open and close the last mentioned port, the valve element carried by the piston being located within the circumferential line of said piston.

7. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to cooperate with the circular inner face of said cylinder, an abutment extending from the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, said eccentrically mounted piston being movable away from the inlet port and toward the outlet port to provide for the admission and discharge of fluid, said eccentrically mounted piston being also movable from an extreme position adjacent said outlet port to an initial position adjacent said inlet port, and valve elements carried by said eccentrically mounted piston adjacent said ports whereby said ports are closed during the last mentioned movement of the piston.

8. The combination of a cylinder, a piston in said cylinder, said piston being smaller in diameter than the internal diameter of said cylinder, a rotary member on which said piston is eccentrically mounted so as to contact with the circular inner face of the cylinder, an abutment extending from said piston, a pivotal connection uniting said abutment and the eccentrically mounted piston, said cylinder having inlet and outlet ports at opposite sides of said abutment, said eccentrically mounted piston being movable away from said inlet port and toward said outlet port to provide for the admission and discharge of fluid, said eccentrically mounted piston being also movable on the axis of said pivotal connection from an extreme position adjacent said outlet port to an initial position adjacent said inlet port, and means for closing said ports during the last mentioned movement of said piston, said means comprising a pair of valve elements carried by said piston and located at opposite sides of said abutment, and said cylinder being provided with a pair of valve elements which cooperate with the aforesaid valve elements while the piston is moving on said pivotal connection from the extreme position to the initial position.

In testimony that I claim the foregoing I hereunto affix my signature.

GEORGE F. MOORS.