March 4, 1930. A. S. WELDY 1,749,682

PUMP

Filed Sept. 3, 1926

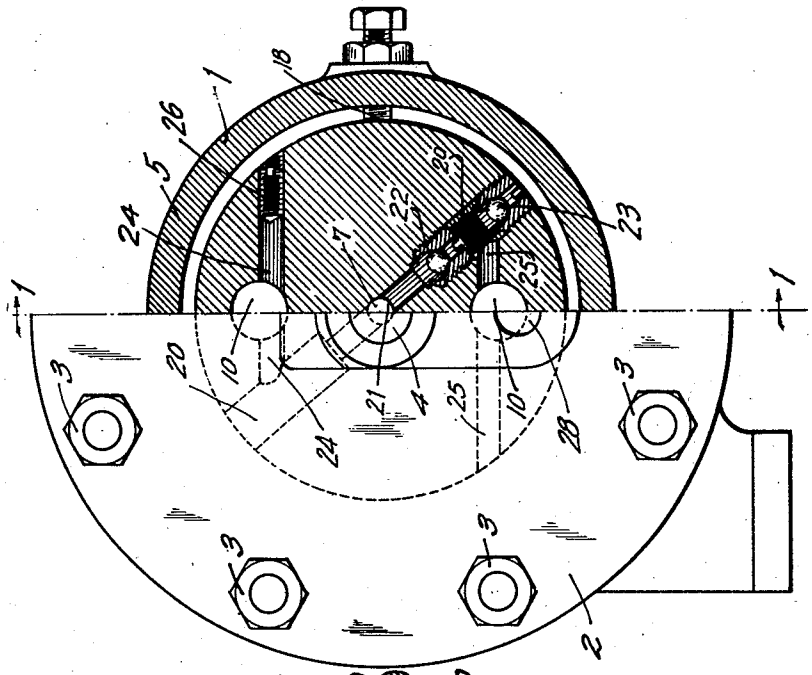


FIG. 2

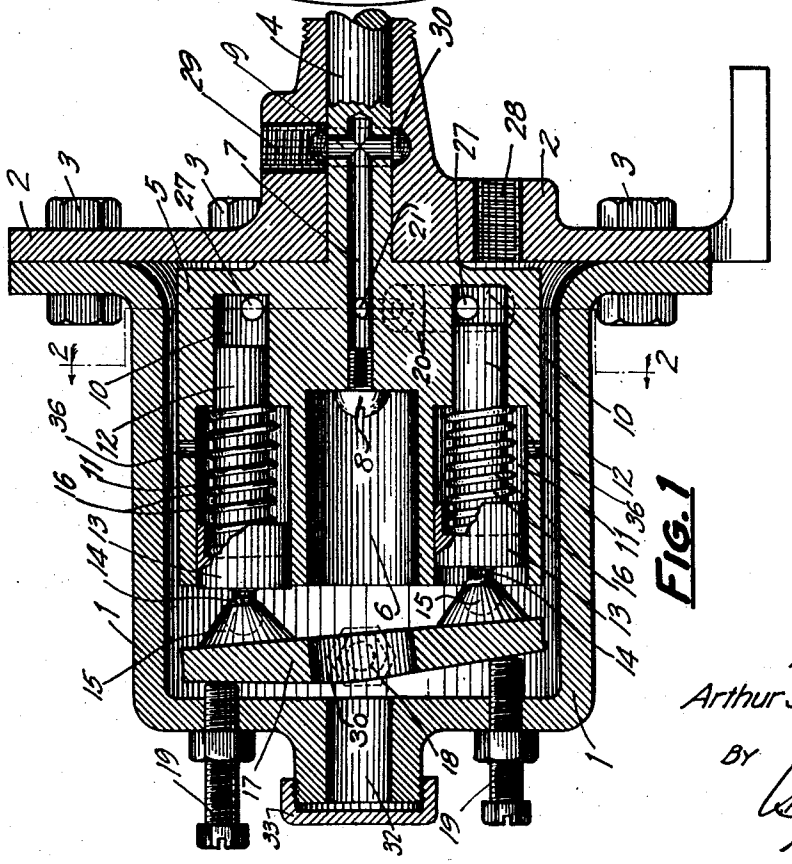


FIG. 1

INVENTOR
Arthur Sheldon Weldy
BY
ATTORNEY

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ARTHUR SHELDON WELDY, OF CANTON, OHIO

PUMP

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My invention relates to pumps and particularly to pumps of that class which have a cylinder or rotor fixed to an operating shaft and provided with two or more piston equipped cylinders disposed in balanced relation and parallel to the axis of rotation.

It relates particularly to a device of this character in which the stroke of the pistons may be easily regulated from the exterior of the device and which is susceptible of minute adjustment so that at any given rate of speed the discharge of the pump may be accurately metered.

The objects of my invention are to provide a pump of this character which is inherently balanced and which may be operated at very high speeds without noise or vibration. Another object of my invention is to provide a pump of this character having novel means for conveying the oil from the cylinders to the discharge pipe whereby loss or leakage between moving and stationary elements is minimized. Another object of my invention is to provide a pump of this character in which the discharge is susceptible of minute regulation so that it may be set to accurately discharge a liquid at any predetermined rate from zero up to the capacity of the pump. Another object of my invention is to provide a novel and improved means for effecting a cut off of the suction passage during the discharge stroke and for cutting off the discharge passage during the suction stroke which will be pressure operated and assisted in their operation by centrifugal force developed by the rotation of the device itself. Another object of my invention is to provide a device in which the elements subjected to wear are of simple character and may be easily and cheaply replaced when necessary.

With these objects in view my invention includes the novel elements and combinations of elements described below and illustrated in the accompanying drawing in which—

Fig. 1 is a section of my device longitudinal of the shaft in the plane 1—1 of Fig. 2;

The left half of Fig. 2 is a front elevation of my device as seen from the shaft side; and the right half of Fig. 2 is a half section of my device in the plane 2—2 of Fig. 1.

Referring to the drawing, 1 is a cup-like container forming a housing for the mechanism, and 2 is a cover for the housing which is secured thereto by bolts, 3. The cover, 2, is provided with a bearing for driving shaft, 4, and the end of this bearing may be threaded, as shown in Fig. 1 to receive a packing nut. Preferably integral with the inner end of the shaft, 4, is the cylindrical rotor, 5. The shaft, 4, is provided with an axially extending passage, 7, terminating at a point within the bearing and plugged at the other end by a screw, 8. To lighten the device the rotor may be counterbored, as shown at 6. The shaft, 4, is cross-bored to communicate with the passage, 7, as shown at 9.

The rotor is provided with diametrically disposed cylinders, 10, terminating within the rotor, and having their outer portions counterbored, as shown at 11 in Fig. 1. The pistons, 12, are closely fitted to and adapted to reciprocate within the cylinders, 10, and enlarged bases, 13, on the pumping pistons, 12, reciprocate in the counterbores, 11, which communicate at all times with the interior of the casing through openings, 36, to prevent the creation of any substantial difference in pressure between the counterbore chamber and the casing. The bases of the pistons are provided with balls, 14, about which are spun the conical cups, 15, having flat bases of substantial area to distribute the pressure, and which form ball and socket joints having a universal movement. Surrounding the pistons, 12, and compressed between the bottoms of the counterbores in the rotor and the enlarged portions, 13, of the pistons, are springs, 16, which tend to force the pistons out of the cylinders and also act to prevent any end play in the rotor.

The left end or back of the housing, 1, is provided with a circular cam plate, 17, which is pivotally supported upon adjustable trunnion bearings, 18, passing through the sides of the housing, 1. The center part of the cam plate, 17, may be open, as shown at 30, and the back or rear end of the housing may be provided with a bearing, 32, closed with a

cap, 33, when not used, and through which a shaft may be extended from the rotor, if desired.

The angle which the cam plate, 17, makes with the shaft, 4, may be varied by the adjusting screws, 19, to regulate the stroke of the pistons. It will be evident that as the shaft, 4, is turned, the rotor carrying the pistons will revolve, and the conical bases, 15, will move in contact with the fixed cam plate, 17, so that the pistons, 12, by the rotation of the shaft and the action of springs, 16, will be reciprocated in the cylinders, 10. The springs will effect the movement of the pistons on the intake or suction strokes, and the cam plate will effect the movement on the discharge or compression strokes.

Referring to Fig. 2, the rotor, 5, is provided with a diametrically extending passage, 20, near the closed ends of the cylinders, 10, and shown in the drawing as having its axis lying substantially in the plane 2—2. This passage, of course, communicates, as shown at 21, with the axial passage, 7, in the driving shaft. Each end of the passage, 20, is counterbored or enlarged, and is threaded to receive the ball check valves, 22 and 23. Although not shown, it is to be understood that these ball check valves are provided at each end of passage, 20.

The passage, 20, is placed in communication with the cylinders, 10, by the passages, 24 and 25, which are drilled in from the outer surface of the rotor and afterwards closed by the plugs, 26. The passage, 20, communicates with one cylinder through the passage, 24, and with the other cylinder through passage, 25. These passages open into the cylinders, as shown at 27 in Fig. 1.

It will be apparent that the cylinders, 10, are now placed in communication both with the axial passage, 7, in the shaft, through ball check valves, 22, and with the interior of the casing through ball check valves, 23. It will also be observed that the seat of each check valve is nearer the periphery of the cylinder than the ball so that as the rotor is revolved at high speed the balls will be normally held in closed position by centrifugal force.

Referring to Fig. 1, it will be observed that the upper piston is at the end of the suction or intake stroke, and the lower piston is at the end of the discharge or compression stroke. It is to be understood that the casing, 1, is kept full of oil or other liquid to be pumped from a source of supply, which is introduced through opening, 28, in the cover. As the rotor revolves and the pistons reciprocate in the cylinders, liquid is sucked from the casing through ball check valves, 23, passages, 20, and passages, 24 and 25, into cylinders, 10. During this intake or suction part of the pumping cycle, ball check valves, 22, will remain closed under the combined influence of atmospheric pressure created by the suction of the piston and centrifugal force. On the compression strokes the liquid will be forced out of the cylinders through passages, 24 and 25, respectively, into passage, 20, through ball check valves, 22, into the axial passage, 7, and thus out through the cross-bore, 9, into the discharge opening, 29. During this part of the pumping cycle, ball check valves, 23, will remain closed under the combined influence of centrifugal force and oil pressure developed by the compression strokes of the pistons. The ball check valves, 22, will tend to remain closed under the action of centrifugal force but this will be overcome by the oil pressure developed. Referring to Fig. 1, it will be observed that the bearing, in the vicinity of the cross-bore, 9, is cored out, as shown at 30, so that the ends of cross-bore, 9, are always open regardless of the rotation of the shaft.

From the foregoing it will be observed that the surface areas in contact between the stationary and moving elements of my device and between which surfaces oil might leak, are very greatly reduced, and are confined to the areas between the shaft and bearing which must necessarily fit closely. The parts which revolve at high speed are absolutely balanced and the cut off means separating the suction and compression strokes is simple, non-wearing, and automatic in its operation.

When the face of cam plate, 17, is in a plane perpendicular to the axis of rotation of shaft, 7, the pistons will not reciprocate in the cylinders, and the pump will not function. Between this position of the cam plate and the maximum tilt or inclination which may be given thereto, the discharge from the cylinders, at any given rate of speed will vary substantially as the slope on the cam plate varies from the perpendicular. By providing the adjusting screws, 19, with comparatively fine threads the angular tilt of the cam plate may be minutely varied so that corresponding variations in the discharge of the pump may be effected.

Should the cam plate become worn, it is of such simple construction that the cost of replacing will be very small, and it may be readily removed from the assembly by loosening the trunnions, 18.

While I have described my invention somewhat in detail for the purpose of clearness it is to be understood that the words which I have used are words of description and not of limitation and that changes within the purview of the appended claims may be made without departing from the true spirit of my invention in its broadest scope.

What I claim is—

1. In a pump of the character described, a rotor provided with a plurality of parallel disposed pumping cylinders, a hollow shaft adapted to be placed in communication with

said cylinders through passages angularly disposed to the axis of said shaft, and check valves in said passages having movable elements adapted to be actuated by centrifugal force developed by the moving rotor for normally cutting off communication between said shaft and cylinders.

2. In a pump of the character described, a cylindrical rotor provided with an axial passage and having a pump cylinder therein communicating with said axial passage through a second, substantially radial passage extending from the periphery of the rotor, and check valves in said radial passage intermediate the cylinder and axial passage and the cylinder and periphery of the rotor, respectively, having movable elements adapted to be actuated by centrifugal force for normally maintaining said valves in closed position.

3. In a pump of the character described, a rotor comprising an integral metal cylinder provided with an axial passage and having a plurality of parallel disposed pump cylinders formed therein about and communicating with said passage, and a check valve in said rotor intermediate each cylinder and said passage normally cutting off communication therebetween.

4. In a pump of the character described, the combination with a casing of a rotor therein comprising an integral metal cylinder provided with an axial passage and having a plurality of pump cylinders formed therein about said passage; each pump cylinder communicating with said passage and the interior of said casing through substantially radial passages in the rotor, and check valves in each radial passage adapted to be operated by centrifugal force for normally cutting off communication between each cylinder and the axial passage and casing respectively.

5. In a pump of the character described, the combination with a shaft having a discharge passage therein, of a plurality of pumping units comprising parallel disposed cylinders with pistons therein adapted to be actuated by the revolution of and discharge through said shaft, means providing communication between said pumping units and the supply of fluid to be pumped, and means, operable by centrifugal force developed by the revolution, normally cutting off communication between the pumping units and the supply of fluid.

6. In a pump of the character described, the combination with a rotor having a plurality of parallel disposed cylinders provided with pistons adapted to reciprocate therein, of a shaft on said rotor having a passage therein communicating with said cylinders during the compression strokes of said pistons, means for placing said cylinders in communication with a supply of liquid to be pumped, and means adapted to be operated by centrifugal force developed by the movement of the rotor for cutting off communication between the cylinders and shaft passage during the intake strokes of the pistons.

7. In a pump of the character described, the combination with a casing adapted to be supplied with liquid to be pumped, of a shaft mounted in said casing and having a passage therein, a rotor on said shaft provided with a plurality of parallel disposed reciprocating pumping units adapted to revolve with said shaft, means providing communication between said cylinders and the interior of said casing, and means adapted to be actuated by centrifugal force developed by the moving rotor for normally cutting off communication between the pumping units and the supply of liquid in said casing.

8. In a pump of the character described comprising a shaft having a discharge passage therein, a plurality of parallel disposed pumping units mounted upon and rotated by said shaft, and means providing communication between said units and said discharge passage, check valves in the communicating means normally open when said pump is not in operation, but having movable elements adapted to be actuated by the centrifugal force of rotation for mornally closing communication between said units and passage.

9. In a pump of the character described comprising a casing adapted to contain a liquid to be pumped, a plurality of parallel disposed pumping units rotatably mounted in said casing, and means providing communication between said units and the interior of said casing, check valves in the communicating means intermediate the pumping units and the supply of liquid in said casing normally open when said pump is not in operation, but having movable elements adapted to be actuated by the centrifugal force of rotation for normally closing communication between said units and the supply of liquid when said pump is in operation.

10. In a pump of the character described comprising a casing adapted to contain a liquid to be pumped, a shaft journalled in said casing and having a discharge passage therein, a plurality of parallel disposed pumping units on said shaft, and means providing communication between the pumping units and the supply of liquid and discharge passage, respectively, check valves in the communicating means normally open when said pump is not in operation, but having movable elements adapted to be actuated by centrifugal force for normally closing communication between the pumping units and the supply of liquid and discharge passage, respectively, when said pump is in operation.

ARTHUR SHELDON WELDY.