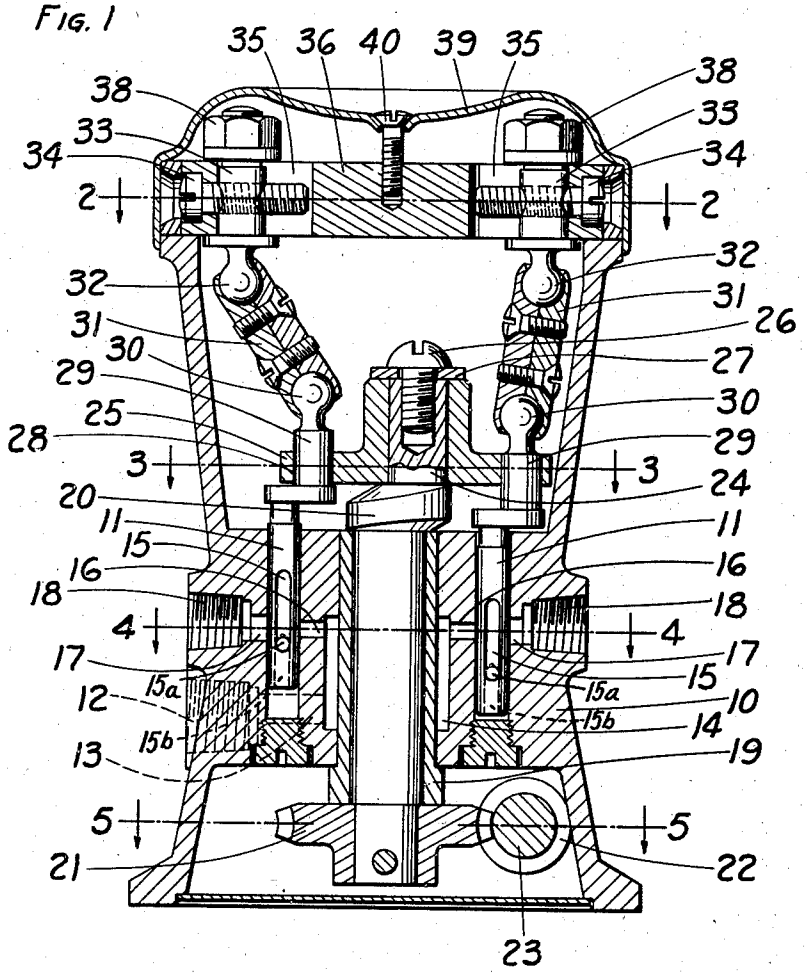
Feb. 13, 1945 B. E. FOLKE 2,369,345

HYDRAULIC PUMP

Filed May 27, 1944 4 Sheets-Sheet 1

FIG. 1



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HYDRAULIC PUMP

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FIG. 2

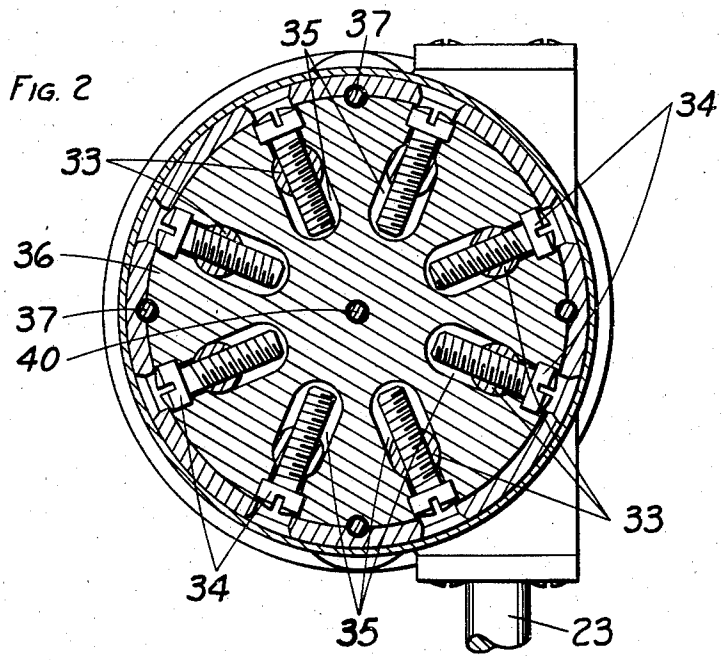
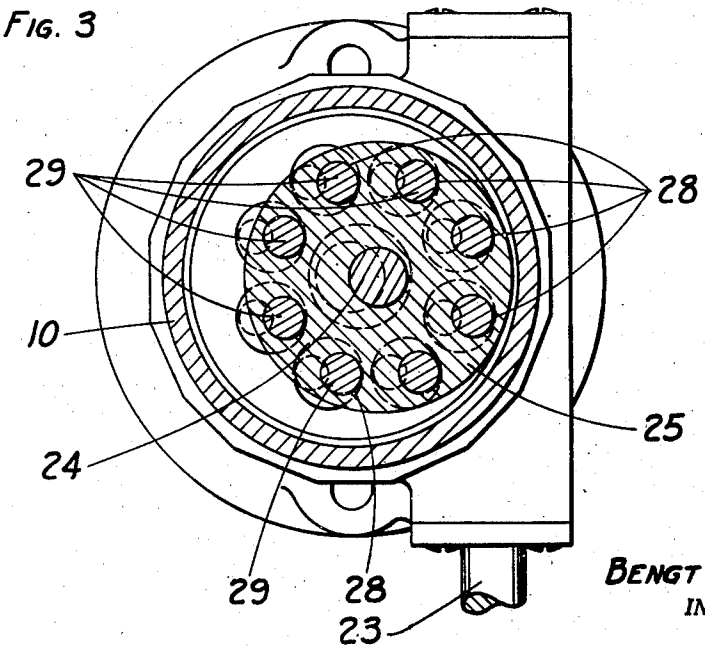


FIG. 3



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HYDRAULIC PUMP

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FIG. 4

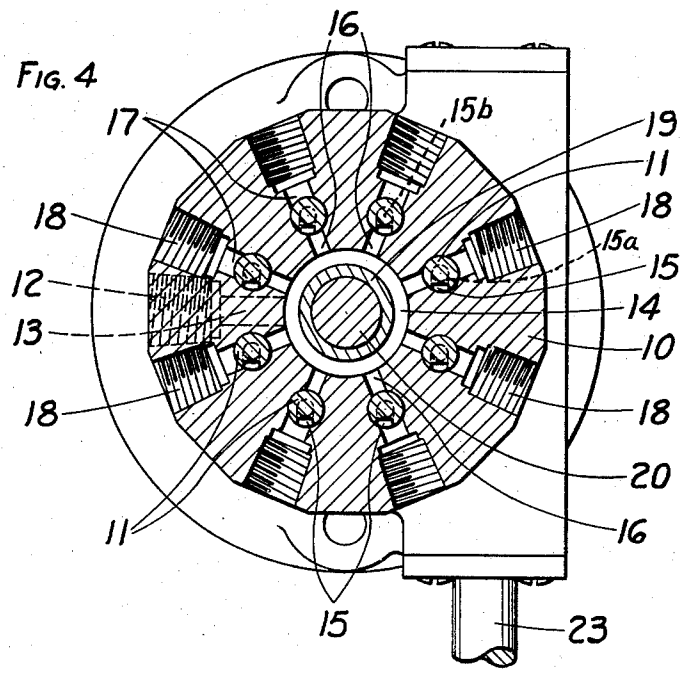
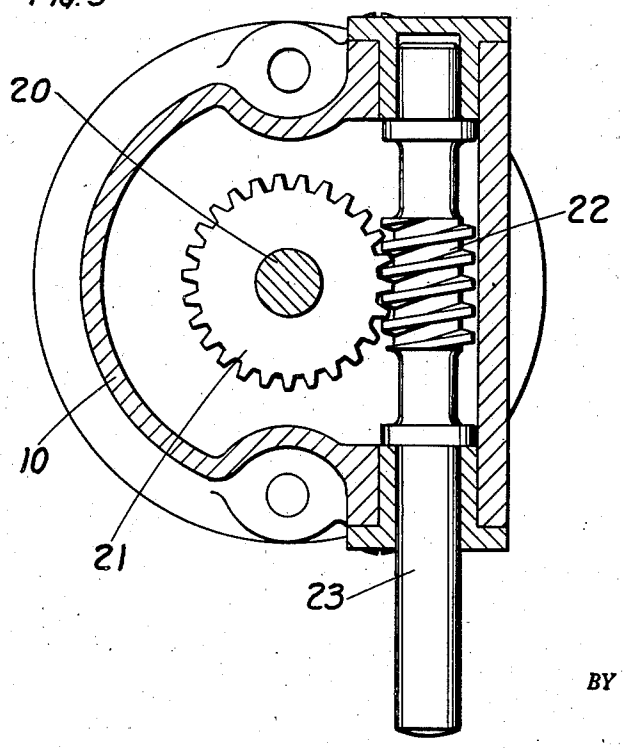


FIG. 5



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HYDRAULIC PUMP

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FIG. 6

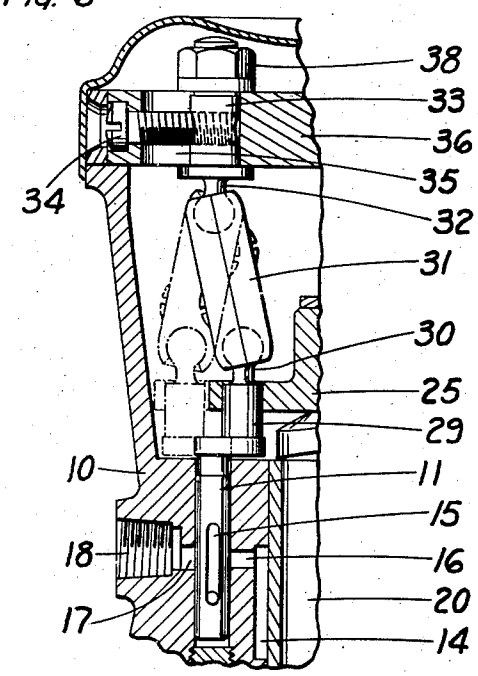
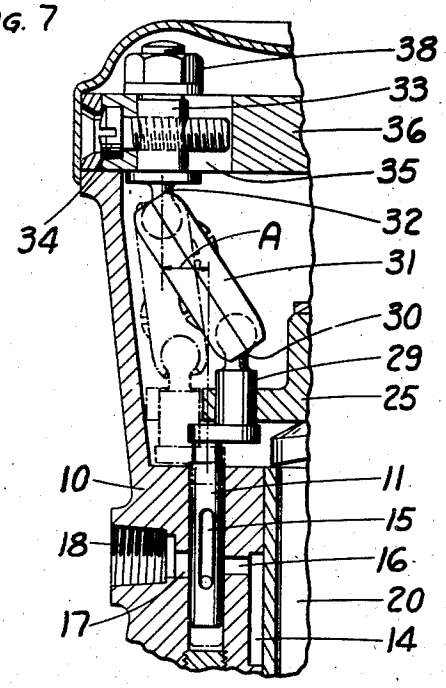


FIG. 7



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Patented Feb. 13, 1945 2,369,345

UNITED STATES PATENT OFFICE

2,369,345

HYDRAULIC PUMP

Bengt E. Folke, Mamaroneck, N. Y., assignor to Nathan Manufacturing Company, New York, N. Y., a corporation of New York

Application May 27, 1944, Serial No. 537,756

20 Claims. (Cl. 103—157)

The object of this invention is to provide new and useful improvements in hydraulic pumps having one or more pumping units adapted to deliver predetermined exact amounts of a fluid or for maintaining certain pressure conditions in one or more hydraulic lines, and which may be used as mechanical lubricators, spinning pumps, or for similar purposes.

Another object is to provide means for changing the stroke of the individual pistons for the purpose of regulating the fluid discharge from each individual pumping unit or from all pumping units as may be desired.

Another object is to provide means for the purpose of eliminating the use of lost motion for regulating the piston strokes.

A further object is to provide means to obtain sequential discharges from the pumping units for the purpose of distributing evenly the load on the actuating mechanism and to permit combining the discharges into a nearly constant fluid flow.

A still further object is to provide a compact pumping mechanism suitable for high pressures and high operating speeds.

Still further objects will become apparent in the following specification and in the drawings in which a preferred embodiment of the invention is shown.

In the drawings,

Fig. 1 is a longitudinal sectional view through the pump assembly;

Fig. 2 is a cross-sectional view along the plane of line 2—2 in Fig. 1;

Fig. 3 is a cross-sectional view along the plane of line 3—3 in Fig. 1;

Fig. 4 is a cross-sectional view along the plane of line 4—4 in Fig. 1;

Fig. 5 is a cross-sectional view along the plane of line 5—5 in Fig. 1; and

Figs. 6 and 7 show fragmentary sectional views to illustrate the action of the actuating parts in positions of minimum and maximum piston strokes, respectively.

Referring to Fig. 1, 10 is a pump body into which are fitted pistons 11. The body 10 is provided with an inlet 12 supplying liquid through a passage 13 to an annular well 14. Each of the pistons is adapted to be rotated and reciprocated in its cylinder by means described later in such a manner that a groove 15 at the outside of the piston, forming a port with the cylinder wall, communicates alternately with an inlet passage 16 from the annular well 14 during the intake or suction stroke and with a discharge passage 17 during the pumping stroke. Groove 15 is in constant communication through a cross duct 15*a* and a vertical duct 15*b* through the lower end of the piston with a chamber below the piston formed by the piston cylinder, as shown in Figs. 1 and 4. The body 10 is provided with threaded outlets 18, each connected to a discharge passage 17.

The center of the pump body 10 is provided with a bearing sleeve 19 which supports a crank shaft 20. The crank shaft 20 is rotated by means of suitable gears comprising a worm wheel 21 on the shaft 20 and a worm 22 on a shaft 23 adapted to be driven from any suitable source of power. The upper end of the crank shaft 20 is provided with a crank pin 24 eccentrically disposed with respect to the shaft. A disc 25 is oscillatingly mounted on the pin 24 and is secured in place by a screw 26 and a washer 27.

As shown in Fig. 3, the disc 25 is provided with a number of holes 28 which serve as bearings for off-set extensions or crank pins 29 of the pistons 11. The eccentricity of the pins 29 with respect to the axes of pistons 11 is the same as the eccentricity of the crank pin 24 in relation to the crank shaft 20. It will be seen, therefore, that rotation of the crank shaft 20 results in a corresponding rotation of the pistons 11.

The crank pin 29 of each piston 11 terminates in a ball 30 which is universally coupled by means of a rigid link 31 of fixed length with a ball 32 depending from a cylindrical block 33 carried by the pump body and normally displaced laterally with reference to the axis of the piston. The link 31 is provided with a socket at each end, one socket embracing ball 30 and the other socket ball 32. The ball 32 thus forms a fixed universal pivot and the ball 30 a movable eccentric universal pivot which are connected by the link or universal coupling 31 which maintains a constant linear distance between them. The block 33 is mounted directly on a screw 34 within a radial slot 35 in a disc 36 secured to the pump body by means of screws 37. The lateral displacement of the block 33 and its ball pivot 32 with reference to the axis of the piston may be adjusted by turning the screw 34, thereby moving the block radially in its slot 35. During the pumping operation the block 33 is fixed in adjusted position by means of a lock nut 38. A cover 39 encloses the regulating mechanism and is secured to the shelf 36 by a screw 40.

By referring to Fig. 6, it will be observed that when the regulating block 33 is located in a position so that the ball 32 is immediately above and coaxial with the piston 11, rotation of the piston

11 imparted to it by the oscillation of the disc 25 does not result in any reciprocating movement of the piston. By referring to Fig. 7, it will be noted that when the ball 32 is displaced a distance A from the center line or axis of the piston 11, the piston will be reciprocated while it is being rotated, due to the action of the link 31, the crank pin 29 sliding axially in its bearing 28 in the disc 25. The amplitude of this reciprocation is a factor of the distance A, which is the lateral displacement of the block 33. Thus by adjusting the position of block 33, as previously explained, the stroke of the piston and the discharge of the pump may be nicely regulated. It will be noted further that the movement imparted to the piston 11 will be free from lost motion regardless of whether or not the regulating block 33 is set for minimum or maximum discharge. It will also be apparent that ample bearing surfaces exist between the ball pins 30 and 32 and the link 31, permitting operation with high pressures and at high speeds. It will also be clear that any desired sequence of operation between the several pistons may be obtained by positioning the slots 35 and the grooves 15 in the pistons 11 and the inlet passages 16 and the discharge passages 17 in any desired relation to each other. It is obvious, of course, that the pump can be provided with one or more outlets. By admitting fluid under pressure, the pump may be used as a motor, an expedient well known in the art.

Many other changes in the form, proportion, combination of parts and minor details of construction may be resorted to without departing from the principles or sacrificing any of the advantages of the invention, as defined in the appended claims.

What I claim as new, is:

1. In a pump, a cylinder having inlet and discharge passages, a rotary and reciprocatory piston within the cylinder, said piston having a groove in communication with the cylinder below the piston, means to bring said groove in alternate communication with said inlet and discharge passages, and means to vary the stroke of the piston including a regulating block, in spaced relation to said piston, an eccentric pin on the piston, a link connecting said block with the eccentric pin, and means for laterally displacing the block with reference to the axis of the piston.

2. In a pump, a cylinder having inlet and discharge passages, a rotary and reciprocatory piston within the cylinder, said piston having a groove in communication with the cylinder below the piston, means to bring said groove in alternate communication with said inlet and discharge passages, and means to vary the stroke of the piston including a regulating block, in spaced relation to said piston, an eccentric pin on the piston, a link connecting said block with the eccentric pin, and means for laterally and radially displacing the block with reference to the axis of the piston, the distance between block and pin remaining constant.

3. In a pump, a cylinder having inlet and discharge passages, a rotary and reciprocatory piston within the cylinder, said piston having a groove in communication with the cylinder below the piston, means to bring said groove in alternate communication with said inlet and discharge passages, and means to vary the stroke of the piston including a support in spaced relation over said piston, a regulating block, radially movable in said support with respect to the piston, an eccentric pin on the piston, a link connecting said block with the eccentric pin, and means for laterally displacing the block with reference to the axis of the piston.

4. In a pump, a cylinder having inlet and discharge passages, a rotary and reciprocatory piston within the cylinder, said piston having a groove in communication with the cylinder below the piston, means to bring said groove in alternate communication with said inlet and discharge passages, and means to vary the stroke of the piston including a regulating block, in spaced relation to said piston, an eccentric pin on the piston, a link, ball joints at both ends of the link connecting it with, respectively, the said block and the said eccentric pin maintaining a constant linear distance between them, and means for laterally displacing the block in reference to the axis of the piston.

5. In a pump, a cylinder having inlet and discharge passages, a rotary and reciprocatory piston within the cylinder, said piston having a groove in communication with the cylinder below the piston, means to bring said groove in alternate communication with said inlet and discharge passages, a regulating block, an eccentric pin on the piston, a link, and ball joints at both ends of the link connecting it with, respectively, the said block and the said eccentric pin maintaining a constant linear distance between them, said block being laterally displaced with reference to the axis of the piston to reciprocate the piston while it is being rotated.

6. In a pump, a cylinder having inlet and discharge passages, a piston within the cylinder, said piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet and discharge passages, an off-set extension to said piston eccentric with respect to its axis, a shaft, a crank pin on said shaft eccentric with respect to its axis, the eccentricity of said crank pin and said off-set extension being the same, a disc movably secured to said crank pin, said off-set extension being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of the piston during which the groove in the piston communicates alternately with said inlet and discharge passages, and means to reciprocate, the piston including a fixed block laterally displaced with reference to the piston axis and a link connecting said block with the off-set extension of the piston.

7. In a pump, a cylinder having inlet and discharge passages, a piston within the cylinder, said piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet, and discharge passages, an off-set extension to said piston eccentric with respect to its axis, a shaft, a crank pin on said shaft eccentric with respect to its axis, the eccentricity of said crank pin and said off-set extension being the same, a disc movably secured to said crank pin, said off-set extension being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of the piston during which the groove in the piston communicates alternately with said inlet and discharge passages, means to reciprocate, and adjust the travel of, the piston including a regulating block, in spaced relation to said piston, a

link connecting said block with the off-set extension of the piston and means for laterally displacing the block with reference to the axis of the piston.

8. In a pump, a cylinder having inlet and discharge passages, a piston within the cylinder, said piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet and discharge passages, an off-set extension to said piston eccentric with respect to its axis, a shaft, a crank pin on said shaft eccentric with respect to its axis, the eccentricity of said crank pin and said off-set extension being the same, a disc movably secured to said crank pin, said off-set extension being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of the piston during which the groove in the piston communicates alternately with said inlet and discharge passages, means to reciprocate, and adjust the travel of, the piston including a regulating block, in spaced relation to said piston, a link connecting said block with the off-set extension of the piston, and means for laterally and radially displacing the block with reference to the axis of the piston, the distance between block and offset extension remaining constant.

9. In a pump, a cylinder having inlet and discharge passages, a piston within the cylinder, said piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet and discharge passages, an off-set extension to said piston eccentric with respect to its axis, a shaft, a crank pin on said shaft eccentric with respect to its axis, the eccentricity of said crank pin and said off-set extension being the same, a disc movably secured to said crank pin, said off-set extension being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of the piston during which the groove in the piston communicates alternately with said inlet and discharge passages, means to reciprocate, and adjust the travel of, the piston including a regulating block, in spaced relation to said piston, a link connecting said block with the off-set extension of the piston, ball joints at both ends of the link connecting it with, respectively, the said block and the off-set extension of said piston maintaining a constant linear distance between them, and means for laterally displacing the block with reference to the axis of the piston.

10. In a pump, a casing having an inlet and a plurality of outlets, a shaft, a crank pin on said shaft eccentric with respect to its axis, a plurality of cylinders, annularly disposed around and parallel to said shaft, each cylinder having an inlet passage in communication with said inlet and a discharge passage in communication with one of said outlets, a piston in each of said cylinders, each piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet passage and said discharge passage, an off-set extension to each of said pistons eccentric with respect to the axis of the piston, the eccentricity of said crank pin and said off-set extensions being the same, a disc movably secured to said crank extension, said off-set pin being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of each piston during which the groove in each piston communicates alternately with said passages, and means to reciprocate the pistons including for each piston a fixed block laterally displaced with reference to the piston axis, and a link connecting said block with the off-set extension of the piston.

11. In a pump, a casing having an inlet and a plurality of outlets, a shaft, a crank pin on said shaft eccentric with respect to its axis, a plurality of cylinders, annularly disposed around and parallel to said shaft, each cylinder having an inlet passage in communication with said inlet and a discharge passage in communication with one of said outlets, a piston in each of said cylinders, each piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet passage and said discharge passage, an off-set extension to each of said pistons eccentric with respect to the axis of the piston, the eccentricity of said crank pin and said off-set extensions being the same, a disc movably secured to said crank extension, said off-set pin being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of each piston during which the groove in each piston communicates alternately with said passages, and means to reciprocate, and adjust the travel of, the pistons, including for each piston a regulating block, in spaced relation to the piston, a link connecting said block with the off-set extension of the piston and means for laterally displacing the block with reference to the axis of the piston.

12. In a pump, a casing having an inlet and a plurality of outlets, a shaft, a crank pin on said shaft eccentric with respect to its axis, a plurality of cylinders, annularly disposed around and parallel to said shaft, each cylinder having an inlet passage in communication with said inlet and a discharge passage in communication with one of said outlets, a piston in each of said cylinders, each piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet passage and said discharge passage, an off-set extension to each of said pistons eccentric with respect to the axis of the piston, the eccentricity of said crank pin and said off-set extensions being the same, a disc movably secured to said crank pin, said off-set extensions being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of each piston during which the groove in each piston communicates alternately with said passages, and means to reciprocate, and adjust the travel of, the pistons including for each piston a regulating block, in spaced relation to the piston, a link connecting said block with the off-set extension of the piston and means for laterally and radially displacing the block with reference to the axis of the piston, the distance between block and offset extension remaining constant.

13. In a pump, a casing having an inlet and a plurality of outlets, a shaft, a crank pin on said shaft eccentric with respect to its axis, a plurality of cylinders, annularly disposed around and parallel to said shaft, each cylinder having an inlet passage in communication with said

inlet and a discharge passage in communication with one of said outlets, a piston in each of said cylinders, each piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet passage and said discharge passage, an off-set extension to each of said pistons eccentric with respect to the axis of the piston, the eccentricity of said crank pin and said off-set extensions being the same, a disc movably secured to said crank pin, said off-set extensions being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of each piston during which the groove in each piston communicates alternately with said passages, and means to reciprocate, and adjust the travel of, the pistons including a support in the casing in spaced relation over the pistons, a regulating block for each piston radially movable in said support with respect to the piston, and a link connecting said unit with the off-set extension of the piston, and means for laterally displacing the block with reference to the axis of the piston.

14. In a pump, a casing having an inlet and a plurality of outlets, a shaft, a crank pin on said shaft eccentric with respect to its axis, a plurality of cylinders, annularly disposed around and parallel to said shaft, each cylinder having an inlet passage in communication with said inlet and a discharge passage in communication with one of said outlets, a piston in each of said cylinders, each piston having a groove in constant communication with the cylinder below the piston and so disposed that it will be in alternate communication with said inlet passage and said discharge passage, an off-set extension to each of said pistons eccentric with respect to the axis of the piston, the eccentricity of said crank pin and said off-set extensions being the same, a disc movably secured to said crank pin, said off-set extensions being movably fitted to said disc, whereby a revolution of said crank pin will effect an oscillation of said disc and a complete revolution of each piston during which the groove in each piston communicates alternately with said passages, and means to reciprocate, and adjust the travel of, the pistons including for each piston a regulating block, in spaced relation to the piston, a link connecting said block with the off-set extension of the piston, ball joints at both ends of the link connecting it with, respectively, the said block and the off-set extension of its piston maintaining a constant linear distance between them and means for laterally displacing the block with reference to the axis of the piston.

15. A pump comprising a cylinder having inlet and discharge passages, a rotary and reciprocatory piston in the cylinder having means for alternately placing the inlet and discharge passages in communication with the cylinder as the piston rotates, an eccentric pivot carried by the piston, a fixed pivot laterally displaced with reference to the piston axis, a universal coupling, ball joints at both ends of said coupling connecting it with, respectively, said eccentric pivot and said fixed pivot, and means for rotating and thereby reciprocating the piston.

16. A pump comprising a cylinder having inlet and discharge passages, a rotary and reciprocatory piston in the cylinder having means for alternately placing the inlet and discharge passages in communication with the cylinder as the piston rotates, an eccentric pivot carried by the piston, a fixed pivot laterally displaced with reference to the piston axis, a universal coupling between the pivots, means for rotating and thereby reciprocating the piston, and means for adjusting the lateral displacement of the fixed pivot to regulate the stroke of the piston.

17. A pump comprising a cylinder having inlet and discharge passages, a rotary and reciprocatory piston in the cylinder having means for alternately placing the inlet and discharge passages in communication with the cylinder as the piston rotates, an eccentric pivot carried by the piston, a fixed pivot laterally displaced with reference to the piston axis, a universal coupling between the pivots, and means for rotating and thereby reciprocating the piston, the rotating means making axially slidable driving contact with the piston, whereby lost motion is eliminated.

18. A pump comprising a cylinder having inlet and discharge passages, a rotary and reciprocatory piston in the cylinder having means for alternately placing the inlet and discharge passages in communication with the cylinder as the piston rotates, an eccentric pivot carried by the piston, a fixed pivot laterally displaced with reference to the piston axis, a universal coupling between the pivots, means for rotating and thereby reciprocating the piston, and means for adjusting the lateral displacement of the fixed pivot to regulate the stroke of the piston, the rotating means making axially slidable driving contact with the piston.

19. A pump comprising a casing having an inlet and a plurality of outlets, said casing having a chamber in communication with the inlet, a plurality of cylinders, each cylinder having an inlet passage in communication with said chamber and a discharge passage in communication with one of said outlets, a rotary and reciprocatory piston in each cylinder having means for alternately placing said inlet passage and said discharge passage in communication with the cylinder as the piston rotates, an eccentric pivot carried by each piston, a fixed pivot for each piston laterally displaced with reference to the piston axis, a universal coupling between each fixed and eccentric pivot, and means for rotating and thereby reciprocating the pistons.

20. A pump comprising a casing having an inlet and a plurality of outlets, a plurality of cylinders, each cylinder having an inlet passage in communication with said inlet and a discharge passage in communication with one of said outlets, a rotary and reciprocatory piston in each cylinder having means for alternately placing said inlet passage and said discharge passage in communication with the cylinder as the piston rotates, an eccentric pivot carried by each piston, a fixed pivot for each piston laterally displaced with reference to the piston axis, a universal coupling between each fixed and eccentric pivot, means for rotating and thereby reciprocating the pistons, and means for adjusting the lateral displacement of each fixed pivot to regulate the stroke of the piston.

BENGT E. FOLKE.

CERTIFICATE OF CORRECTION.

Patent No. 2,369,345. February 13, 1945.

BENGT E. FOLKE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 51, after "reciprocate" strike out the comma; line 61, after "inlet" strike out the comma; page 3, first column, line 2, and second column, lines 37 and 66, after "piston" insert a comma; same page first column, lines 74 and 75, and second column, line 27, for "extension, said off-set pin" read --pin, said off-set extentions--; page 4, first column, line 22, after "piston," strike out "and"; line 56, after "them" insert a comma; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of April, A. D. 1945.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.