L. E. BAKER.

PUMP.

APPLICATION FILED NOV. 7, 1917.

1,382,450. Patented June 21, 1921.

4 SHEETS—SHEET 1.

Fig. 1

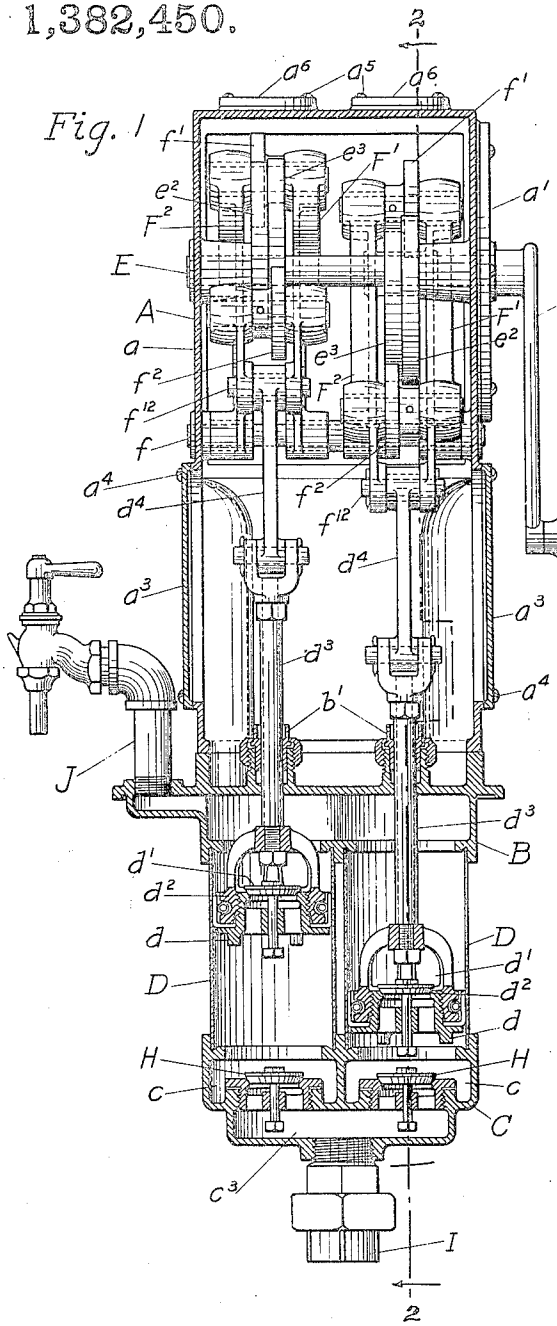
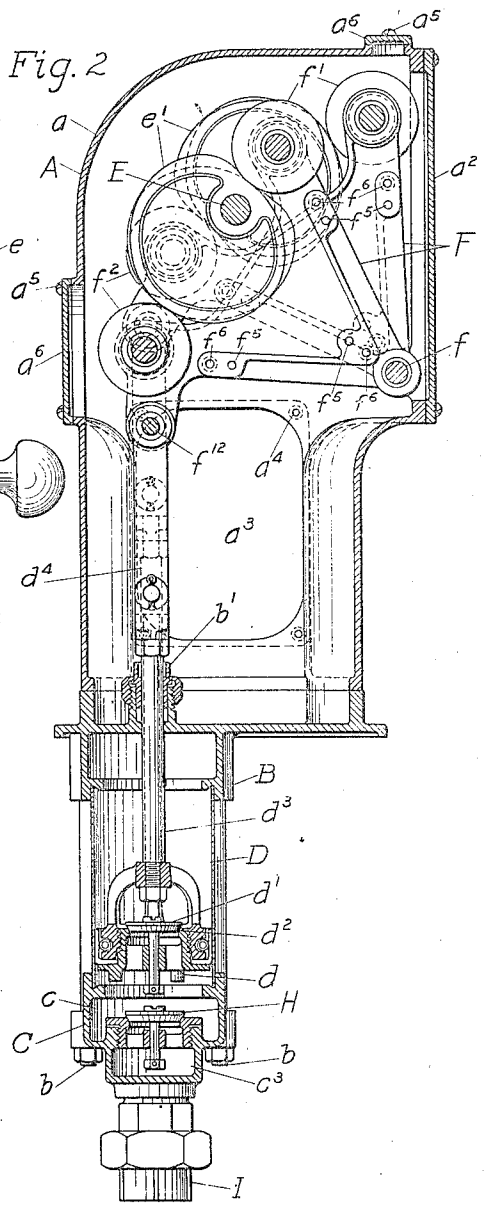


Fig. 2



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4 SHEETS—SHEET 2.

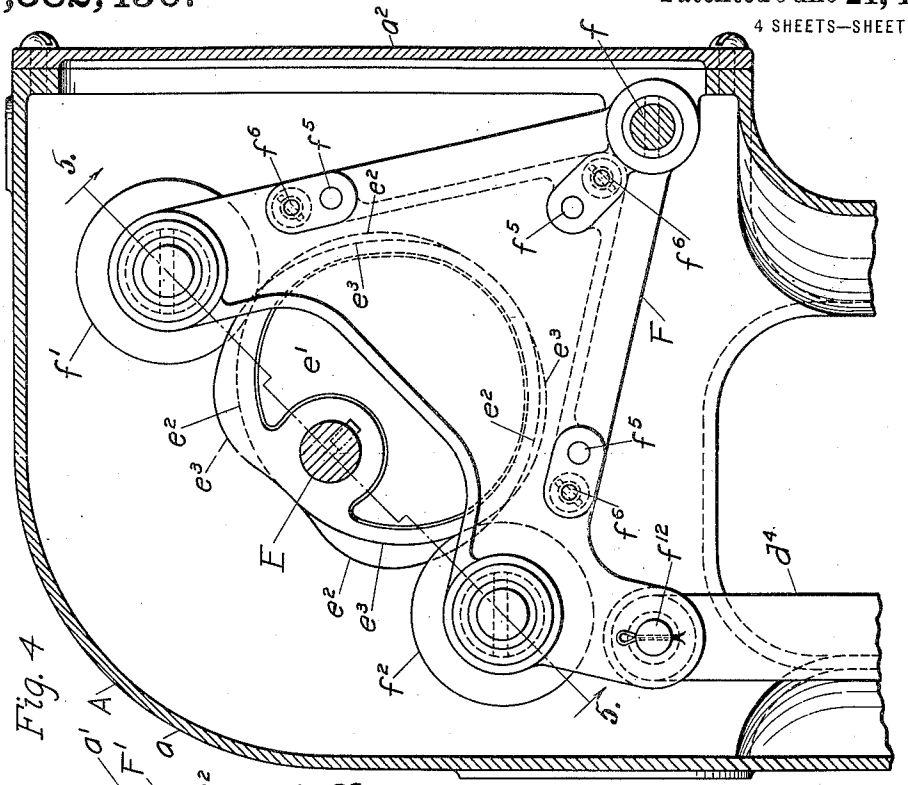


Fig. 4

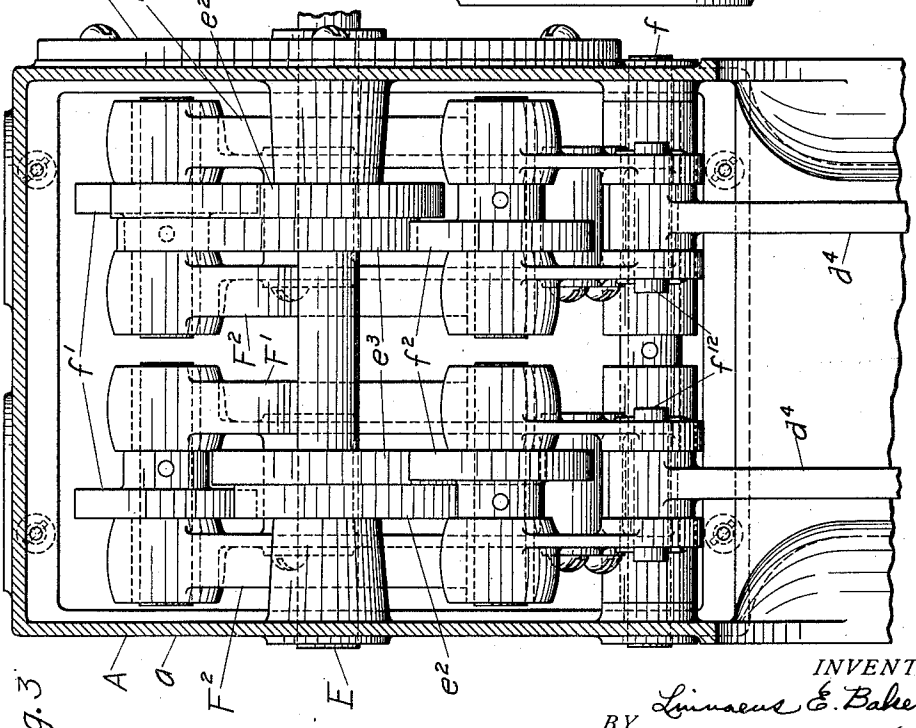


Fig. 3

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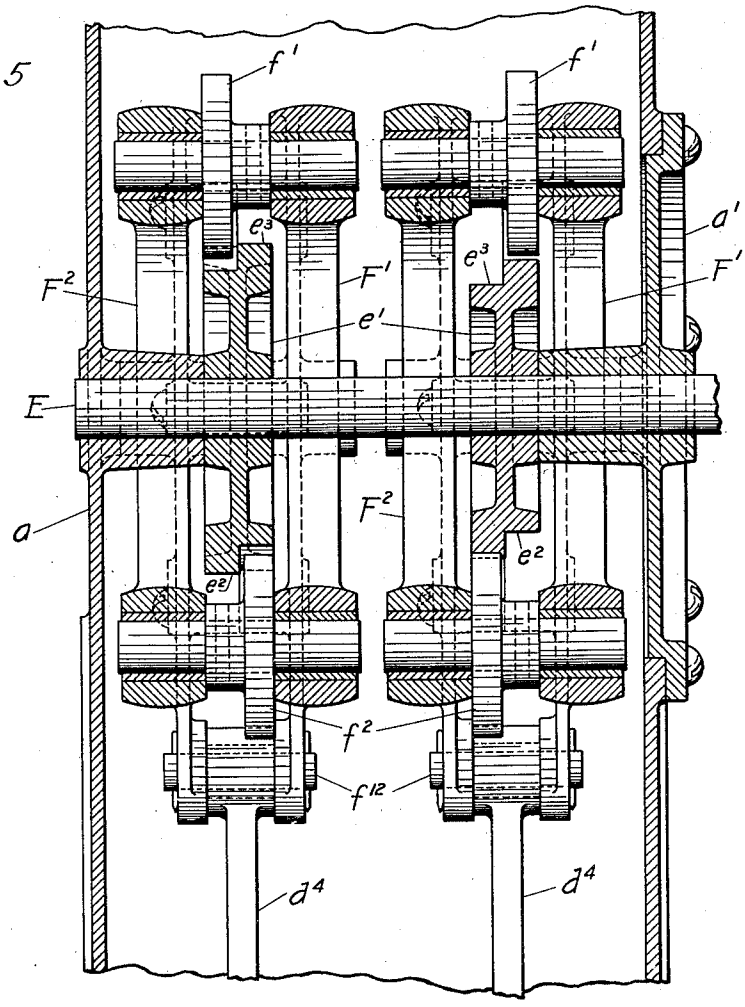
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4 SHEETS—SHEET 3.

Fig. 5



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4 SHEETS—SHEET 4.

Fig. 6

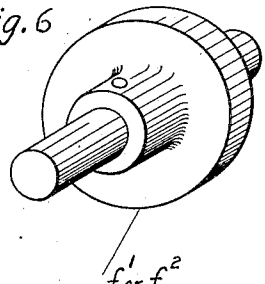


Fig. 7

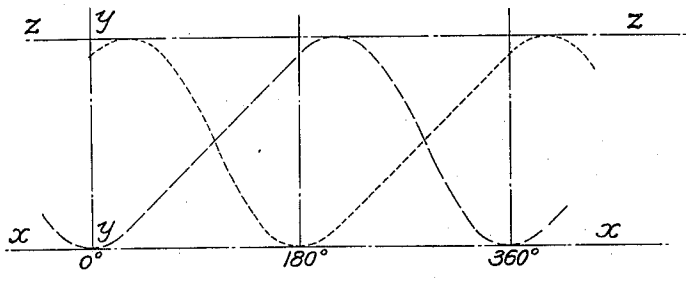


Fig. 8

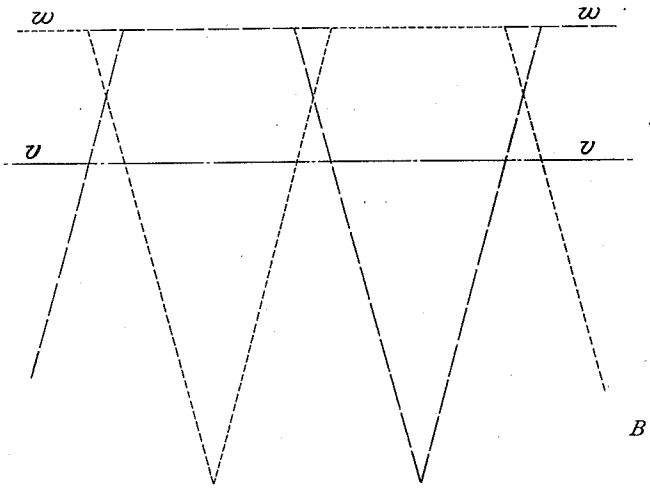


Fig. 9

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UNITED STATES PATENT OFFICE.

LINNAEUS E. BAKER, OF FORT WAYNE, INDIANA, ASSIGNOR TO WAYNE OIL TANK & PUMP COMPANY, OF FORT WAYNE, INDIANA, A CORPORATION OF INDIANA.

PUMP.

1,382,450. Specification of Letters Patent. Patented June 21, 1921.

Application filed November 7, 1917. Serial No. 200,714.

To all whom it may concern:

Be it known that I, LINNAEUS E. BAKER, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented new and useful Improvements in Pumps, of which the following is a specification.

My invention relates to cam-driven reciprocating piston pumps intended to produce a constant flow. Obviously a constant flow pump will be more efficient than any other type. Many so-called continuous or constant flow pumps do not in reality produce a constant flow but only roughly approximate it. A true constant flow pump is one in which the ratio of the angular displacement of the cam shaft to the volumetric displacement of the pump is a constant.

The present practice in power driven pumps shows a tendency to multiply the number of pistons so as to as closely as possible approximate a constant flow of the fluid pumped. With my improvements two single acting cylinders and pistons produce an absolutely constant flow; thus I accomplish completely the end desired with extremely simple mechanism.

My invention includes a structure embodying such parts and such functional relation of parts as that:—

(*a*) The quantity of liquid delivered will correspond with the quantum of partial or entire revolution or revolutions of the cam-shaft employed in reciprocating the pistons;

(*b*) The structure as a whole is simple and compact and the arrangement of mechanism is such that all working parts are readily accessible for removal, replacement and repair;

(*c*) The pump is operable with facility by hand or other power and is strong, durable and easily maintained in working order;

(*d*) The piston driving mechanism is so arranged that generous bearings and extra strong members are possible throughout;

(*e*) The rolls and cams are so arranged that the size of rolls relative to the stroke of the piston is very great and the length of the path of roll contact upon the cam relative to the stroke of the piston is reduced to a minimum, thereby conducing to efficiency in driving energy;

(*f*) By the use of two rolls for operating each piston, the cam may be so constructed that its greatest radius is reduced to a minimum, thereby minimizing the necessary space in the pump cam-case, and moreover the rolls never reverse their direction of rotation, as in the usual form of cam, where the roll runs in a groove and at certain positions in the rotation of the cam-shaft, slips, due to the inertia of the roll in reversing its direction of rotation;

(*g*) The relative positions of cam-shaft, cam roll axes and oscillating frame pivot make it possible to economize space and at the same time provide generous bearings and strong members; and

(*h*) The arrangement of mechanism provided facilitates the location of bearings near the outside of the cam-case where they can most conveniently be gotten at for oiling.

These and other incidental ends are attained in the structure shown in the accompanying drawings, forming part of this specification, which drawings exhibit the embodiment of my invention in the best form known to me.

Figure 1 is a sectional elevation of the cam case, cylinder heads and cylinders, exposing the interior mechanism to view, the pistons being also shown in section.

Fig. 2 is a sectional elevation of the cam case, cylinder heads and right hand cylinder of the pump taken on an axial plane at right angles to the preceding figure, and exposing the interior mechanism to view; the right hand piston being also shown in section.

Fig. 3 is an enlarged elevation of the cam mechanism as viewed from the front and cam-casing being sectioned for the purpose.

Fig. 4 is an enlarged sectional view similar in a general way to the upper part of Fig. 2.

Fig. 5, a detail, is a section through the cam case, cam and cam roll bearings taken on the line 5—5 of Fig. 4.

Fig. 6, a detail, is a perspective view of one of the cam rolls and its roll shaft.

Fig. 7, a detail, is a perspective view of the cam shaft and the cams in position thereon.

Fig. 8 is a diagram illustrating the relative positions of the pistons during operation, and

Fig. 9 is a diagram representing the velocity of the pistons corresponding to their positions in Fig. 8.

Referring now to the drawings: the driv-

ing mechanism of the pump is contained in a case, A, composed of the fixed portion, a, fitted with a bearing plate, a^1, which when loosened enables the cam shaft and attached cams hereinafter described to be withdrawn. The case is also provided with a cover plate, a^2, which when removed exposes the contents of the case to give accessibility to the mechanism for adjustment or repair. There is a plate, a^3, on each side of the case, A, held in place by screws, a^4. The case is also provided with four small doors, a^6, for convenience in oiling. These are secured to the case, A, by screws, a^5.

The case A is superimposed upon and secured to the top cylinder head B by means of screws 7. B is a one-chambered cylinder head forming a common discharge chamber for both cylinders with the usual outlet J, and is provided with stuffing boxes, b^1, for the piston rods, d^3.

Two cylinders, D, are secured between the top cylinder head, B, and the bottom cylinder head, C, in the usual manner, and held securely in place by external tie rods. Each cylinder is provided with a piston, d, provided with a check valve, d^1, adapted to close on the valve seat, d^2. Piston rods, d^3, and connecting rods, d^4, are of any usual type.

The bottom cylinder head, C, has its upper portion divided into two chambers, c, one for each cylinder. Each of these chambers is provided with a check valve, H. A single lower chamber, c^3, of the bottom cylinder head, C, is connected with the inlet pipe, I, in the usual manner, and constitutes a common inlet chamber for both of the pump cylinders.

Journaled in the cam case at one side in the fixed portion, a, and at the other side in the bearing plate, a^1, is a cam shaft, E, provided with a crank, e, or other means for rotation. Fixed to the cam shaft are two similar cams, e^1. Each cam has two principal bearing surfaces or tracks; track e^2 for the load roll hereinafter to be described, and track e^3 for the slack roll hereinafter to be described. These two cams are set on the shaft with the corresponding high and low points of their similar cam tracks 180° apart.

Secured to the cam case by a pivot, f, are oscillating frames, F. There is one complete oscillating frame F and its attendant parts for each of the cams, e^1. The oscillating frame is preferably of a general triangular shape. Considering the oscillating frame as pivoted at the apex, one of the two cam rolls is journaled in it near one of the base angles, and the other cam roll near the other. The load or lifting roll, f^1, is adapted to roll upon the cam track, e^2. The slack or return roll, f^2, is adapted to roll upon the cam track, e^3. (See Figs. 4, 5 and 6.)

The oscillating frame, F, is shown made in halves: F^1, F^2, for convenience in placing the rolls, f^1, f^2, in position, and the halves are doweled at f^5, and bolted together at, f^6, forming a rigid frame.

To the lower side of the frame, F, and toward one end thereof is journaled at, f^{12}, the connecting rod, d^4.

It will now be apparent that the oscillating frame F carrying the load roll near the base at its upper side, the slack roll near the base at its lower side, and the connecting rod connection on its lower side, while pivoted at the apex to the case, forms an extremely simple and efficient mechanism.

Referring to Fig. 8, the two curves represent graphically, when plotted to a scale, the relative positions of the pistons during rotation of the cam shaft. Line x—x represents the lowest position of the pistons, line z—z represents their highest position and their successive positions are measured upward from the line x—x. Angular motion of the cam shaft in degrees is reckoned to the right from the line y—y.

The line formed by long dashes in Fig. 8 represents the movement of one of the pistons, while the line formed by short dashes represents the movement of the other during consecutive angular positions of the cam shaft.

Similarly formed lines in Fig. 9 represent in the usual way the velocity of the said pistons in corresponding angular positions of the cam shaft.

The piston movements diagrammatically shown in Fig. 8, consist of such a combination of straight line and gravity curves as enable one skilled in the art to plot the cam curves requisite to produce such piston motion; while the attendant velocities of these piston movements are diagrammatically shown in Fig. 9, and constitute a graphic analysis of the sum of the piston velocities derived from Fig. 8, demonstrating that the result of their joint pumping actions is continually the same.

These two diagrammatic figures together show that the mechanism produces such movements of the pistons that the sum of their upward movements will be always the same. Most of the time this upward movement is of one piston only but for a brief period at each change of direction of the strokes the result is the sum of the upward movement of both.

With the particular form of cams herein illustrated and described, the relation of cam tracks and roll treads is such that a duplicate of the load roll and its shaft turned end for end may be used as a slack roll. This results in simplicity and economy in manufacture.

I conceive as within the scope of my invention any form of oscillating driver where the distance between the axis of the oscilla-

tion pivot and the axis of the cam shaft is less than the distance between the axis of the oscillation pivot and the axis of the roll shaft. It is possible to prevent the cam track for one roll from projecting radially and interfering with the hub of the opposed roll only when the distance between the axis of the oscillation pivot and the axis of the cam shaft is substantially less than the distance between the axis of the oscillation pivot and the axis of the roll shaft. The distance from the axis of each roll shaft to the axis of the oscillation pivot should be the same for economy and convenience in manufacture.

I have herein illustrated and described my invention in its preferred form of construction, combination and arrangement, but it is apparent that others skilled in the pump art might make various changes therefrom without departing from the spirit and scope of this invention.

I claim as my invention and desire to secure by Letters Patent of the United States:—

1. A pump having in combination a pair of cylinders and pistons, an oscillating member with rolls adapted to reciprocate each of said pistons, and a unitary cam member actuating each oscillating member, each cam member having a lead roll track and a slack roll track, the curves of each of said cams being a combination of gravity and constant gradient curves modified to correct the angularity of the connecting rod, the arc motion of the oscillating member, the radius of the rolls at their bearing point, and the piston rod displacement.

2. In a pump, the combination with two pump cylinders and reciprocating pistons therein, of two oscillating members each adapted to actuate one of said pistons, and two rotary cam members and means for rotating them at equal speeds, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of the cams.

3. In a pump, the combination with two pump cylinders and reciprocating pistons therein, of two oscillating members, each adapted to actuate one of said pistons, a cam shaft and two rotary cam members fixed to the said cam shaft, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cams and cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of said cams.

4. In a pump, the combination with two parallel pump cylinders and single acting reciprocating pistons therein, of two oscillating members each adapted to actuate one of said pistons, and two rotary cam members and means for rotating them at equal speeds, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cams and cam track being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of the cams.

5. In a pump, the combination with two pump cylinders and reciprocating pistons therein, of a suction manifold and a discharge manifold for each of said cylinders, two oscillating members each adapted to actuate one of said pistons, and two rotary cam members and means for rotating them at equal speeds, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cams and cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of the cams.

6. In a pump, the combination with two pump cylinders in parallel and reciprocating pistons therein, of a suction manifold and a discharge manifold for each of said cylinders, two oscillating members each adapted to actuate one of said pistons, and two rotary cam members and means for rotating them at equal speeds, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cams and cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of the cams.

7. In a pump, the combination with two pump cylinders and reciprocating single acting pistons therein, of a suction manifold and a discharge manifold for each of said cylinders, two oscillating members each adapted to actuate one of said pistons, and two rotary cam members and means for rotating them at equal speeds, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated

thereby, said cams and cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of the cams.

8. In a pump, the combination with two pump cylinders and reciprocating pistons therein, of a common suction manifold, and a common discharge manifold, two oscillating members each adapted to actuate one of said pistons, and two rotary cam members and means for rotating them at equal speeds, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cams and cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of the cams.

9. In a pump, the combination with two pump cylinders in parallel and single acting reciprocating pistons therein, of a common suction manifold and a common discharge manifold, two oscillating members each adapted to actuate one of said pistons, a cam shaft and two rotary cam members fixed to the said cam shaft, each of said cam members adapted to actuate one of said oscillating members and provided with separate cam tracks for discharge and return motions of the oscillating member actuated thereby, said cams and cam tracks being so arranged and formed in relation to each other that the pistons are actuated to deliver equal quantities of fluid pumped for all equal arcs of revolution of said cams.

10. A pump having in combination, a pair of cylinders; for each of the cylinders, a piston, piston rod, suitable operating connection for the piston rod, oscillating member with the operating connection attached thereto, two track cams adapted to actuate the oscillating member, a load roll for one track of the cam and an oppositely disposed slack roll for the other track, both rolls journaled to the oscillating frame; and a shaft to which said cams are fixed substantially 180° apart, the curves of each of the cams being a combination of gravity and constant gradient curves modified to correct the angularity of the connecting rod, the arc motion of the oscillating member, the radius of the rolls at their bearing point, and the piston rod displacement; so as to produce a constant flow of fluid pumped.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LINNAEUS E. BAKER.

Witnesses:
ELIZABETH C. HARKENRIDER,
WALTER A. KNIGHT.