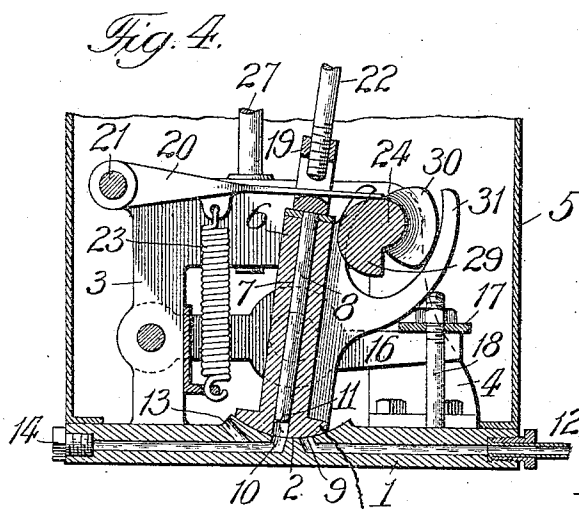
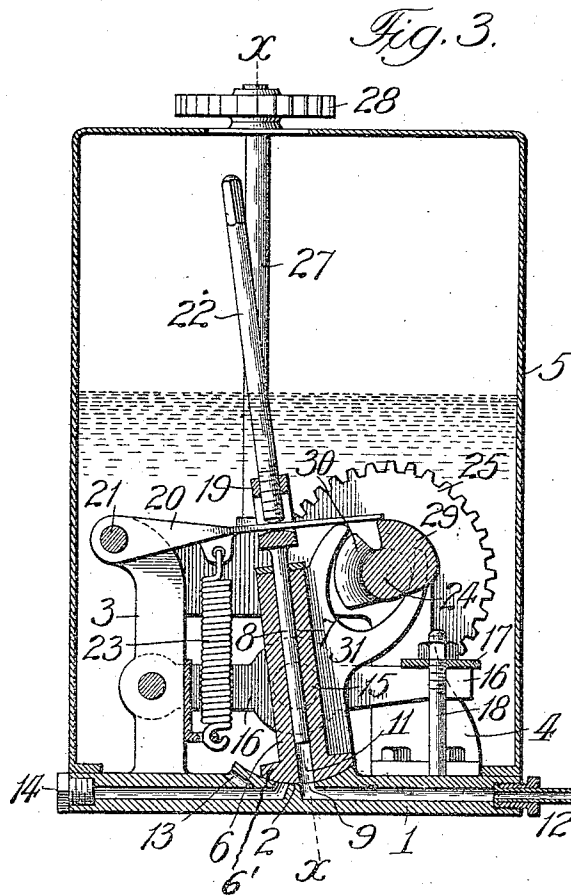


C. C. HILL.
PUMPING APPARATUS.
APPLICATION FILED DEC. 30, 1904.

951,397.

Patented Mar. 8, 1910.

3 SHEETS—SHEET 2.



Attest:

John Enders.

M. H. Holmes.

Inventor:

C. C. Hill.

by Robert Burns

Attorney.

C. C. HILL.
PUMPING APPARATUS.
APPLICATION FILED DEC. 30, 1904.

951,397.

Patented Mar. 8, 1910.

3 SHEETS—SHEET 3.

Fig. 5.

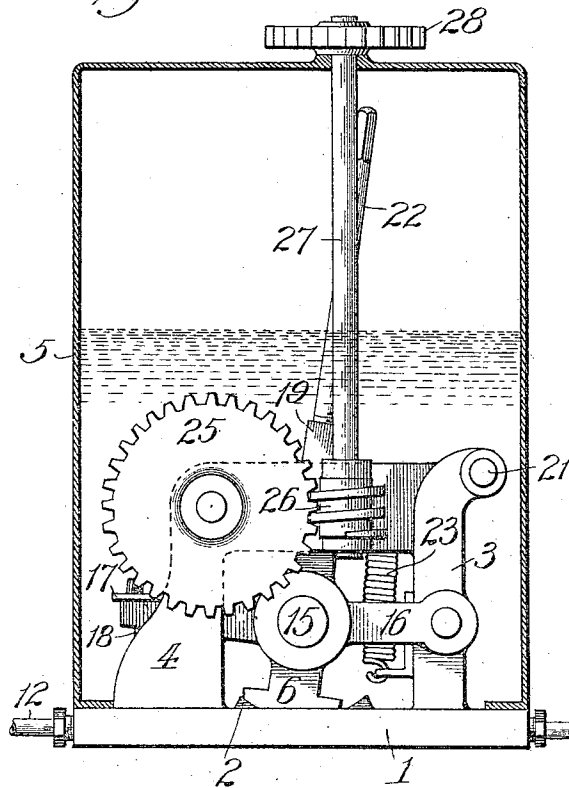
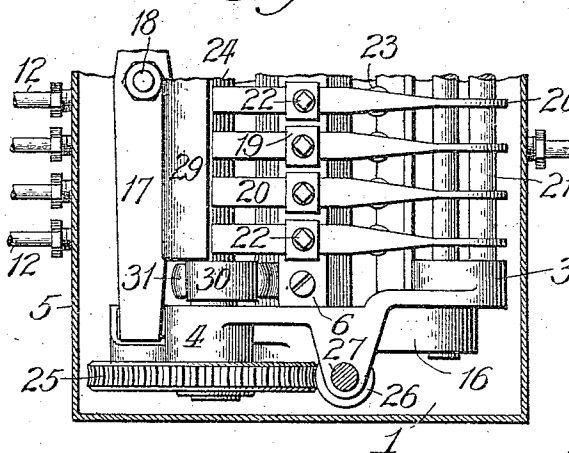


Fig. 6.



Attest:

John Enders.

W. H. Holmes.

Inventor:

Christian C. Hill.

by Robert Burns
Attorney.

UNITED STATES PATENT OFFICE.

CHRISTIAN C. HILL, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
PRECISION APPLIANCE COMPANY, A CORPORATION OF NEW JERSEY.

PUMPING APPARATUS.

951,397.

Specification of Letters Patent.

Patented Mar. 8, 1910.

Continuation of application Serial No. 196,759, filed March 5, 1904. This application filed
December 30, 1904. Serial No. 238,933.

To all whom it may concern:

Be it known that I, CHRISTIAN C. HILL, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a specification.

The present invention relates to a pumping apparatus for use in connection with automobiles and other machinery to positively feed in predetermined quantities lubricating and other fluids to the different bearings and parts of the same, and in connection with explosion engines to positively feed in a regulatable manner a precise or measured quantity of gasoline or like explosive fluid into the inlet passage of the explosion engine for each active stroke of the same; and the object of the present improvement is to provide a simple and efficient structural formation and combination of the pump parts and their operating accessories involving the entire absence of independent inlet and outlet valves for controlling the flow of fluid and in which the stroke of the pump piston or plunger can be varied to afford any required discharge, in an easy and convenient manner, and without interference with the continued movement of the power mechanism by which such pump piston is driven; and by which a series of independent pumps are arranged to operate in unison and to have the stroke of their individual pump pistons or plungers varied in an independent manner to afford the required and positive discharge of fluid from any particular pump without interference with the volume of discharge of the other pumps of the series, all as will hereinafter more fully appear and be more particularly pointed out in the claims.

In the accompanying drawings illustrative of the present invention:—Figure 1, is a longitudinal sectional elevation at line $x-x$, Fig. 3, of a duplex pumping apparatus constructed in accordance with the present invention and adapted to feed a suitable lubricant to the different bearings of an automobile or other machine. Fig. 2 is a fragmentary front elevation of the mech-

anism with the casing in section. Fig. 3 is a transverse sectional elevation of the same, at line $x'-x'$, Fig. 1. Fig. 4 is a similar view showing the parts in a different position to that shown in Fig. 3. Fig. 5 is an end elevation of the mechanism with the casing in section. Fig. 6 is a fragmentary plan view of the mechanism with the casing in section.

Similar numerals of reference indicate like parts in the several views.

Referring to the drawings:—1 represents the stationary base or bed plate of the apparatus, which in the present invention is provided with a longitudinally extending concave or segmental seat or valve element 2 for the oscillating pump cylinder or casing, and with inlet and outlet ports and passages for the oil or other fluid which is to be pumped, as hereinafter more fully described. The bed plate 1, is also provided with standards or uprights 3 and 4, for supporting the mechanism by which the pump is operated.

5 is a shell or casing secured to the borders of the bed plate 1, to form an inclosure for the present pump mechanism, and which in the type of the present invention illustrated in the drawings, is adapted to contain the supply of lubricating or other oil to be pumped, and in which oil the present pumping mechanism is immersed.

6 is the pump cylinder the lower end of which is provided with lateral flanges 6' to provide the required width to the bottom face of the pump cylinder to constitute the movable valve member thereof. The bottom face of said flanges and the bottom face of the pump cylinder are of a convex or segmental form and of the same radius as the concave seat or valve element 2, aforesaid, and adapted to have an oscillatory sliding movement upon such seat or valve element in the operation of the present apparatus. Such pump casing 6, in the preferred form of the present invention as shown in the drawings, is of a longitudinally elongated form, and provided with a series of any required number of vertical bores in parallel and separated relation to constitute a series of independent piston chambers 7, in which the reciprocating pump pistons or

plungers 8, have movement; such piston chambers extend vertically through the pump casing 6, with their lower ends adapted to register alternately with the inlet and outlet ports of the seat or valve element 2, now to be described.

9 and 10 are companion outlet and inlet ports or passages opening through the seat or valve element 2, aforesaid, and arranged in parallel relation to each other and in the direction of oscillation of the pump casing 6; each pair of such ports are individual to a piston chamber 7, of the series of piston chambers before described, and are adapted to alternately register with the single central induction-duction duct 11, at the lower end of each piston chamber, during the continued oscillation of the pump casing in actual use.

The series of outlet ports or passages 9, are arranged independent of each other, and will extend through the base 1, in any suitable direction and be connected to individual passages or pipes 12, each one of which extends to a point where the discharge of a particular pump chamber is to be used, and which may be a bearing to be lubricated, or the inlet passage of an explosion engine, and into the body of air moving through such passage a charge of volatile hydrocarbon is to be discharged to render the same explosive. The series of inlet ports or passages 10, as distinguished from the series of outlet ports or passages 9, above described, will have their arrangement varied to meet the varied requirements of the different special applications of the present invention, and so that they will take their supply from a common source of supply in any application of the present apparatus, where a single fluid is to be distributed to various points for use, such for instance as the feeding of one grade of lubricating fluid to the various bearings of an automobile or other mechanism, or a supply of volatile hydrocarbon into the inlet passages of a series of explosion engines. In other applications of the present invention and where different grades of fluids are to be pumped, such inlet ports or passages will be connected in groups comprising one or more of said inlet ports or passages, and with each group connected to an independent source of supply.

In the particular construction shown in the drawings, said inlet ports or passages are formed as a series of independent passages in the base 1, and connected with the upper surface of such base 1, by the branch passages 13, so as to communicate with the supply chamber formed by such base and the casing 5, heretofore described; with the described arrangement any one or more of the passages 10, may be closed by a clo-

sure plug 14, and the corresponding branch passages 13, left open, or one or more of said branch passages may be closed by a like closure plug and the corresponding passages 10, left unobstructed and connected to a separate supply tank as the particular requirement may indicate.

15 are trunnions formed on the ends of the pump casing 6, and having an axial arrangement in relation to the radius of the segmental lower end of the said pump casing.

16 are transverse beams, the central portions of which have engagement with the aforesaid trunnions 15; such beams are pivotally attached at one end to the standards or uprights 3, of the base 1, while the other and free ends are engaged by an adjustable and yielding bar now to be described.

17 is a longitudinally extending equalizer spring or bar, the respective ends of which have bearing upon the respective free ends of the beams 16, as best illustrated in Fig. 2.

18 is a vertical bolt secured to the base 1, with its upper end passing through central part of the equalizer bar 17, and provided with an adjustable nut which bears upon the upper face of said bar, and by means of which the stress exerted by the equalizer bar in holding the oscillating pump casing 6, to its seat can be regulated as required in a ready, uniform and efficient manner.

19 are individual yokes, secured to the upper ends of the respective pump pistons or plungers 8, and provided with vertically elongated yoke openings of a substantially rectangular shape for the reception of the individual levers by which said pistons or plungers are operated.

20 are the individual operating levers of the pump plungers aforesaid, pivoted at one end on a longitudinal pivot shaft 21, carried by the uprights or standards 3, of the base 1, and with their free ends arranged in the path of the operating cam hereinafter described; such levers intermediate of their length engage in the openings of the yoke 19, heretofore described, so as to have operative connection with the pump pistons or plungers.

22 are individual abutment stems screwing through the upper bars of the yokes 19, with their lower ends forming adjustable abutments for the respective levers 20, aforesaid; as so arranged such abutments can be adjusted to permit of more or less lost motion between the parts with a corresponding change in the amount of rectilinear movement imparted to the pump plungers or pistons 8, and in such manner afford a ready and convenient means for adjusting the delivery of any one pump in a manner entirely independent of that of the other pumps of the series.

23 are individual springs connected to the levers 20, aforesaid and adapted to impart motion to the same in one direction.

24 is a cam shaft journaled in bearings 5 at the upper ends of the standards or uprights 4, of the base 1, and receiving motion in any suitable manner from a power source most convenient for the operation of the apparatus; in the particular operating mechanism shown in the drawing; 25 is a worm wheel on the cam shaft 24, having operative engagement with a worm 26, carried by a shaft 27, which extends vertically to a point above the top of the casing 5, of the apparatus, as shown in Figs. 1 and 3; and such shaft is provided at its upper end with a ratchet or other wheel 28, adapted to receive rotation from a convenient power source.

29 is a longitudinally extending cam on the cam shaft 24, common to the series of levers 20, aforesaid, and adapted to impart intermittent oscillation to the same.

30 are cams on the shaft 24, near the respective ends of the cams 29, aforesaid, and having operative engagement with cam yokes 31, attached to the pump casing 6, and adapted to impart intermittent oscillation to such pump casing, with a view to allow the induction-education port 11, of the pump chambers to remain for a period of time in full communication with the inlet and outlet ports 9 and 10, of the stationary base 1, in the normal operation of the apparatus, and attain a free and ample inlet and a like free and ample discharge from the series of pump chambers.

The operation of the apparatus is as follows: With a continued revolution of the cam shaft 24, the cam 29 is adapted to impart the suction stroke to the series of pump pistons or plungers 8, against the stress of the springs 23, which springs are adapted to impart the ejector stroke to said pistons or plungers as the cam 29 moves from under the intermediate operating levers 20. The cams 30 are adapted to impart intermittent oscillation to the pump casing by engagement with the cam yokes 31 on said casing. Said cams 29 and 30 are so positioned with relation to each other that the induction-education ports 11 of the pump chambers will be in communication with the inlet ports 9 when the pump pistons or plungers 8 are making their suction stroke, and in connection with the outlet ports 10 when said pistons or plungers are making their ejector stroke.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A pumping apparatus, comprising a pump casing having a piston chamber and an inlet-outlet port, a piston in said cham-

ber, and means for imparting reciprocation 65 to said piston, the same comprising a spring and intermediate lever adapted to move said piston in one direction, a cam engaging said lever for moving said piston in the other direction, and means for varying the operative engagement of said lever with the piston, substantially as set forth.

2. A pumping apparatus, comprising a pump casing having a piston chamber and an inlet-outlet port, a piston in said chamber, and means for imparting reciprocation 75 to said piston, the same comprising a yoke on said piston, a lever engaging said yoke, an adjustable abutment at the upper end of said yoke, a spring for moving said lever 80 in one direction, and a cam mechanism for moving said lever in the other direction, substantially as set forth.

3. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, and means for imparting reciprocation to said piston, the same comprising a spring for moving said piston in one direction, and a cam mechanism for moving said piston in the other direction and for imparting oscillation to the pump casing, substantially as set forth. 95

4. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, and means for imparting reciprocation to said piston, the same comprising a spring and intermediate lever for moving said piston in one direction and a cam mechanism for moving said piston in the other direction and for imparting oscillation to the pump casing, substantially as set forth. 105

5. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, and means for imparting reciprocation to said piston, the same comprising a yoke on said piston, a lever engaging said yoke, an adjustable abutment at the upper end of said yoke, a spring for moving said lever in one direction, and a cam mechanism for moving said lever in the other direction and for imparting oscillation to the pump casing, substantially as set forth. 115

6. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston 125

moving in said chamber, means for imparting reciprocation to said piston, the same comprising a spring for moving said piston in one direction and a cam mechanism for moving said piston in the other direction and for imparting oscillation to the pump casing, and a casing attached to the base aforesaid and adapted to inclose the pump mechanism and form a containing chamber for the fluid to be pumped, substantially as set forth.

7. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting reciprocation to said piston, and means for imparting intermittent oscillation to said pump casing, the same comprising a cam yoke on the pump casing and a cam engaging said yoke, substantially as set forth.

8. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting reciprocation to said piston, the same comprising a spring for moving said piston in one direction and a cam mechanism for moving said piston in the other direction, and means for imparting intermittent oscillation to said pump casing, substantially as set forth.

9. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting reciprocation to said piston, the same comprising a spring and intermediate lever for moving said piston in one direction and a cam mechanism for moving said piston in the other direction, and means for imparting intermittent oscillation to said pump casing, substantially as set forth.

10. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting intermittent oscillation to the pump casing the same comprising a cam yoke on the pump casing and an operating cam engaging said yoke, and means for imparting reciprocation to the piston, substantially as set forth.

11. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump cas-

ing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting intermittent oscillation to the pump casing the same comprising a cam yoke on the pump casing and an operating cam engaging said yoke, and means for imparting reciprocation to the piston, the same comprising a spring for moving said piston in one direction and a cam mechanism for moving said piston in the other direction, substantially as set forth.

12. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting intermittent oscillation to the pump casing the same comprising a cam yoke on the pump casing and an operating cam engaging said yoke, and means for imparting reciprocation to the piston, the same comprising a spring for moving said piston in one direction and a cam and intermediate lever for moving said piston in the other direction, substantially as set forth.

13. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for imparting intermittent oscillation to the pump casing the same comprising a cam yoke on the pump casing and an operating cam engaging said yoke, and means for imparting reciprocation to the piston, the same comprising a yoke on said piston, a lever engaging said yoke, an adjustable abutment at the upper end of said yoke, a spring for moving said lever in one direction and a cam mechanism for moving said lever in the other direction, substantially as set forth.

14. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing, the same comprising a cam yoke on the pump casing and a cam engaging said yoke, and means for imparting reciprocation to the piston, substantially as set forth.

15. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for yieldingly holding the pump casing to the seat, means

for imparting intermittent oscillation to the pump casing, and means for imparting reciprocation to the piston, the same comprising a spring for moving said piston in one direction and a cam mechanism for moving said piston in the other direction, substantially as set forth.

16. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing adapted to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing, and means for imparting reciprocation to the piston, the same comprising a spring and intermediate lever for moving said piston in one direction and a cam mechanism for moving said piston in the other direction, substantially as set forth.

17. A pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a pump casing to oscillate on said seat and provided with a piston chamber, a piston moving in said chamber, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing, and means for imparting reciprocation to the piston, the same comprising a yoke on said piston, a lever engaging said yoke, an adjustable abutment at the upper end of said yoke, a spring for moving said lever in one direction and a cam mechanism for moving said lever in the other direction, substantially as set forth.

18. A multiple pumping apparatus, comprising a single pump casing having a series of piston chambers and suitable inlet-outlet passages, individual pistons in said chambers, and means for imparting reciprocation to said pistons, the same comprising individual levers and springs for moving said pistons in one direction and a cam engaging said levers for simultaneously moving said pistons in the other direction, substantially as set forth.

19. A multiple pumping apparatus, comprising a single pump casing having a series of piston chambers and suitable inlet-outlet passages, individual pistons in said chambers, and means for imparting reciprocation to said pistons, the same comprising individual yokes on said pistons, levers engaging said yokes, adjustable abutments at the upper ends of said yokes, springs for moving said levers in one direction, and a cam moving said levers in the other direction, substantially as set forth.

20. A multiple pumping apparatus, comprising a single oscillating pump casing having a series of piston chambers and suitable inlet-outlet passages, individual pistons in

said chambers, means for imparting reciprocation to said pistons, the same comprising individual springs moving said pistons in one direction and a cam mechanism moving said pistons in the other direction, a supporting base for the mechanism having a concave seat for the pump casing, and a casing attached to said base and adapted to inclose the pump mechanism and to form a containing chamber for the fluid to be pumped, substantially as set forth.

21. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, and means for imparting simultaneous reciprocation to said pistons in the same direction, substantially as set forth.

22. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, and means for imparting reciprocation to such pistons, the same comprising individual springs moving said pistons in one direction and a cam mechanism moving said pistons in the other direction, substantially as set forth.

23. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, and means for imparting reciprocation to such pistons, the same comprising individual levers and springs for moving said pistons in one direction and a cam engaging said levers for moving said pistons in the other direction, substantially as set forth.

24. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, and means for imparting reciprocation to such pistons, the same comprising individual yokes on said pistons, levers engaging said yokes, adjustable abutments at the upper ends of said yokes, springs for moving said levers in one direction and a cam for moving said levers in the other direction, substantially as set forth.

25. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers,

means for imparting reciprocation to said pistons, and a casing attached to the pump base and adapted to inclose the pump mechanism and form a containing chamber for the fluid to be pumped, substantially as set forth.

26. A multiple apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing, and means for imparting simultaneous reciprocation to said pistons in the same direction, substantially as set forth.

27. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing, and means for imparting reciprocation to said pistons, the same comprising individual springs moving said pistons in one direction and a cam mechanism moving said pistons in the other direction, substantially as set forth.

28. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing, and means for imparting reciprocation to said pistons, the same comprising individual levers and springs for moving said pistons in one direction and a cam engaging said levers for moving the pistons in the other direction, substantially as set forth.

29. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing and means for imparting reciprocation to said pistons, the same comprising individual yokes on said pistons, levers engaging said yokes, springs for moving said levers in one direction and a cam moving said levers in the other direction, substantially as set forth.

30. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation

to said pump casing, and means for imparting reciprocation to said pistons, and a casing attached to the pump base and adapted to inclose the pump mechanism and to form a containing chamber for the fluid to be pumped, substantially as set forth.

31. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing, the same comprising a cam yoke on said casing and an operating cam engaging said yoke, and means for imparting reciprocation to said pistons, substantially as set forth.

32. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing the same comprising a cam yoke on said casing and an operating cam engaging said yoke, and means for imparting reciprocation to said pistons, the same comprising individual springs moving said pistons in one direction and a cam mechanism moving said pistons in the other direction, substantially as set forth.

33. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing the same comprising a cam yoke on said casing and an operating cam engaging said yoke, and means for imparting reciprocation to said pistons, the same comprising individual levers and springs for moving said pistons in one direction and a cam engaging said levers for moving the pistons in the other direction, substantially as set forth.

34. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing the same comprising a cam yoke on said casing and an operating cam engaging said yoke, and means for imparting reciprocation to said pistons, the same comprising individual yokes on said pistons, levers engaging said yokes, adjustable abutments at the upper ends of said yokes, springs for moving said levers in one direc-

tion and a cam moving said levers in the other direction, substantially as set forth.

35. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for imparting intermittent oscillation to said pump casing, the same comprising a cam yoke on said casing and an operating cam engaging said yoke, means for imparting reciprocation to said pistons, and a casing attached to the pump base and adapted to inclose the pump mechanism and form a containing chamber for the fluid to be pumped, substantially as set forth.

36. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing, and means for imparting reciprocation to the pistons, substantially as set forth.

37. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing the same comprising a cam yoke on the pump casing and an operating cam engaging said yoke, and means for imparting reciprocation to the pistons, substantially as set forth.

38. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing, and means for imparting reciprocation to the pistons, the same comprising individual springs moving said pistons in one direction and a cam mechanism moving said pistons in the other direction, substantially as set forth.

39. A multiple pumping apparatus, comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, means for imparting intermittent oscillation to the pump casing, the same

comprising a cam yoke on the pump casing and an operating cam engaging the same, and means for imparting reciprocation to the pistons, the same comprising individual springs moving said pistons in one direction and a cam mechanism moving said pistons in the other direction, substantially as set forth.

40. A multiple pumping apparatus comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, the same comprising a pair of pivoted end beams engaging said pump casing, a spring equalizer bar engaging the free ends of said beams and a central tension adjusting bolt engaging the equalizer bar, means for imparting intermittent oscillation to the pump casing and means for imparting reciprocation to the pistons, substantially as set forth.

41. A multiple pumping apparatus comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, the same comprising a pair of pivoted end beams engaging said pump casing, a spring equalizer bar engaging the free ends of said beams and a central tension adjusting bolt engaging the equalizer bar, means for imparting intermittent oscillation to the pump casing, the same comprising a cam yoke on the pump casing and an operating cam engaging said yoke, and means for imparting reciprocation to the pistons, substantially as set forth.

42. A multiple pumping apparatus comprising a base provided with a concave seat and suitable inlet and outlet passages, a single pump casing adapted to oscillate on said seat and having a series of piston chambers, individual pistons in said chambers, means for yieldingly holding the pump casing to the seat, the same comprising a pair of pivoted end beams engaging said pump casing, a spring equalizer bar engaging the free ends of said beams and a central tension adjusting bolt engaging the equalizer bar, means for imparting intermittent oscillation to the pump casing and means for imparting reciprocation to the pistons, the same comprising individual springs moving the pistons in one direction and a cam mechanism moving said pistons in the other direction, substantially as set forth.

43. A pumping apparatus comprising in combination, a substantially straight rank

of pump units arranged in parallel relation, a single valve element operating in unison with the pump units and provided with a series of inlet-outlet ports individual to the
5 pump units, a single stationary valve seat or element formed with a plurality of inlet and outlet ports with which the pump units alternately communicate in an individual and simultaneous manner, and means for
10 actuating said pump units and movable valve element.

44. A pumping apparatus comprising in combination, a containing casing, a substantially straight rank of pump units arranged
15 in parallel relation a single valve element operating in unison with the pump units and provided with a series of inlet-outlet ports individual to the pump units, a single stationary valve seat or element formed with
20 a plurality of inlet and outlet ports with which the pump units alternately communicate in an individual and simultaneous manner, and means for actuating said pump units and movable valve element.

25 45. A pumping apparatus comprising in combination, a substantially straight rank of pump units arranged in parallel relation, a single valve element operating in unison with the pump units and provided with a
30 series of inlet-outlet ports individual to the

pump units, a single stationary valve seat or element formed with a plurality of inlet and outlet ports with which the pump units alternately communicate in an individual and simultaneous manner, means for indi- 35
vidually adjusting the stroke of the pump units, and means for actuating said pump units and movable valve element.

46. A pumping apparatus comprising in combination, a containing casing, a substantially straight rank of pump units arranged
40 in parallel relation, a single valve element operating in unison with the pump units and provided with a series of inlet-outlet ports individual to the pump units, a single 45
stationary valve seat or element formed with a plurality of inlet and outlet ports with which the pump units alternately communicate in an individual and simultaneous manner, means for individually adjusting 50
the stroke of the pump units, and means for actuating said pump units and movable valve element.

Signed at Chicago, Illinois, this 22d day of December, 1904.

CHRISTIAN C. HILL.

Witnesses:

ROBERT BURNS,
M. H. HOLMES.