No. 886,047. PATENTED APR. 28, 1908.

R. J. FLINN.

VARIABLE DELIVERY PUMP.

APPLICATION FILED AUG. 2, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

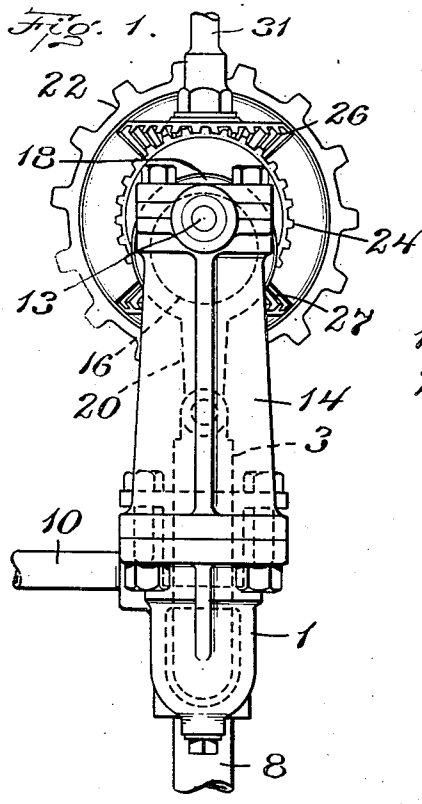


Fig. 2.

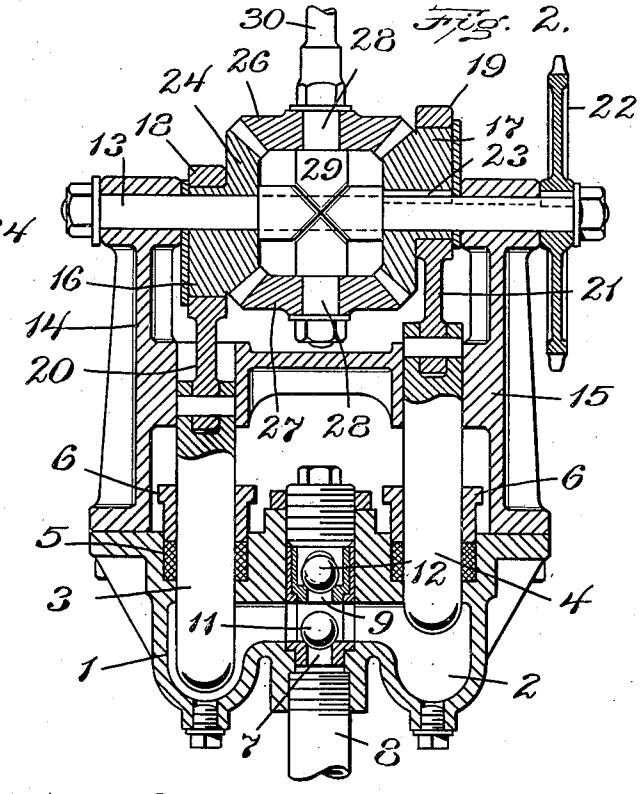
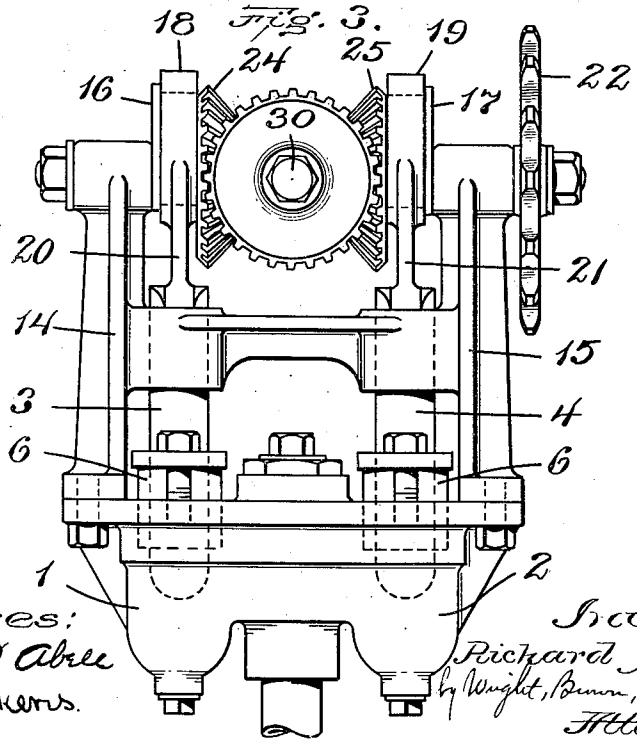


Fig. 3.



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2 SHEETS—SHEET 2.

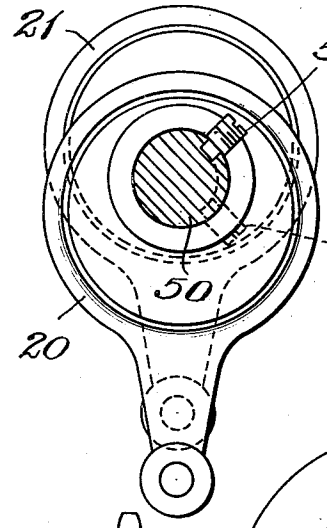

Fig. 5.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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VARIABLE-DELIVERY PUMP.

No. 886,047. Specification of Letters Patent. Patented April 28, 1908.

Application filed August 2, 1905. Serial No. 272,313.

To all whom it may concern:

Be it known that I, RICHARD J. FLINN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Variable-Delivery Pumps, of which the following is a specification.

The object of this invention is to provide a pump which is adapted to be driven at a constant speed and which will have capability of varying its output without reducing or increasing the speed at which it is driven. The manner in which this result is accomplished consists in the employment of one or more plungers arranged to reciprocate in a chamber and driven by two or more eccentrics, these eccentrics being adjustable so that the strokes of the plungers may be varied to alter the volume effective in the chamber to displace the fluid therein during a complete stroke.

The details in which my invention is practically embodied are illustrated in the accompanying drawings and described and claimed in the following specification.

In the drawings,—Figure 1 represents an end elevation, Fig. 2 a vertical longitudinal section, and Fig. 3 a side elevation of one form of pump, constructed to embody the principles of this invention. Fig. 4 represents a vertical central section of another form of pump having a different driving mechanism. Fig. 5 represents a cross-section of the driving mechanism of this form of pump.

The same reference characters indicate the same parts in all the figures.

The pump having the construction illustrated in Fig. 1, 2 and 3 will be first described. This pump consists of a casing 1 inclosing a chamber 2 adapted to contain air, water, oil or other fluid. Into this chamber extend the ends of plungers 3 4 which are adapted to be moved forward and backward to project into and partially withdraw from the chamber. These plungers extend through stuffing boxes in the upper wall of the chamber and are surrounded by suitable packing 5 and glands 6 for preventing escape of the contained fluid. An inlet 7 allows fluid to be drawn into the chamber through a supply-pipe 8 and a passage 9 provides an outlet through which it may be forced into the pipe 10. Ball-valves 11 and 12 normally rest upon seats surrounding the passages 7 and 9 to close them, valve 11 being lifted from its seat whenever the pressure in the chamber is caused by the withdrawal of the plungers to become less than that in the supply-pipe, while valve 10 is lifted when the plungers are forced into the chamber and raise the pressure therein above the back pressure in the outlet pipe 10.

A shaft 13 is journaled in standards 14 15 supported upon and rising from the casing, and upon the shaft are supported eccentrics 16 17 which are encircled by eccentric straps 18 19 connected to eccentric rods 20 21 which are pivoted to the plungers 3 4 respectively. Thus each eccentric is separately connected to one of the plungers and when rotated causes reciprocation of its respective plunger.

The shaft 13 is positively driven by any suitable desired means from any source of power which may be capable of connection thereto. In the form here illustrated, there is provided a sprocket-wheel 22 keyed to the shaft which may receive motion through a chain from an engine or a counter-shaft. One of the eccentrics, as the eccentric 17, is rigidly connected to the shaft by a key 23 and the other eccentric is loose on the shaft. Each eccentric, however, has rigidly joined to it a beveled toothed portion 24 25 respectively, which are either made integrally with the eccentrics or are made separate and rigidly secured thereto. These toothed portions are concentric with the shaft and constitute bevel gears with which mesh planetary gears 26 27 journaled upon studs 28 of a holder 29 which is centrally bored at right angles to the studs 28 and is revolubly mounted upon the shaft. An arm 30 extends away from the holder externally of the gears.

Of the two eccentrics, only eccentric 17 is positively driven, the other eccentric receiving its motion from the first through the gear train consisting of gear elements 25 and 24 and the intermediate idle gears 26 27. As long as the holder or carrier 29 is stationary and in the position shown in Figs. 1 and 2, the eccentrics will be rotated simultaneously and will be located with their points of greatest eccentricity extending on diametrically opposite sides of the shaft, so that the plungers 3 and 4 will be reciprocated in opposite directions at the same speed. Thus, while

one plunger is being advanced into the chamber, the other is being withdrawn at exactly the same rate so that the effective fluid-holding volume of the chamber remains the same and the fluid therein is simply caused to flow from one side as it is displaced by the advancing plunger into the space left by the receding plunger in the other side of the chamber. Thus no fluid is delivered from the pump but the plungers work idly simply churning the fluid from one side to the other of the chamber.

By turning the holder and planetary gears about the shaft, the gears 26 27 are caused to roll about gears 25 and to communicate an increased motion to the gear 24, rotating the latter through an angle twice as great as that through which the holder 29 is turned. Thus when the holder is turned through an angle of 90° from the position shown in Figs. 1 and 2 to that in Fig. 3, gear 24 and with it eccentric 16 is turned through 180° and thereby the center of eccentric 16 is brought to the same side of the shaft as the center of eccentric 17 and the plungers are brought into corresponding positions. Thus, when the shaft is rotated, the plungers are moved together, entering and being retracted from the chamber at the same time. Then an amount of fluid is displaced from the chamber equal in volume to the combined volume of those portions of the plungers which project into the casing. Thereby the maximum output of the pump is secured. By moving the arm 30 into a position intermediate that of the extremes above referred to, the eccentrics and plungers can be adjusted relatively to each other to any desired degree so that the phases of the stroke of one may be altered relatively to those of the other. Thus one plunger may be commencing its advance when the other plunger has half completed its advance, or they may advance and retract together, or one advance while the other is retracted, or any other desired arrangement may be made and the amount of delivery of the pump may thus be varied from nothing to any required quantity up to that of the maximum discharge. It will be seen that the variation in the delivery of the pump is thus wholly independent of the speed at which it is run, and also of the length of stroke of the plungers, and thus it is not necessary to slow down or speed up the pump when a variation in the quantity of fluid supply is wanted, nor is it necessary to change the eccentricity of the eccentrics and thereby vary the stroke of the plunger. This capability of varying the delivery without changing the speed fits the pump to be connected to an engine which must be driven at a certain definite speed where it is impossible to reduce the speed or increase it to accommodate the demands on the pump. Consequently the device is of great utility for use in automobiles to pump water or oil and avoids the necessity of utilizing a by-pass for accommodating the excess, as has hitherto been customary.

In order to retain the holder in any position where it is put, I may provide a curved notched arm, such as that designated by 31 in Fig. 7, and provide a latch 32 to engage the notches, or any other usual and satisfactory retaining means may be employed.

In the form shown in Figs. 4 and 5, both eccentrics are mounted side by side on a single shaft 50 which is journaled in bearings 51 so as to be movable both rotarily and longitudinally therein. The eccentrics are provided with wide hubs 52 53 which occupy the entire portion of the shaft between the bearings and mounted in the hubs are set-screws 54 55 respectively, extending into cam slots in the shaft. These slots are inclined and occupy 90° of the angular surface of the shaft. They are also inclined oppositely to each other. Their construction and arrangement is such that when the shaft is shifted endwise so as to bring the set-screws from one end to the other of the shaft, the eccentrics are rotated oppositely and may thereby be moved from the position wherein they are parallel and extend on the same side of the shaft, to one in which they are opposite. A sprocket 56 furnishes means for rotating the shaft and is connected thereto to impart rotary movement by means of a screw 57 which projects into a longitudinal slot 58 in the shaft. The slot permits movement of the shaft lengthwise and also retains it in driving connection with the sprocket. A sleeve 59 interposed between the shaft and sprocket has a shoulder 60 which is engaged by the shoulder 61 of an annular nut threaded outside one of the bearings 51. The screw 57 penetrates this sleeve and secures the sprocket thereto. Thus motion of the sprocket in the direction of the length of the shaft is prevented. An arm 62 is pivoted at one end to a link 63 which is also pivoted to a lug 64 extending from the standard 65 of one of the bearings. Between its ends the arm is pivotally engaged at 66 with the shaft and is movable so as to operate the shaft endwise. It embraces a pivoted rod 67 and is provided with a clamp 68 which may hold it in adjusted position upon the rod.

I do not desire to limit myself to the details of construction shown and described herein, but on the contrary include under the scope of my invention any pump which has a plunger operating in a chamber to displace fluid therefrom, which plunger is capable of having its stroke adjusted in amount or in phase while the driving means is operating at an unchanged speed, to alter the volume of the displacement caused by the plunger in the chamber. I do not also limit myself to the employment of two plungers in such a pump as one, two or any other num-

ber desired may be caused to reciprocate in the same chamber or in connected chambers.

I have hereinbefore spoken of this device as being applicable to automobiles, but its usefulness is not limited to such a connection as it may be made of any size desired, both for light and heavy work, and it will be found of service as a boiler feeder where electric power is to be employed for driving.

I claim:—

1. A pump comprising a chamber adapted to contain fluid and having an inlet and an outlet, displacing means having a reciprocatory movement into and out of said chamber, a plurality of eccentrics arranged to cause reciprocation of said displacing means, a single shaft on which the eccentrics are mounted gearing intermediate said eccentrics connected thereto for transmitting motion from one to another, said gearing being constructed and arranged with capability of planetary movement about the axis of said shaft whereby the angular adjustment of the eccentrics relatively to each other may be varied, and connections for driving said shaft.

2. In a pump having a fluid-containing chamber and plunger-displacing means operating therein for changing the effective volume of the chamber, mechanism for operating said plunger-displacing means and for varying the amount of displacement thereof in the chamber, comprising a single shaft a plurality of eccentrics connected to reciprocate said plunger-displacing means and angularly adjustable mounted on said shaft and one of them secured to turn therewith, a gear-wheel rigidly connected to each of said eccentrics, intermediate idle gears meshing therewith and arranged to transmit movement from one to another, and means for rotating the shaft and thereby turning positively one of the eccentrics and its connected gear, said intermediate gears having capabilities of planetary adjustment about the axes of the eccentrics whereby the latter may be angularly shifted with respect to each other.

3. A pump comprising a fluid chamber, a plurality of reciprocating plungers arranged to enter and withdraw from the chamber, and driving means therefor including a single shaft and eccentrics mounted on said shaft relatively adjustable about the axis of rotation to vary the relative positions of the plungers and the relative timing of their strokes without affecting the length thereof.

4. A pump consisting of connected fluid-containing spaces, plungers reciprocable into said spaces to vary the effective volume therein, a single driving shaft, rotatable by external means, a plurality of eccentrics mounted on said shaft, connections between each one of the eccentrics and one of the plungers for reciprocating the latter, and means for shifting the relative angularity of the eccentrics.

5. A pump consisting of connected fluid-containing spaces, plungers reciprocable into said spaces to vary the effective volume thereon, a pair of eccentrics mounted on the same axis and having bevel gear portions on their adjacent sides, driving connections from the eccentrics to the plungers, intermediate bevel pinions between the eccentrics for transferring motion from one to the other, and a holder for said pinions mounted rotarily on the same axis with the eccentrics and adapted to be turned while one eccentric is stationary to shift the other eccentric.

6. A pump consisting of connected fluid-containing spaces, plungers reciprocable into said spaces to vary the effective volume thereon, a single driving shaft rotatable by external means, an eccentric fixed to said shaft and driven thereby, a second eccentric loosely mounted on said shaft, driving connections between the eccentrics and plungers, a pinion carrier loose on the same shaft between the eccentrics, and bevel pinions mounted on said carrier meshing with beveled toothed portions on the adjacent sides of the eccentrics, whereby the loose eccentric may be driven by the fixed one and shifted angularly with respect thereto.

7. A pump comprising a chamber having inlet and outlet passages, a pair of plungers arranged to enter and withdraw from the chamber, a pair of independent eccentrics each connected to one of the plungers for operating the same, a driving shaft connected to turn one of the eccentrics and loosely rotatable within the other, toothed elements rigidly joined to the eccentrics, and intermediate gearing meshing therewith and connecting the two eccentrics, said intermediate gearing being mounted so as to be movable bodily about the axis of said shaft and eccentrics, whereby the relative angular positions of the eccentrics may be altered.

In testimony whereof I have affixed my signature, in presence of two witnesses.

RICHARD J. FLINN.

Witnesses:

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ARTHUR H. BROWN.