June 24, 1930. L. H. L. BELLEM 1,768,102

PUMP

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Fig. 1.

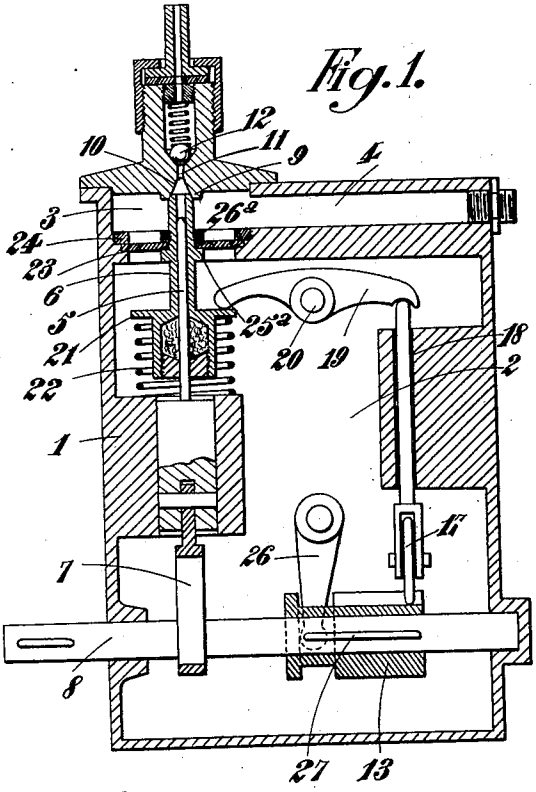


Fig. 3.

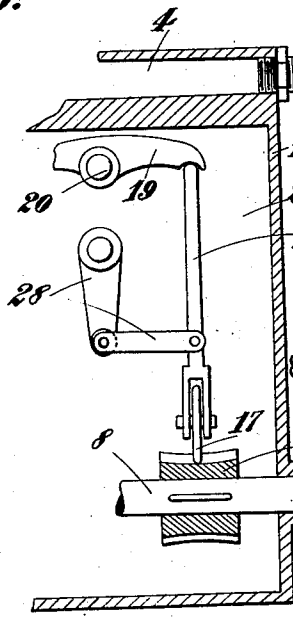
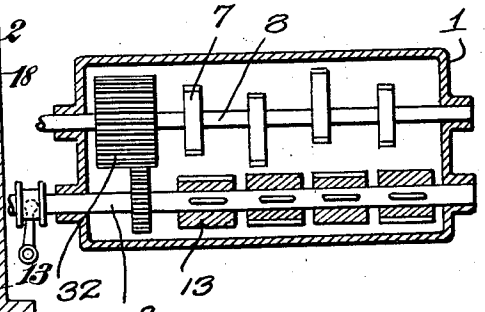


Fig. 7.



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Fig. 2.

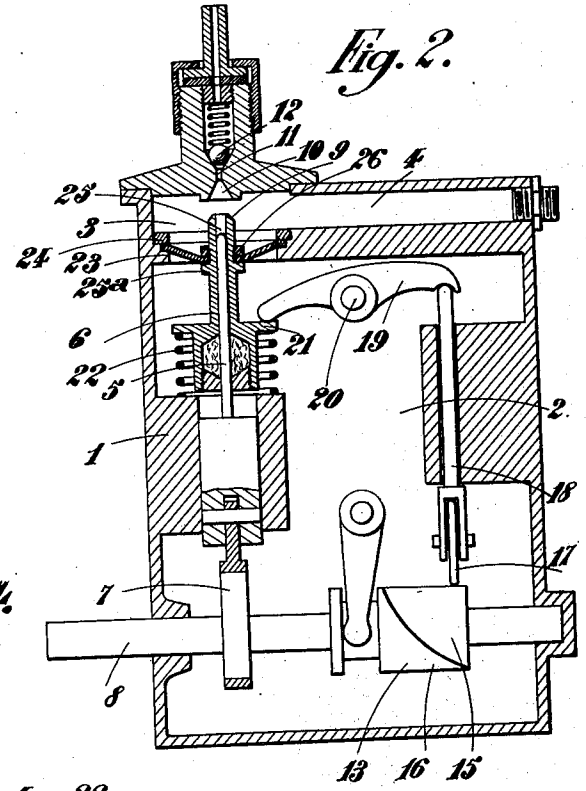


Fig. 4.

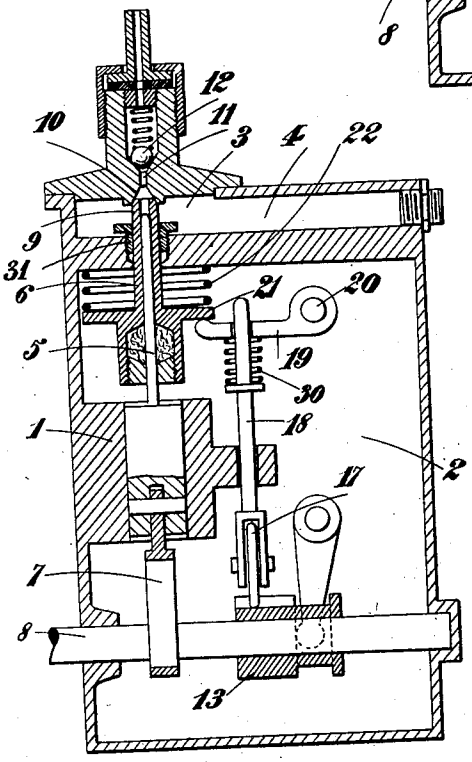


Fig. 6.

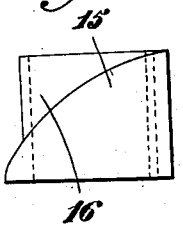
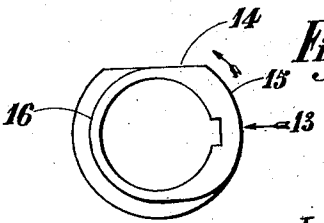


Fig. 5.



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UNITED STATES PATENT OFFICE

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PUMP

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The present invention relates to improvements in pumps, and more particularly those used for feeding internal combustion engines by means of heavy fuels, but nevertheless, capable of being put to other uses.

The improved pump according to the present invention is of the type comprising a movable cylinder, the discharge end of which is applied in a fluid-tight manner during a portion of the discharge stroke of the piston, against a discharge orifice formed in the tank containing the liquid to be discharged and in which the cylinder moves, and this pump is essentially characterized by the fact that it comprises, for the purpose of displacing the cylinder, a cam or its equivalent preferably mounted on the shaft, carrying the pump piston driving eccentric, the profile of said cam and its angular position with respect to said eccentric being such that through the intermediary of a suitable kinematic system, said cam, during the suction stroke of the piston, displaces the cylinder in order to withdraw same from the discharge orifice and, during the discharge stroke of the piston, displaces said cylinder in the opposite direction, in order to apply the same against said discharge orifice.

Means are provided for controlling the amplitude of the portion of the discharge stroke of the piston during which the cylinder remains applied against the discharge orifice, said means, which thus allow the pump's discharge to be regulated, consisting according to a particular form of embodiment in varying the cross-sectional profile of said cam along the width thereof in such manner that the instant at which said cam causes the cylinder to be applied against the discharge orifice varies during the discharge stroke of the pump piston with the cross-section of the cam in use.

According to a particular form of embodiment, this cam is formed by a cylinder having a groove bounded on one side by a generatrix, and on the other side by a helicoidal slope, the two ends of which latter are at an angle of 180° one with respect to the other, said cam raising or lowering a roller which controls the displacement of the cylinder through the intermediary of any suitable linkage mechanism, the pump's discharge being regulated by varying the longitudinal position of the cam with respect to the roller. This variation of the relative longitudinal position of the cam with respect to the roller can either be obtained by a longitudinal displacement of the cam on the shaft carrying the same, or by displacing the roller relatively to said cam.

The linkage mechanism interposed between the roller and the cylinder can assume different forms.

According to one characteristic of the invention, the various driving members of the piston and the cylinder, are situated in a casing in which the lower end of the cylinder also moves, the upper end of said cylinder moving, as stated above, in the tank containing the liquid to be discharged, said casing and tank being separated by a slightly resilient membrane which is held on its periphery on a bearing in the casing, whilst on its inner side it is attached to the cylinder which is able to move owing to the resilience of this membrane.

Various forms of embodiment of the device according to the invention are illustrated diagrammatically and merely by way of example, in the accompanying drawings.

In these drawings:

Fig. 1 is a longitudinal sectional elevation of a first form of embodiment.

Fig. 2 is a view corresponding to Fig. 1, but showing the pump in a different position.

Fig. 3 shows an alternative form of construction of the device shown in Fig. 1.

Fig. 4 shows another form of construction of the pump according to the invention.

Figs. 5 and 6 are two detail views.

Fig. 7 illustrates a multi-cylinder pump.

The pump represented in Fig. 1 essentially comprises a pump body 1, forming at its lower end a casing 2 in which are located the different pump members and, at its upper end, a tank 3, which is constantly main-

tained full of the liquid to be discharged, which latter is admitted by the conduit 4.

The piston 5 of this pump reciprocates within a cylinder 6 under the action of an eccentric or similar member 7 mounted on the driving shaft 8. The cylinder 6 is also adapted to reciprocate in such a manner as to occupy either the position shown in Fig. 1, wherein its upper end 9, which is made slightly conical, is applied in a fluid-tight manner against a conical mouthpiece 10 of the discharge orifice 11 provided with a ball-valve 12, or the position shown in Fig. 2, wherein the end 9 of this cylinder is withdrawn from said mouthpiece 10. The displacement of this cylinder 6 is controlled by means of a cam 13 keyed on the shaft 8 and shown in detail in Figures 5 and 6. As will be seen in these figures, this cam is essentially constituted by a cylinder in which a groove is provided, bounded on one side by a generatrix 14 of this cylinder and, on the other side, by a helicoidal slope, the two ends of which are at an angle of 180° one with respect to the other, the length of said groove thus varying according to the different transverse sections of the cylinder constituting the cam. In other words, this cam comprises two concentric cylindrical portions 15 and 16, the length of the inner concentric portion 16 varying according to the transverse section of the cam. The angular position of the cam on the shaft 8 is such that the generatrix 14 corresponds to the upper dead centre of the piston 5. The cam 13 acts on a roller 17 carried by a rod 18 which acts at its upper end on a rocking lever 19, pivoted at 20 and acting at its other end, on a shoulder 21 of the cylinder 6. A spring 22 or its equivalent, constantly acts on the cylinder 6 in order to apply its end 9 against the mouthpiece 10.

In the case, as illustrated, of a pump for feeding internal combustion engines, it is necessary to separate the tank 3 from the tank 2 in a fluid-tight manner. In the case of Fig. 1, this result is obtained by means of a resilient membrane 23 supported on the outside in bearings 24 in the casing I and gripped on its inner side between a shoulder 25^a of the cylinder 6 and a nut 26^a. The cylinder can move by reason of the resilience of this membrane 21 which is capable of being deformed, as shown in Fig. 2.

The mode of operation of the pump is as follows:

The piston 5 being at its upper dead centre, as shown in Fig. 1, the cylinder 6, owing to the way in which the cam 13 is mounted, also occupies its upper position in which its end 9 is applied against the mouthpiece 10. As soon as the suction-stroke of the piston 5 begins, the cam 13 which rotates in the direction of the arrow shown in Fig. 5, acts, by means of its outer cylindrical portion 15, on the roller 17 in order to raise this latter. As a result of this raising action, the rocking lever 19 is rocked and said lever acts on the shoulder 21 in opposition to the action of the spring 22 in order to bring the cylinder 6 into the position shown in Fig. 2 in which its end 9 is clear of the mouthpiece 10. It will be remarked that due to the fact that the outer portion 15 of the cam is cylindrical, the cylinder 6 remains stationary in the position shown in Fig. 2 during a certain interval of time, during which the oil or other liquid contained in the tank 3 enters the upper chamber 25 of this cylinder 6. The piston 5, after having passed the lower dead center, begins its discharge stroke, which latter has no other effect than to discharge the oil from the chamber 25 into the tank 3 during such time as the end 9 of the cylinder is not applied against the mouthpiece 10. On the contrary, as soon as the outer cylindrical portion 15 of the cam 13 ceases to be operative and the inner cylindrical portion 16 comes before the roller 17, this latter may fall and, under the action of the spring 22, the cylinder 6 moves upward and its end 9 is applied in a fluid-tight manner against the mouthpiece 10. The piston 5 on completing its discharge stroke, discharges the oil contained in the chamber 25 through the delivery orifice 11.

It will be readily understood that by varying the amplitude of the portion of the stroke of the piston 5 during which the end 9 is held applied against the seat 10, the output of the pump will be varied by reason of the fact that the length of the useful discharge stroke of said piston 5 is varied. In the example shown in Figs. 1 and 2, this result is obtained by longitudinally shifting the cam 13 over the shaft 8. Depending on the longitudinal position occupied by this cam relative to the roller 17, this latter will be maintained in its upper position during a longer or shorter interval of time depending on the length of the outer cylindrical portion 15, said length varying according to the different transverse sections of the cam 13. This latter is shifted longitudinally by means of an oscillating arm 26 driven from without, the cam 13 being mounted on keys 27, which allow of its being longitudinally shifted but which constrain it to rotate with the shaft 8.

In the example shown in Fig. 3, the cam 13 is longitudinally fixed and the roller 17 is adapted to move relative to this cam. To this end, its upper end can pivot relative to the corresponding end of the rocking lever 19 and this pivoting action is controlled by the link mechanism 28 actuated from without. In order that the roller 17 shall always lie perpendicular to the surface of the cam 13, this latter is slightly curved, the centre of the curvature being

preferably near the point about which rotates the roller 17.

An alternative form of construction of the transmission means interposed between the cam 13 and the cylinder 6 is shown in Fig. 4. According to this alternative, the spring 22 constantly tends to bring the cylinder 6 back into its lower position whilst the rocking lever 19 acts on said cylinder to apply its end 9 against the mouthpiece 10. In this case, the groove of the cam 13 is replaced by a projection of similar shape, that is to say, said projection is bounded in one direction by a generatrix, and in the other direction by a helicoidal slope. In order to give a certain amount of flexibility to the movement transmitting means, thanks to which the end 9 of the cylinder 6 will always be applied in a fluid-tight manner against the mouthpiece 10, the rod 18 controls the rocking lever 19 through the medium of a spring 30.

It will be remarked that the membrane 23, by reason of its reciprocating motion caused by the displacement of the cylinder 6, produces a suction effect which facilitates the ingress of the liquid into the reservoir 3. However, in certain cases, this membrane could be replaced by an ordinary stuffing-box 31, as is the case in Fig. 4.

The pump according to the invention is particularly adapted for use in feeding internal combustion engines. Considerable advantages accrue from the use of this pump by reason of the fact that the cylinder being positively driven, contrary to the arrangements known heretofore, the said cylinder will always effect its displacement in the desired condition however worn the parts may be. Furthermore, the output of the pump can be very accurately controlled.

Of course, the invention is applicable to the case of multi-cylinder pumps, as shown in Fig. 7. In this case, the eccentrics 7 are keyed on a single driving shaft 8, and the cams 13 are keyed on a parallel shaft 8^a driven by the shaft 8 by means of the gears 32. The control of the output of the various pumps is obtained by displacing the shaft 8^a longitudinally.

It is evident that the invention has only been described and illustrated in a purely explanatory but by no means limitative manner and that it could be subjected to various modifications in its details without departing from the spirit thereof.

I claim:

1. In a fluid discharging pump, the combination of a cylinder plunging in the liquid to be pumped, a discharge pipe in alignment with the axis of said cylinder, said cylinder being displaceable into and out of contact with the edge of the orifice of said discharge pipe, a plunger reciprocating in said cylinder, said plunger discharging fluid through said discharge orifice when said cylinder contacts with the edge of said orifice, means for displacing said cylinder independently of said plunger, and means, operable both when the pump is stationary and when it is working, for varying the instant at which said cylinder is brought into contact with the edge of said discharge orifice during the discharge stroke of said plunger.

2. In a fluid discharging pump, the combination of a cylinder plunging in the liquid to be pumped, a discharge pipe in alignment with the axis of said cylinder, said cylinder being displaceable into and out of contact with the edge of the orifice of said discharge pipe, a plunger reciprocating in said cylinder, said plunger discharging fluid through said discharge orifice when said cylinder contacts with the edge of said orifice, an elongate cylindrical cam having two concentric cylindrical faces connected by a generatrix and a helical slope, means for rotating said cam in synchronism with said reciprocating plunger, means, including a roller riding on the surface of said cam, for displacing said cylinder as said roller passes from one of said cylindrical cam faces to the other, and means for varying the relative positions of said cam and roller axially of said cam whereby the instants of rise and fall of said roller are varied and hence the moment at which said cylinder is brought into contact with the edge of said discharge orifice during the discharge stroke of said plunger.

3. In a fluid discharging pump, the combination of a cylinder plunging in the liquid to be pumped, a discharge pipe in alignment with the axis of said cylinder, said cylinder being displaceable into and out of contact with the edge of the orifice of said discharge pipe, a plunger reciprocating in said cylinder, said plunger discharging fluid through said discharge orifice when said cylinder contacts with the edge of said orifice, means for displacing said cylinder independently of said plunger, and means, operable both when the pump is stationary and when it is working, for varying both the instant at which said cylinder is brought into contact with the edge of said discharge orifice during the discharge stroke of said plunger and the time during which said cylinder remains in contact with said edge of said discharge orifice.

4. In a fluid discharging pump, the combination of a cylinder plunging in the liquid to be pumped, a discharge pipe in alignment with the axis of said cylinder, said cylinder being displaceable into and out of contact with the edge of the orifice of said discharge pipe, a plunger reciprocating in said cylinder, said plunger discharging fluid through said discharge orifice when said cylinder contacts with the edge of said orifice,

an elongate cam the profile of which varies along its length, means for rotating said cam in synchronism with said reciprocating plunger, means, including a roller riding on the surface of said cam, for displacing said cylinder, and means for varying the relative positions of said cam and roller axially of said cam, whereby the instants of rise and fall of said roller are varied and hence both the instant at which said cylinder makes contact with the edge of said discharge orifice during the discharge stroke of said plunger and also the duration of said contact.

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