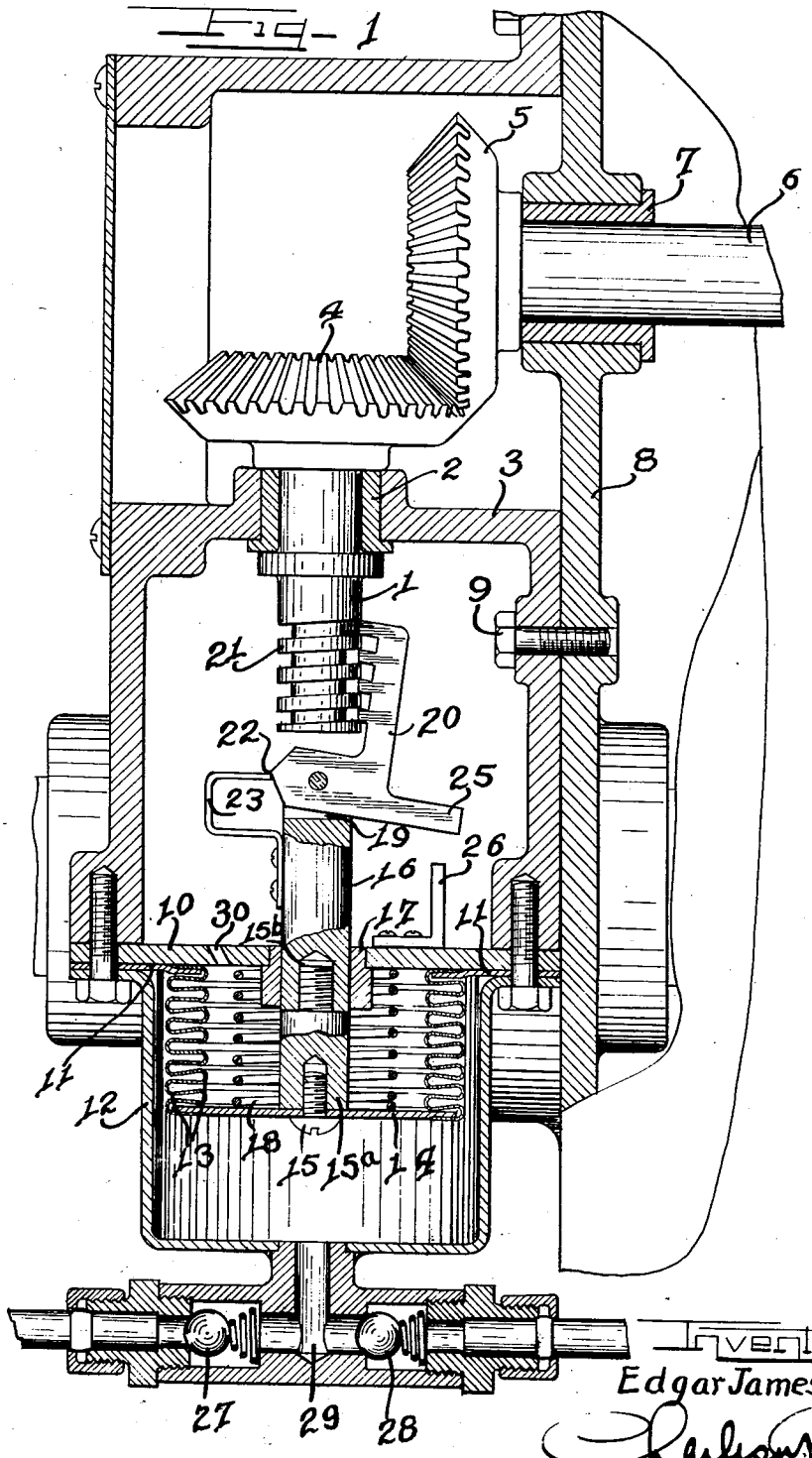
Dec. 10, 1929. E. J. LEACH 1,739,318

LIQUID PUMP

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Fig. 1



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Fig. 3

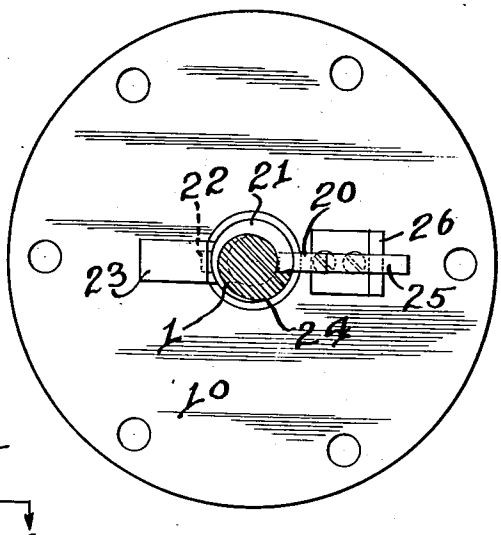


Fig. 2

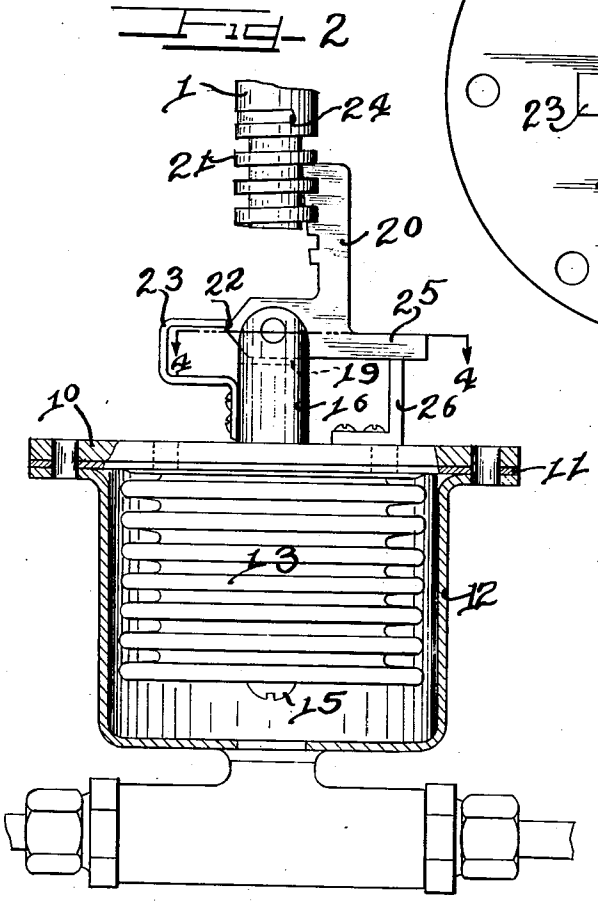
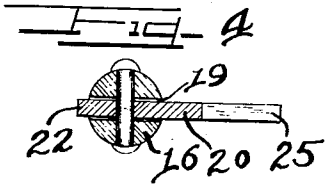


Fig. 4



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Patented Dec. 10, 1929 1,739,318

UNITED STATES PATENT OFFICE

EDGAR JAMES LEACH, OF JANESVILLE, WISCONSIN

LIQUID PUMP

Application filed September 15, 1924. Serial No. 737,654.

This invention relates to improvements in liquid pumps and more particularly to those adapted to lifting gasoline from the supply tank and delivering it under a slight pressure to the carburetor of a gasoline engine. There have been in the past three systems of gasoline feed in general use: first, the gravity feed; second, the vacuum feed; and, third, the pressure feed. The gravity feed failed when, in an automobile, the gasoline was low in the supply tank and a steep grade was encountered. The vacuum feed is an expensive mechanism and sometimes fails to supply sufficient fuel to operate the engine, especially under conditions where the throttle remains continuously open for a considerable period. The pressure feed as heretofore used, is uneconomical and is also expensive to construct and install.

It is therefore the object of this invention to provide a means for overcoming the disadvantages of the gravity feed without incurring the disadvantages of the latter two systems.

It is further the object of this invention to provide a system similar to the pressure system but which delivers the gasoline at such a comparatively low pressure that it may be more properly called a lift system.

It is an object of this invention to provide a pump of this type in which the independent stroke responds to the fuel demand.

It is also an important object of this invention to provide a pump of this type in which the independent stroke continues throughout the entire predetermined length of the stroke in accordance with the fuel demand.

It is also an object of this invention to provide a pump in which the length of the independent stroke is unaffected by the fuel demand.

It is also an important object of this invention to provide a pump in which the length of the independent stroke is adapted to be predetermined to meet any condition or engine requirement.

It is also an important object of this invention to provide an improved means for transferring uniform rotational movement of a shaft into a resilient reciprocating movement of the piston.

It is also an important object of this invention to provide a means for lifting and discharging liquid in which there is no piston leakage and in which only that fuel required by the engine is supplied.

It is an important object of this invention to provide an apparatus of the kind described providing an intermittent rather than a pulsating feed.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

On the drawings:

Figure 1 is an elevation partly in section of the device and its connections.

Figure 2 is another elevation showing the lower part of the device.

Figure 3 is a plan view of Figure 2.

Figure 4 is a section along the line 4—4 of Figure 2.

Like numerals refer to like parts throughout.

As shown on the drawings:

The pump selected for illustration comprises a worm shaft 1 which revolves in a bushing 2 fixed in a casing section 3. Secured to the shaft 1 is a gear 4 which meshes with a gear 5 on a driving shaft 6. The shaft 6 which in this instance constitutes the cam shaft of an automobile engine, is journaled in a bushing 7 provided in the engine casing 8. The section or strap 3 is bolted to the engine casing 8 as by a bolt 9. Secured to the strap 3 is a circular plate 10 which constitutes the head of a pump cylinder 12. Supported between the flange of the cylinder 12 and the plate 10 is a flexible member or piston 13 comprising a collapsible resilient sheath having one peripheral edge thereof secured to a disc member 11, with the other edge thereof hermetically sealed to a disc 14 to provide an expansible piston. The top of the cylinder 13 is securely held against the plate 10 by the disc 11.

In line with the shaft 1 and secured to the bottom 14 of the resilient member 13 by means of a screw 15 is a shaft 16 which, as

here shown, is in two interfitting threaded sections 15[a] and 15[b] to facilitate assembly and adjustment of the piston travel in accordance with the engine requirements. The shaft 16 is slidable in the bushing 17 fixed in the plate 10. Surrounding the shaft 16 and compressed between the plate 10 and the bottom 14 of the resilient vessel is a spring 18. Pivoted on the upper end of the shaft 16 in a slot 19 therein is a rack member 20. On the upper inner edge of the member 20 are a series of graduated teeth adapted to engage a worm 21 on the shaft 1. A cam 22 on the member 20 coacts with a spring 23 on the shaft 16 to hold said member 20 in or out of operative position until it has been moved a predetermined amount away from either of said positions. The bottom of the helical groove on the worm 21 is of uniform depth until it reaches within about one turn of the upper end of the worm where it begins to approach the surface of the shaft as at 24 (see Figure 2) where it merges with the surface of the shaft 1. At the beginning of the stroke or at what may be called the up stroke the rack member 20 is in the position shown in Figure 2 with its teeth engaging the worm 21; the teeth being pressed against the bottom of the groove in the worm 21 by means of the spring 23 pressing down over the cam portion 22 of the member 20. As it reaches the top of the worm 21 the member 20 is thrown to the right by means of the groove reaching the surface of the cam as at the point 24. At this point the spring 23 slips to the bottom side of cam 22 as shown in Figure 1 and the spring 18 which was further compressed on the up stroke now acts to lower the shaft, the graduated teeth permitting the rack to move downwardly beside the worm without engaging therewith, and also permitting the shafts 1 and 16 to be in axial alignment. As the shaft 16 reaches the bottom of the stroke, a lug 25 extending rearwardly on the member 20 carried by said shaft contacts with a stop 26 on the plate 10. This stop throws the member 20 back into the position shown in Figure 2, the spring 23 slipping back again to the top of cam 22 holding the member 20 against the worm 21 ready for the up stroke. Spring pressed valves 27 and 28 are of the ball suction and discharge type respectively having a common lead 29 to the pump cylinder 12. The valve 27 is connected to the gasoline tank and the valve 28 discharges to the float chamber of the carburetor. A vent 30 in the plate 10 accommodates for the air suction and discharge as the collapsible vessel is actuated.

The operation is as follows:

At the beginning of the up stroke the rack member 20 is in the position shown in Figure 2 with the teeth engaging the worm 21. The rotation of the shaft 1 connected to the shaft 6 by the gears 4 and 5, carries the rack 20 connected to shaft 16 upwards. This compresses the resilient cylinder 13 and the spring 18 so that when the rack 20 is thrown out of the worm 21, due to the groove reaching the surface, the spring 18 forces the shaft 16 downward, carrying with it the rack 20. The rack 20 is again thrown into engagement with the worm 21 due to the lug 25 on the rack striking the stop 26 at the limit of the down stroke.

It will be seen that as on the up stroke the corrugated resilient cylinder 13 and the spring 18 are compressed a vacuum will occur within the cylinder 12 and gasoline will be drawn in through the ball valve 27. On the down stroke the spring 18 and the vessel are expanded compressing the gasoline within the cylinder 12 and causing a discharge to flow out of the valve 28 to the float chamber of the carburetor.

It will also be seen that upon the completion of the upward or positive stroke the downward or independent stroke under the action of the spring 18 will begin and will continue in accordance with the demands of the engine for fuel until the end of the down stroke is reached when the stop 26 trips the rack member 20 and the upward stroke begins.

Since the downward or independent stroke continues in accordance with the fuel demand until it has gone the full distance of the stroke even though it is held up temporarily by a slowing up of the fuel demand the life of the flexible piston member is greatly increased. In pumps heretofore the length of the independent stroke would end with the slowing up of the fuel demand which resulted in a number of short rapid strokes which fatigued the flexible member and shortened its life. Thus by causing the independent strokes to be fewer and longer the usefulness of the device is increased and the length of the stroke may be predetermined to meet any condition or engine requirement. The length of the stroke may be varied in different ways the most obvious perhaps being by varying the size of the stop 26 or substituting an adjustable stop therefor. After changing the length of the stroke the length of the shaft 16 may be varied by adjusting the sections 15[a] and 15[b] thereof to bring the travel well within the elastic limits of the corrugated member 13.

Since the pressure is caused by the spring 18 in the resilient vessel of the piston a comparatively uniform pressure is obtained and no excessive pressures need be feared. This device is simple and inexpensive. It is not subject to the disadvantages mentioned in either the gravity, vacuum or pressure systems.

The discharge is intermittent rather than pulsating, is regulable by adjusting the piston stroke and as will be apparent, is automatically governed so that fuel in excess of

the engine's requirements is not supplied to the carburetor.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

What I claim is:

1. Means for converting movement of a rotatable shaft into a longitudinal movement of a rod in one direction, said means comprising a worm on said shaft, a rack pivoted on said rod, means for engaging said rack with said worm, a cam groove in said worm for disengaging said rack from said worm, and means for holding said rack disengaged until said rod has moved a predetermined distance in the opposite direction.

2. Means for converting movement of a rotatable shaft into longitudinal movement of a second shaft, said means comprising a worm on one of said shafts, a rack on the other of said shafts and disposed substantially between the adjacent ends of said shafts, and means for engaging and disengaging said rack and said worm.

3. Means for converting movement of a rotatable shaft into longitudinal movement of a rod, said means comprising a worm on said shaft, a rack pivoted to said rod, a cam surface on said rack, a resilient member secured to said rod and riding on said cam surface to retain said rack in engagement with said worm a predetermined time and to disengage it therefrom, and means to reengage said rack with said worm after the lapse of a second predetermined time.

4. In combination, a rotatable shaft, a second and longitudinally movable shaft, resilient means for moving said second shaft in one direction, a worm on said rotatable shaft, a rack connected to said second shaft, means to engage said rack with said worm after said resilient means has moved said second shaft a predetermined distance, and means to disengage said rack from said worm after said rotatable shaft has moved said second shaft a predetermined distance in the opposite direction.

5. In a pump, a rotatable driving shaft, a longitudinally movable pump rod, a worm on said shaft, a rack on said rod pivotal into engagement with said worm to convert the rotatable movement of said shaft into longitudinal movement of said rod, a cam surface on said rack, a resilient member engaging said cam surface for holding said rack in and out of engagement with said worm depending on the part of said surface engaged by said spring, means associated with said worm for disengaging said rack therefrom after a predetermined movement of said pump rod in one direction, and means for engaging said rack with said worm after a predetermined movement of said rod in the opposite direction.

6. In a device of the character described, a rotatable shaft, a worm on said shaft, a longitudinally movable rod, a rack having graduated teeth on said rod and pivotal into and out of engagement with said worm, means for pivoting said rack into engagement with said worm for movement of said rod in one direction, and means for pivoting said rack out of engagement with said worm after a predetermined movement of said rod.

In testimony whereof I have hereunto subscribed my name.

EDGAR JAMES LEACH.