Nov. 5, 1929. E. J. SCOTT 1,734,600

VALVELESS ROTARY PUMP

Filed March 28, 1929

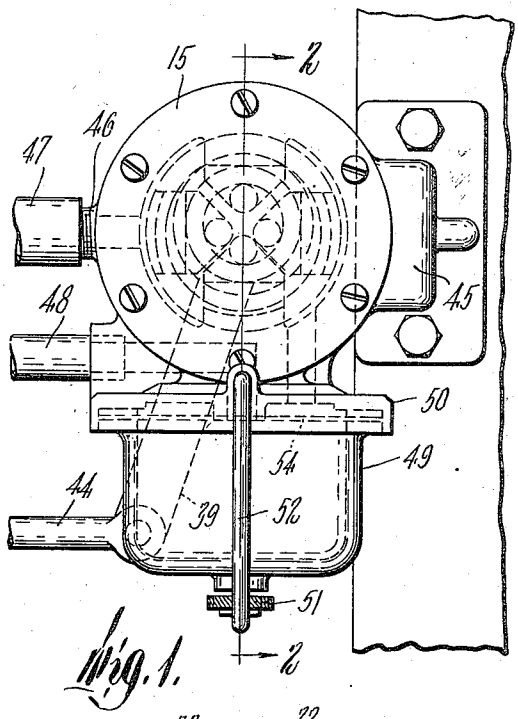


Fig. 1.

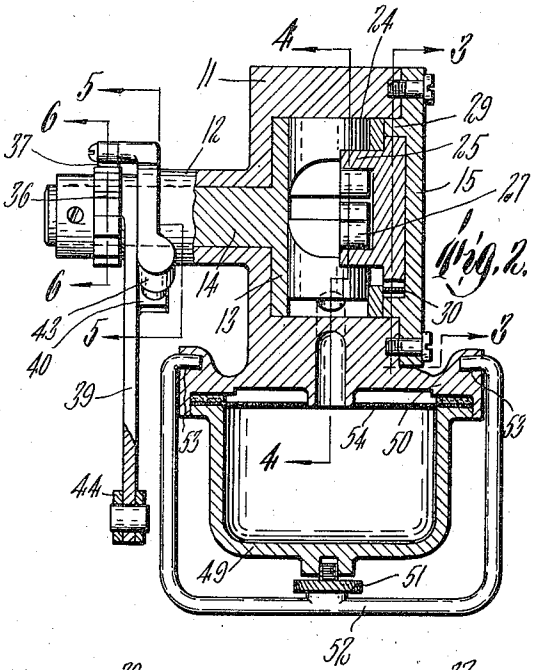


Fig. 2.

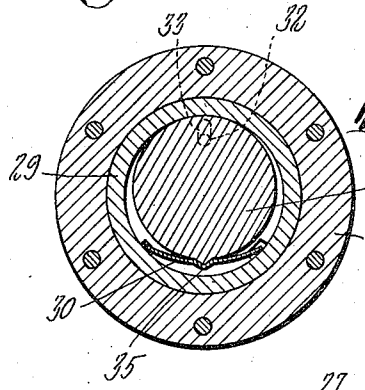


Fig. 3.

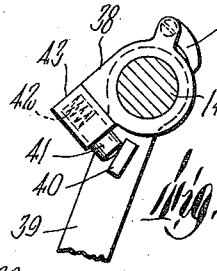


Fig. 5.

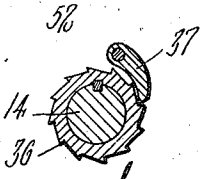


Fig. 6.

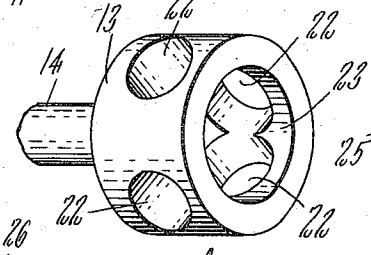


Fig. 7.

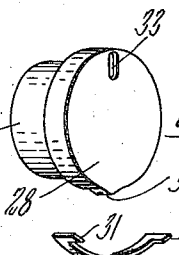


Fig. 8.

Fig. 9.

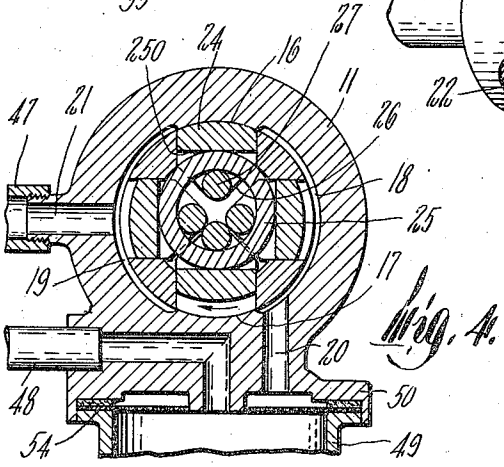


Fig. 4.

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UNITED STATES PATENT OFFICE

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VALVELESS ROTARY PUMP

Application filed March 28, 1929. Serial No. 350,649.

The object of this invention is to provide a rotary pump adapted to furnish an adequate quantity of liquid to fulfill its intended purpose, and to limit the pressure at which the liquid is furnished, without employing valves. Such a pump may be used in connection with an automobile to transfer liquid fuel from a tank carried at a relatively low level on the automobile to the carbureter of the engine at a nigher level. I mention this use, not as an exclusive or limiting one, but as an illustration for better explanation of the utility of the new step of the present invention. In this use, for instance, it is important that the pump deliver enough fuel to supply the engine when operating at maximum load at any speed, but equally important that the delivery pressure of the pump be limited so that the fuel will not be forced past the float controlled valve of the carbureter in excess of the needs of the engine.

In a pending application filed by me February 1, 1929, Serial No. 336,713, I have disclosed a pump adapted to the use above mentioned, among others, in which the pressure of delivery of the liquid is limited by a spring loaded valve, which opens and permits return of the liquid through a bypass to the suction side of the pump when the delivery pressure tends to mount above the predetermined maximum. According to the present invention I have produced a pump of the same type as that shown in the said application, but in which the quantity and pressure of the delivered liquid is limited and controlled by the structural and operating parts of the pump itself, without need or use of any valve or return bypass.

Having thus explained the purpose and nature of the invention, but without attempting to indicate any bounds to the purposes and uses to which it may be applied, I will now proceed to describe in detail one of its possible embodiments.

In the drawings,—

Fig. 1 is an elevation of the pump above referred to;

Fig. 2 is a central vertical section thereof taken on line 2—2 of Fig. 1;

Figs. 3, 4, 5 and 6 are sections taken on lines 3—3, 4—4, 5—5 and 6—6, respectively, of Fig. 2;

Fig. 7 is a perspective view of the rotor element of the pump;

Fig. 8 is a perspective view of the shiftable cam or eccentric by which the rotor-carried plungers of the pump are reciprocated;

Fig. 9 is a perspective view of the spring by which such cam is yieldingly held in position to reciprocate the plungers.

Like reference characters designate the same parts wherever they occur in all the figures.

The pump comprises a casing 11 having a cavity open at one end and a bearing sleeve 12 extending from the opposite end. A rotor 13 occupies the cavity and is joined, integrally or otherwise, to a shaft 14 which rotates in the bearing 12. A detachable cover or wall 15 completes the casing, being fitted to the encircling walls thereof and crossing the open side of the cavity.

The cylindrical surface of the rotor is coaxial with shaft 14. The encircling walls of the casing are formed with abutments 16 and 17 at opposite sides, which are coaxial with the rotor and equally distant from its axis, and fit the surface of the rotor closely enough to prevent any substantial leakage while permitting free rotation. These abutments extend from the back w ll of the casing to the cover and are approximately equal in width to the after mentioned pockets in the rotor, or permissibly somewhat wider than such pockets. Between the abutments the lateral walls of the casing are recessed forming chambers 18 and 19 which are partitioned off from one another by the rotor and the abutments. Passages 20 and 21 in the casing enter these chambers. Either one of these chambers may serve as the suction or intake chamber of the pump, and the other as the discharge chamber, depending on the direction of rotation of the rotor. When the latter turns in the direction indicated by the arrow in Fig. 4 liquid is drawn into the chamber 18 through passage 20 and transferred to the chamber 19, by the rotor and its plungers or pistons, and discharged through the passage 21.

In the rotor are any desired number of ra-

dial passages or pockets 22 (in this case four) extending from the cylindrical circumference of the rotor into a central space 23 which is open at the end of the rotor opposite to the shaft. Pistons or plungers 24 fit slidingly in these passages. Such plungers are moved in and out through their passages by an annular eccentric or cam 25 which extends from the cover 15 into the central space 23 of the rotor. Each plunger is cut away at one side of its inner end, forming a shoulder 250 adapted to bear on the outer circumference of the cam and an extension 26 to cross the end of the cam rib. A stud 27, preferably surrounded by a rotatable anti-friction sleeve or roll projects from the extension 26 parallel to shoulder 250 to engage the inner surface of the cam, being separated from the shoulder by a space approximately equal to the thickness of the cam rib. The side of the plunger extension which forms the bottom of this space is plane and extends, in part at least, throughout the full width of the plunger; and the cam rib extends to this bottom surface and is formed with a plane end face which, by engagement with the before named surface, prevents the plunger from being rotated in its passage or pocket by the friction of the plunger and its stud on the side faces of the cam. The outer end of the plunger is preferably finished off with a transverse cylindrical curvature of the same radius as the outer circumference of the rotor.

Said cam rib projects from one side of a base 28, the opposite side of which has a flat surface adapted to bear and slide on the inner surface of the cover. The cover has an annular rib 29 on its inner side which fits in the cavity of the casing and bears on the end of the rotor, and preserves a space between the rotor and the central part of the cover in which the base of the cam is contained. Such base has a flange or rim portion projecting on all sides beyond the cam rib, overlapping to a greater or less extent the rim of the cavity in the rotor but smaller than the space surrounded by the rib 29 of the cover.

A spring 30, preferably made as a strip of spring steel is contained in the cover cavity between the rib 29 thereof and the base of the cam at the side opposite to one of the casing abutments (in this case the abutment 16). The ends of the spring bear on the cover rib 29 and its midde part bears on the flange of the cam base. Its ends are formed with fingers 31 which project into notches in the cover, and one of the notches so closely embraces the contained finger as to anchor the spring, preventing it from being displaced bodily, while the other notch is enough larger than the contained finger to permit flexing of the spring. A pin 32 projecting from the cover into an elongated slot 33 in the face of the cam base opposite to the spring, and a ridge or equivalent abutment 34 on the side of the base flange projecting into a complemental offset 35 in the middle part of the spring, resist rotation of the cam under the drag of the rotor and its plungers.

By means of the spring 30, pin 32 and abutment 34, the cam is normally held eccentric to the rotor with its center in the same diametral plane with the casing abutments 16 and 17. In the illustration shown, the eccentricity of the cam is directed toward the abutment 16. The cam is preferably of circular outline, or substantially so, in order to cause a gradual and continuous movement of the plungers inward and outward with reference to the axis of the rotor.

Thus when the cam is in a position at all eccentric to the pump axis, each plunger is forced outward as it approaches the abutment 16 in its revolution, and drawn inward as it leaves said abutment and approaches the opposite abutment; so that in traversing the chamber 18 the pockets in the rotor which contain the plungers are gradually deepened and filled with liquid, and carry charges of liquid past the abutment 17, while in traversing the chamber 19 the plungers expel the liquid from such pockets. This action takes place and liquid is forwarded by the pump whenever the back pressure is below the prescribed maximum. But when the back pressure increases above the given maximum, it overcomes the force of spring 30, causing the cam to be displaced in such manner that it becomes inoperative to reciprocate the plungers through their full stroke.

The character and extent of such displacement may vary according as the back pressure is gradually or suddenly increased, and whether the increase of pressure is great or small. In the ordinary mode of operation in connection with an automobile engine, the float controlled valve of the engine carbureter causes a back pressure which gradually increases as the valve moves toward closed position with rise of gasolene in the float chamber, and has the effect of shifting the cam more or less nearly to the central position. Of course when the cam is exactly central no movement is given to the plungers. As gasolene is taken from the carbureter to the engine, the float controlled valve is opened and the back pressure reduced, which allows the spring to return the cam to an eccentric position with resulting actuation of the plungers. But if the outlet passage should be suddenly and completely closed while the pump is running, the pistons are blocked by the confined liquid in the positions occupied by them relatively to rotor at the moment of stopping the outlet; and they then impart to the cam a movement compounded of reciprocative translation between the abutments, and rocking about pin 32 they continue to revolve with the rotor.

In this way the delivery pressure of the

pump is limited and its discharge capacity correspondingly limited, without the use of valves. Any desired maximum pressure of delivery may be fixed, within the limits of the size and capacity of the pump, by provision of a spring 30 (or equivalent spring) having the appropriate strength and stiffness, and even a complete stoppage of delivery may occur without causing any injury to the pump or its driving means.

It will be apparent that the means herein disclosed for limiting the pump pressure is very simple while being entirely effective, and it has the important advantage of being self-contained within the structure of the pump itself, requiring no external connections and fittings. A spring of the type and arrangement here shown is confined against endwise movement by engagement of its end anchor fingers with the ends of the notches in which the latter are contained, when the cam is in the eccentric position, while the ends of the spring react against the encircling rib 29 of the cover in holding the cam in this position. For the convenience of this description the eccentric position may be considered as the normal position, for it is assumed when the pump is performing its normal function of delivering liquid, and the central position of the cam may be considered as its abnormal or inoperative position.

Pumps embodying this invention may be made of any dimensions and capacities suited to the duty for which they are designed. Their rotors also may be driven at any desired speed by any suitable means. The particular pump here shown, which has been designed as a fuel pump for automobile engines, is provided with a pawl and ratchet drive, consisting of a ratchet wheel 36 secured to the shaft, a pawl 37 carried by a pawl carrier 38 rotatably mounted on the shaft, and a lever 39 also rotatable on the shaft but separate from the pawl carrier and provided with a lug 40 which transmits movement to the pawl carrier through a plunger 41 and an equalizing or cushion spring 42 held in a socket 43 of the carrier. A link 44 coupled to the lever 39 is adapted to be driven by the automobile engine, so that the pump is driven in synchronism with the engine.

In this instance also the pump casing is provided with a bracket 45 adapted to be secured to the crank case or other framing part of the engine. It has a threaded nipple 46 protruding from one side and containing the outlet passage to which a pipe 47 is connected to lead to the carbureter of the engine. It also has a tapped hole in its base portion in which an inlet pipe 48 leading from the supply tank may be connected. The last named passage opens through the center of the base into a cup 49, the rim of which is held in tight contact with the base flange 50 of the casing by a screw 51 mounted in a yoke 52, the ends of which are held in sockets 53 on the top of the base flange. A strainer 54 is confined between the cup and the base in such manner that liquid drawn from the base through the inlet passage 20 is compelled to pass through it. Foreign matter in the gasolene is removed by the strainer and settles to the bottom of the cup from which it may be removed from time to time; the means for holding the latter in place enabling it to be easily removed and replaced.

What I claim and desire to secure by Letters Patent is:

1. A rotary pump comprising a casing, a rotor mounted coaxially in said casing and having a central interior cavity and a passage extending from said cavity to its circumference, a plunger fitted to reciprocate in said passage having a cam follower on its end within the central cavity, a cam entering said cavity constructed and formed to engage the cam follower and impart back and forth movement to the plunger with rotation of the rotor, means coupling the cam with the casing to prevent rotation of the cam while permitting translative movement thereof between positions wherein it is, respectively, concentric and eccentric to the casing, and a spring engaged with the cam and the casing tending to place and yieldingly hold the cam in its position of maximum eccentricity.

2. A rotary pump, as set forth in claim 1, in which the spring is anchored in the casing and interlocked with the cam to resist in a yieldable manner displacements of the cam.

3. In a pump of the revoluble and reciprocative piston type, including a casing and a piston-actuating cam; means for anchoring the cam against rotation while permitting translative displacement thereof, consisting of a pin and slot connection at one side of the cam, and a spring at the opposite side of the cam acting thereon and reacting against the casing in directions substantially coinciding with the line of the slot element of said pin and slot connection.

4. In a pump of the revoluble and reciprocative piston type, including a casing, a rotor having a substantially radially reciprocative piston, and a cylindrical piston-actuating cam adapted to occupy positions, respectively, eccentric to and concentric with the axis of the pump; means for positioning the cam in a normally eccentric position and preventing its rotation while permitting its translative movement into a concentric position, consisting of a pin and slot connection, the slot element of which is substantially radial to the cam, located at one side of the center of the cam, and a leaf spring engaged at its ends with the casing and at its middle part with the cam and arranged to exert yielding force in a direction substantially

coinciding with the line of said slot whereby to normally place the cam in an eccentric position.

5. In a pump of the revoluble and reciprocative piston type, including a casing and a shiftable piston-actuating cam adapted to occupy positions, respectively, concentric with and eccentric to the casing; means for anchoring the cam against rotation while permitting its translative displacement between such positions, consisting of a slot substantially radial to the cam located at one side of the center thereof, a pin entering said slot, and a leaf spring engaged in its central part with the cam at the side thereof opposite to the pin and slot connection, the ends of said spring being arranged to react on the casing with tendency to place and hold the cam in its eccentric position.

In testimony whereof I have affixed my signature.

EPHRIAM J. SCOTT.