Aug. 9, 1932. W. C. CARTER 1,871,040

PUMP

Filed April 29, 1929

Fig. 1.

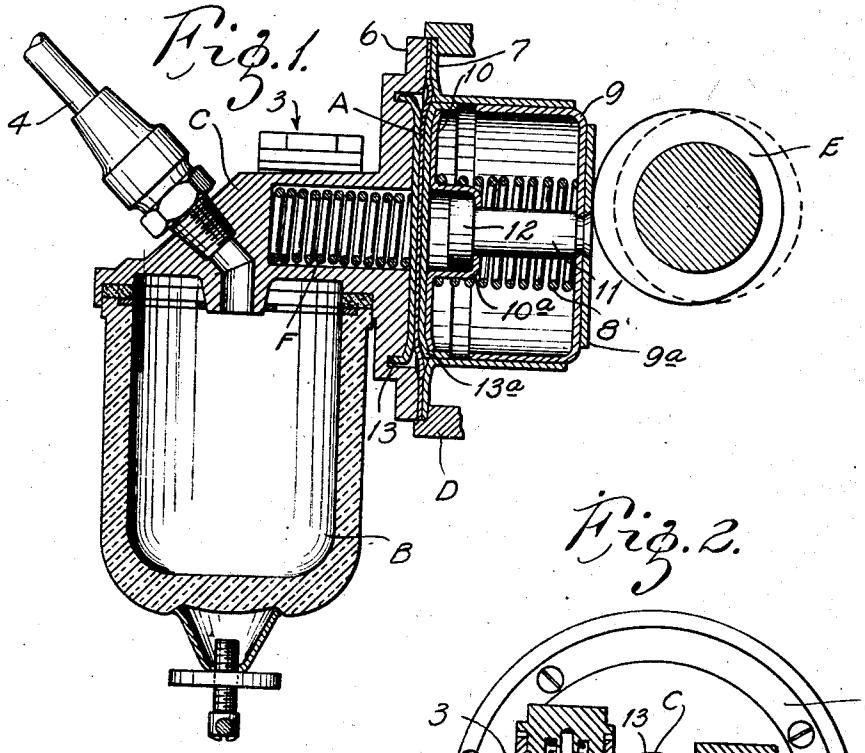


Fig. 2.

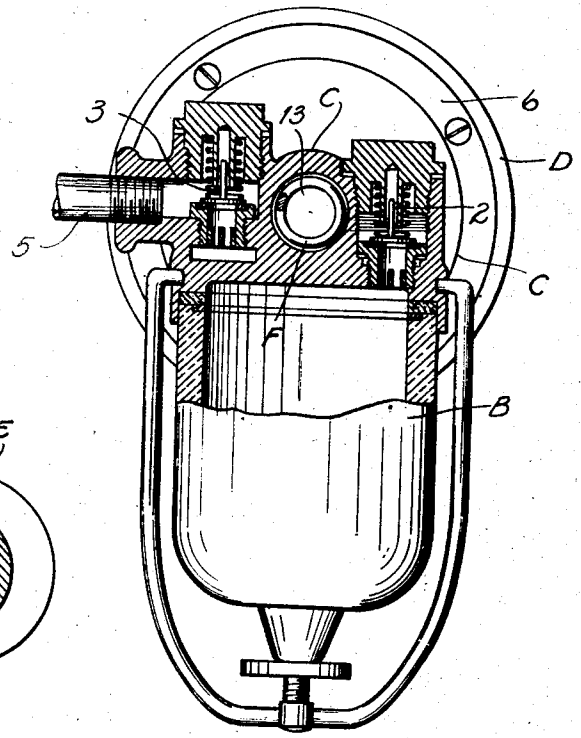
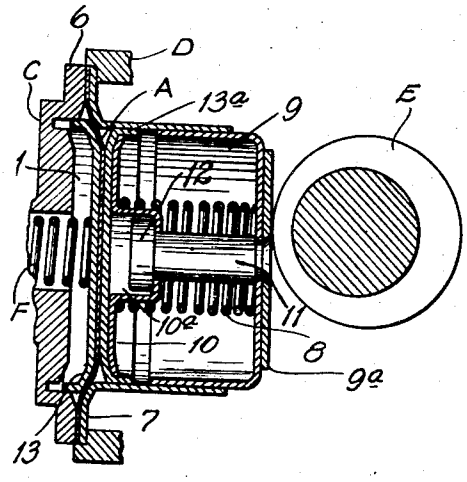


Fig. 3.



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UNITED STATES PATENT OFFICE

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PUMP

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This invention relates to pumps of the kind that are used in fuel supply systems for internal combustion engines for drawing liquid fuel from a source of supply and delivering it to the carburetor of the engine, and particularly, to fuel pumps of the type in which the pumping element consists of a sealed, frictionless, vibrating member like a diaphragm, and the operating mechanism for the pumping element consists of a cam or other mechanically-actuated device driven or operated by the engine and having a fixed or definite path of movement.

The object of my invention is to provide a reliable diaphragm pump for fuel supply systems, that is inexpensive to manufacture and of such design that the operating mechanism for the diaphragm will not wear rapidly.

Figure 1 of the drawing is a vertical sectional view of a pump embodying my present invention.

Figure 2 is a side elevational view of said pump, partly broken away, so as to illustrate the valves of the pump; and

Figure 3 is a fragmentary vertical sectional view, similar to Figure 1, showing the pumping element at the end of its suction stroke.

My improved pump is intended to be used primarily for drawing liquid fuel from a supply tank and delivering said fuel to a reservoir or to the float chamber of the carburetor associated with the internal combustion engine that drives the cam or other mechanically-actuated device that constitutes part of the mechanism for operating the pumping element of the pump. In the accompanying drawing which illustrates the preferred form of my invention, A designates the pumping element which consists of a diaphragm or similar vibrating member that seals one side of the pumping chamber and which operates without producing friction. Said diaphragm may be composed either of one or a plurality of layers of fabric treated with a substance that will render the fabric impervious to gasoline or water without making it brittle or inflexible, and said diaphragm is arranged so that it forms one wall of a pumping chamber 1 into which liquid fuel is drawn when said diaphragm flexes in one direction and from which liquid fuel is forced when said diaphragm is flexed in the opposite direction. The pump is provided with a spring-pressed inlet valve 2 that opens automatically and admits the liquid to the chamber 1 of the pump during the suction stroke of the diaphragm A, and it is also provided with a discharge valve 3 that opens automatically and permits the liquid to escape from said pumping chamber during the discharge stroke of the diaphragm. Any suitable type or kind of inlet valve and discharge valve may be used, and the pump can either be equipped with an inlet pipe that leads directly to the inlet valve, or it can be equipped with a bowl or reservoir B to which the liquid is admitted by a supply pipe and from which the liquid thereafter escapes into the chamber 1 of the pump through the passageway controlled by the inlet valve. In the form of my invention herein illustrated the pump is provided with a bowl B that is detachably connected to the body portion C of the pump and arranged so that the interior of same communicates with an inlet passageway in said body portion in which the inlet valve 2 is arranged, liquid being supplied to the bowl B by a supply pipe 4 attached to the body portion C of the pump and arranged so as to discharge downwardly into the bowl B, as shown in Figure 1. The pump is provided with a discharge pipe 5 that leads from the passageway controlled by the discharge valve 3 to a reservoir or carburetor float chamber (not shown) in which a certain approximate fuel level is maintained by a device that controls a valve arranged between the discharge pipe 5 of the pump and the apparatus to which the pump is delivering fuel. When said apparatus contains its maximum quantity or supply of fuel, the valve interposed between said apparatus and the discharge pipe 5 of the pump remains closed or seated, thereby functioning as an obstruction or cut-off device for the discharge pipe 5 of the pump.

The diaphragm A is disk-shaped and is arranged vertically at one side of a cavity

in the body portion C of the pump that constitutes the pumping chamber 1. The peripheral portion of said diaphragm is clamped between an annular part 6 on the body portion C, and a co-operating housing member 7 having an open-ended tubular guide portion that projects inwardly through an opening in the crank case D of the engine with which the pump is used, as shown in Figure 1. Said housing member 7 preferably consists of a sheet metal stamping and the tubular guide portion of said member has a diameter substantially the same as the diameter of the effective portion of the diaphragm.

The operating mechanism for the diaphragm comprises a cam E or other mechanically-actuated part operated by the engine, a means interposed between said cam and one side of the diaphragm A for imparting a discharge stroke to said diaphragm, and a spring F arranged on the other side of said diaphragm for imparting a suction stroke to the same, the suction stroke of the diaphragm causing liquid to be drawn into the pumping chamber 1 and the discharge stroke of the diaphragm causing liquid to be expelled from the chamber 1 and forced through the discharge pipe 5, or causing a pressure to be created in said discharge pipe, depending upon whether or not the valve interposed between said discharge pipe and the apparatus to which the pump is delivering fuel is capable of opening or is held in its seated or closed condition, due to the apparatus containing its maximum quantity of liquid. The means just referred to that is preferably interposed between the cam E and the diaphragm A is constructed in such a manner that if the flow of liquid through the discharge pipe 5 leading from the pump is obstructed, said means will yield sufficiently to prevent the thrust of the cam E from being exerted on the diaphragm, thereby causing the diaphragm A to remain at rest or in a quiescent state while the cam E continues in operation. Said means is preferably composed of a relatively stiff spring 8, of greater force or strength than the spring F, combined with two members 9 and 10 in such a way as to form in effect a plunger, thrust member or ram, which, under certain conditions, will transmit movement from the cam E to the diaphragm A, but which, under different conditions, will yield sufficiently to permit the diaphragm to remain at rest while the cam E continues in motion. In other words, when the apparatus to which the pump is delivering liquid contains less than its maximum supply of liquid, the spring 8 will co-act with the members 9 and 10 to form a ram that transmits movement from the cam E to the diaphragm A, so as to impart discharge strokes to said diaphragm, thereby causing charges of liquid to be fed intermittently through the discharge pipe 5 leading from the pump, and when said apparatus contains its maximum quantity of liquid, resulting in closing or seating of the discharge valve 3 of the pump, the spring 8 yields sufficiently to permit the diaphragm to remain at rest while the cam continues in motion.

In order to reduce the cost of manufacture and also produce a pump which is of such design that the operating mechanism for the diaphragm will not wear rapidly and will be easy to assemble and combine with the diaphragm, the members 9 and 10 are formed from sheet metal stampings that are arranged in opposed relation with the spring 8 interposed between said members, as shown in Figure 1, the member 9 constituting the outer end portion of the plunger and being arranged in sliding engagement with the tubular guide portion of the housing member 7. After the members 9 and 10 and spring have been assembled, a rod 11 is passed through the center of the member 10 and attached to the center of the member 9 preferably by upsetting one end of said rod. The rod 11 is provided at its opposite end with a head or flange 12 which fits in an integral hollow boss 10^a on the member 10 that projects towards the member 9, and which serves as a guide for the spring 8. The rod 11 is of such length that when the head or flange 12 thereon is in contact or in engagement with the end wall of the hollow boss 10^a on the member 10, as shown in the drawing, the spring 8 will be maintained under such tension that it will serve as a thrust device for transmitting movement from the cam E to the diaphragm A, so as to move said diaphragm from the position shown in Figure 3 into the position shown in Figure 1, thereby imparting a discharge stroke to same that causes the liquid which was drawn into the chamber 1 of the pump during the preceding suction stroke of the diaphragm to be expelled from same past the discharge valve 3 and forced through the discharge pipe 5 to the apparatus to which the pump is delivering liquid. If the inlet valve leading to said apparatus is closed, as previously explained, the discharge valve 3 of the pump will remain closed or seated when the eccentric portion of the cam E starts to act on the member 9, with the result that the spring 8 will yield or compress sufficiently to absorb the motion imparted to the member 9 while the eccentric portion of the cam E is traveling over the same, said spring 8 expanding and returning to its former condition as soon as the eccentric portion of the cam passes out of engagement with the member 9. It will thus be seen that under certain conditions, i. e., when the apparatus to which the pump is delivering liquid contains its maximum quantity of liquid, the diaphragm A of the pump will remain at rest or in a quiescent state, notwithstanding the fact

that the cam E or other mechanically-actuated device of the diaphragm operating mechanism continues in operation.

In order to permit the rod 11 to move relatively to the member 10 under conditions previously described, without imparting a thrust to the diaphragm, the hollow boss 10^a on the member 10 is of such depth or length that the head 12 on the rod 11 can reciprocate therein without exerting a thrust on the diaphragm when the diaphragm is held in an inactive or idle position, due to obstructing the flow of liquid through the discharge pipe 5 leading from the pump. Preferably, flanged metal protecting members 13 and 13^a are interposed between the diaphragm and the spring F and between the diaphragm and the member 10, as shown in the drawing, and the member $13a$ is so proportioned that the flange at the periphery of same is guided by the housing member 7. The member 9 is constructed in the form of a substantially hollow or cup-shaped piston that slides freely in the tubular guide portion of the housing member 7, and said housing member is open at its outer end so that the lubricating oil in the crank case of the engine can enter the interior of said housing, and thus lubricate the portion of same in which the member 9 slides. Due to the fact that the member 9 is moved in one direction (inwardly) by a rotary cam E which has a wiping action on a wear plate $9a$ attached to the outer end of the member 9, said wiping action tends to force the member 9 downwardly or laterally against the lower side of the tubular guide portion of the housing 7 in which the member 9 slides, assuming that the cam E rotates in anti-clockwise direction. In order to counteract or overcome the tendency of the lower side of the member 9 and the tubular guide portion of the housing 7 to wear rapidly, due to the downward thrust or lateral thrust of the cam E, I arrange said cam in such relationship with the member 9 that when said cam first comes into contact with the member 9 it tends to cock or tilt said member 9 sufficient to counteract the downward thrust of the cam on the member 9, and thus in effect cause the friction to be distributed substantially uniformly over the contacting surfaces of the member 9 and the tubular guide portion of the housing member 7 in which the member 9 slides. In the form of my invention herein illustrated this highly desirable result is attained by disposing the member 9 in such relationship with the operating shaft of the cam E that the center of said shaft is slightly higher than the longitudinal axis of the member 9. By constructing the operating mechanism for the diaphragm in this manner I am able to successfully dispense with a friction reducing bearing between the cam E and the member 9 which it operates.

A pump of the construction above described is inexpensive to build, it is reliable in operation, and notwithstanding the fact that the operating mechanism for the pumping element A comprises a cam or other mechanically-actuated device that has a fixed path of travel and which moves constantly when the engine is in operation, the pumping element is capable of remaining at rest or in a quiescent state without interfering with the movement of said cam or similar part, in the event the flow of fuel through the discharge pipe of the pump ceases, due to the fact that the apparatus to which the pump is delivering fuel contains the maximum quantity of fuel which said apparatus is capable of holding.

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

A pump for fuel supply systems provided with a pumping chamber, a diaphragm for creating suction and pressure in said chamber, an open-ended tubular guide projecting laterally from the body of the pump, a spring on one side of said diaphragm for flexing it in one direction, a reciprocating plunger in said tubular guide a second spring that cooperates with said plunger to flex the diaphragm in the opposite direction, and a rotary cam that has a wiping action on the outer end of said plunger, the axis of said cam being disposed sufficiently off center with relation to the longitudinal axis of said plunger to cause the cam to have a tendency to cock or tilt the plunger when it first contacts with same and thus counteract the thrust which the cam exerts on the plunger in a direction tending to force the plunger laterally against the side of the tubular guide in which the plunger reciprocates.

WILLIAM C. CARTER.