July 25, 1933. A. M. BABITCH 1,919,496

FUEL PUMP

Filed Feb. 18, 1931

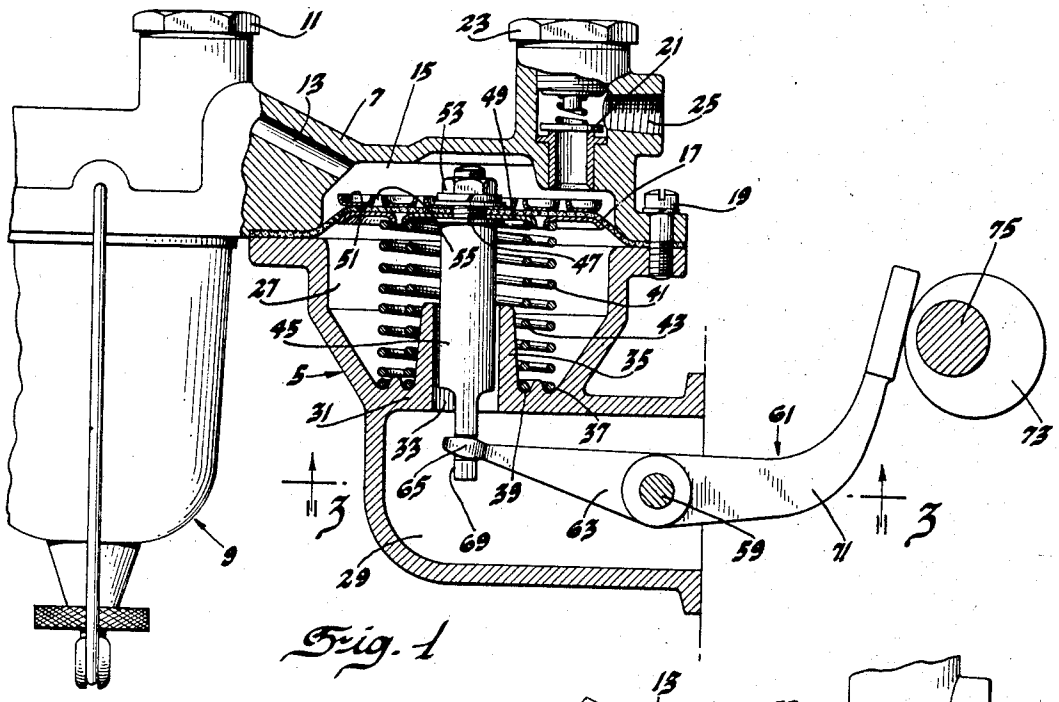


Fig. 1

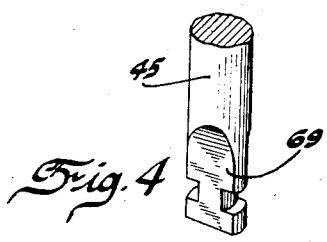


Fig. 4

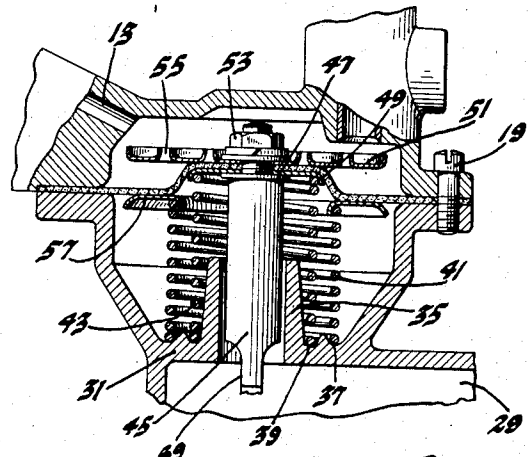


Fig. 2

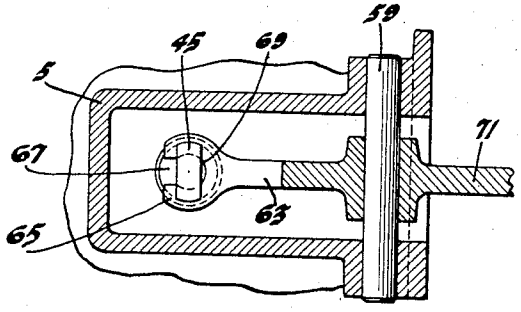


Fig. 3

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FUEL PUMP

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This invention relates to fuel pumps, and has been designed as an improvement in an engine driven pump to supply fuel for the operation of the engine.

In fuel pumps of the kind referred to it has been proposed to reciprocate a pumping member by the movement of a part actuated by engagement of an engine-operated cam. In such pumps the demand for fuel varies and, to provide for the variable demand, in some constructions the discharge stroke has been made variable by the use of a spring as the discharge-producing means, and the suction stroke has been made by the use of a cam acting upon a lever or its equivalent, the lever being connected to the pumping member. In these cases there develops a variable spacing between the cam and the lever occasioned by the variable discharge stroke, and this variable spacing is productive of noise when the cam again engages the lever. To avoid this noise a spring has been used to maintain a constant contact between the cam and the lever and some form of lost motion connection has been introduced in the lever system.

The present invention aims to similarly use a spring to maintain contact between the cam and the part which it actuates, and also aims to avoid the need for the last-mentioned lost motion connection. Specifically it aims to attain the above object by the provision of means to vary the capacity of the pump chamber in accordance with the pressures therein while the device is operating with a constant stroke.

The above and other related objects are secured by this structure herein described and illustrated in the accompanying drawing.

In the drawing—

Fig. 1 is a vertical sectional view of the pump associated with a substantially conventional filter and trap, the latter combined unit being shown in elevation.

Fig. 2 is a vertical section corresponding with the pump portion of Fig. 1 but showing the parts in another relative position.

Fig. 3 is a horizontal section on line 3—3 of Fig. 1.

Fig. 4 is a view in perspective of a detail.

Referring by reference characters to the drawing, numeral 5 is a pump body and 7 is its cover. The cover 7 serves also as a closure for the combined filter and trap represented as a whole by numeral 9. Inasmuch as no novelty is herein claimed for this combined unit it is not further illustrated. The fuel after being cleaned in the filter and trap 9 passes the usual inlet valve, not shown, but located within the cover 7 and reached by means of a cap 11, and then through a passage 13 to the pump chamber 15. This pump chamber is defined by the cover 7 and a diaphragm 17 secured at its periphery between the adjoining faces of the body 5 and cover 7 by fastening means 19. From the pump chamber the fuel passes through an outlet valve 21 covered by a cap 23 and then leaves the pump through an outward passage 25 on its way to the carburetor.

The pump body 5 is preferably an integral casting having an upper spring chamber 27 and a lower lever chamber 29. The two chambers are separated by a wall 31 having an opening 33 which opening also extends through a boss 35 extending from the wall 31 up into the chamber 27. At the bottom of chamber 27 around the boss 35 two concentric grooves are formed, these grooves being represented by numerals 37 and 39. Groove 37 seats a spring 41 and groove 39 seats a spring 43.

An operating pump rod 45 is movable axially through the boss 35 and the wall 31, and its upper end is connected to the diaphragm. At the upper end the pump rod has a flange 47 above which the rod is reduced and threaded. A shallow inverted cup-shaped disc 49 is placed over the reduced end of the pump rod and engages the flange 47. The reduced end also extends through a suitable opening in the diaphragm and above the diaphragm is the disc 51 also placed on the reduced end of the rod. These parts are then held in position by a nut 53 threaded on the end of the rod. It will be observed that disc 51 is larger than disc 49 and is provided with a plurality of holes 55 to permit the passage of fuel from one side to the other. A channel-shaped annular stamping 57 surrounds the stamped disc 49. The upper end of spring 41 is seated

against disc 57 and the upper end of spring 43 engages the stamping 49.

At 59 is a pivot within chamber 29 to provide rotary movement for a two-arm lever 61. One arm 63 of lever 61 extends inwardly to a point adjacent to the end of the pumping rod 45 where its end is bifurcated as at 65, there being an opening 67 between the furcations. The pump rod has its lower end provided with flat surfaces as at 69 to reduce the transverse dimension of the rod between the flat surfaces so that in assembly it may be inserted through the opening 67 and into the the space between the furcations of the lever. The end of the pump rod is of greater diameter than the diameter of the lever opening so that when turned through 90° the parts are locked from separation. The construction of the interlocking surfaces of the pump rod and lever are such as to provide for a centralized rocking motion. Lever 61 has an arm 71 extending outwardly from the pump. When the pump is secured over an opening in the crankcase as is ususal where such pumps are used in connection with internal combustion engines, the lever arm 71 is extended to a position to be engaged and rotated by the engine cam 73 on the camshaft 75.

In the operation of the device the cam 73 rotates the lever and pulls the pump rod and diaphragm from the position shown in Fig. 1 to its lowermost position during which time fuel is drawn inwardly through passage 13 to the pump chamber, and springs 41 and 43 are being compressed. As the cam continues to rotate toward the position shown in Fig. 1, spring 43 is available and is made of sufficient strength to push upwardly on the diaphragm and thereby raise the rod 45 which rotates the lever and maintains it in contact with the cam. The spring 43, it will be understood, is so calibrated as to have sufficient force to at all times maintain the lever in contact with the cam. If the demand for fuel is considerable spring 41, which is calibrated to exert a predetermined pressure on the gas to be delivered to the carburetor, will operate to push the diaphragm upwardly and discharge the fuel. When, therefore, spring 43 is acting to press up against the mid portion of the diaphragm and to maintain contact between the lever and the cam, the spring 41 will exert upward pressure on the diaphragm. Since this pressure is resisted by the variable pressures within the pump chamber, this variability being dependent upon the carburetor demand, the diaphragm will assume varying shapes. It may assume a position as in Fig. 1 at the extreme position of discharge. In this case the spring 41 has moved the diaphragm to its outward limit, this being the condition of maximum fuel demand. In Fig. 2 the spring 43 has moved the mid portion of the diaphragm as before but, owing to lesser demand, the chamber pressure has quickly built up and spring 41 is unable to appreciably raise that region of the diaphragm which it engages. It will be seen that a definite constant stroke in both directions is given to the mid portion of the diaphragm by the action of the cam and lever and spring 43, but that the discharge strokes of the pump influenced by spring 41 cause the diaphragm to assume varying curved forms. The diaphragm therefore has a sort of wave motion under the influence of the varying chamber pressure, the constant stroke at its center, and the varying strokes influenced by spring 41.

The position of the upper plate as shown in Fig. 2 shows the occasion for the provision of openings 55. The spring 43 associated with the provision for flexing the diaphragm into curved shape and thereby changing the volumetric capacity of the pump chamber avoids the need for the provision of lost motion in the lever system. The construction of the pump body is also simplified in that the casting 5 need be provided with no separate abutment for the spring which is to engage the lever as in some earlier forms.

I claim:

1. In a fuel pump, a pump body, a cover secured thereto, a flexible diaphragm secured between the body and cover and forming with the cover a pump chamber, said body provided with two chambers, a spring in a first one of said chambers exerting pressure on said diaphragm tending to produce a discharge stroke and calibrated to overcome pump chamber pressures below a predetermined pressure, a lever pivoted in the second chamber, a pump rod connected to said diaphragm, extending through said first chamber and into said second chamber, and therein connected to said lever, said lever projecting from said pump body to a position adjacent an actuating member, and a second spring in said first chamber engaging said diaphragm, calibrated to overcome higher pump chamber pressures and to at all times hold said lever in contact with said actuating member.

2. The invention defined by claim 1, said second spring being concentric with and within the first spring and operable upon said diaphragm whereby the central region of the diaphragm is influenced by the actuating means and lever and by the second spring to have a substantially constant stroke.

3. In a fuel pump having a pump chamber defined by a rigid wall and a movable diaphragm, positive means including a cam and lever to actuate the diaphragm in one direction to make a suction stroke, resilient means operable upon a part of said diaphragm to overcome pump chamber pressures below a predetermined pressure and to make a discharge stroke, and other resilient means op-

erable upon another part of said diaphragm and calibrated to overcome relatively higher chamber pressures and to maintain said lever in constant contact with said cam.

4. The invention defined by claim 3, said two resilient means engaging a common fixed abutment.

5. The invention defined by claim 3, said two resilient means being in concentric relation.

6. The invention defined by claim 3, said two resilient means being in concentric relation, the inner resilient means and the cam and lever giving a constant stroke to the central portion of the diaphragm.

7. In a fuel pump, a pump body having two chambers, an operating lever extending into one chamber, means to rock said lever to make a suction stroke, a pump rod connected to one arm of said lever and extending into the other chamber, a cover, a diaphragm between said body and cover to form with said cover a pump chamber and to complete the closure of the said other body chamber, said pump rod connected to said diaphragm, concentric springs in said other chamber constantly operable upon said diaphragm, one of said springs being calibrated to overcome chamber pressures less than a predetermined pressure and the other spring calibrated to give a constant stroke to the portion of the diaphragm engaged thereby and to hold the lever in contact with the cam.

8. The invention defined by claim 7 together with circular discs one on each side of said diaphragm and secured thereto with said pump rod, the disc on the body chamber side of the diaphragm serving as an abutment for the innermost of the concentric springs, and a concentric annular disc on the body chamber side of the diaphragm positioned to receive the active end of the outermost of the concentric springs.

9. The invention defined by claim 7 together with circular discs one on each side of said diaphragm and secured thereto with said pump rod, the disc on the body chamber side of the diaphragm serving as an abutment for the innermost of the concentric rings, the disc on the pump chamber side of the diaphragm being formed with apertures for the passage of the fuel.

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