Nov. 7, 1950 C. W. VAN RANST ET AL 2,529,204

FUEL PUMP

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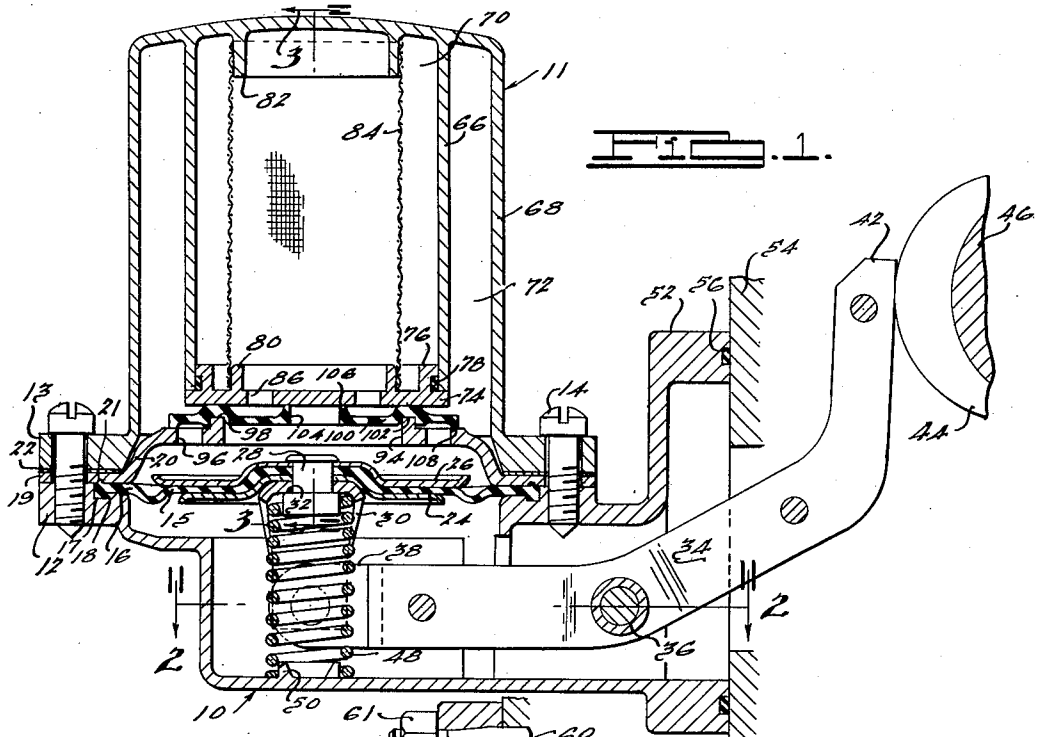


FIG. 1.

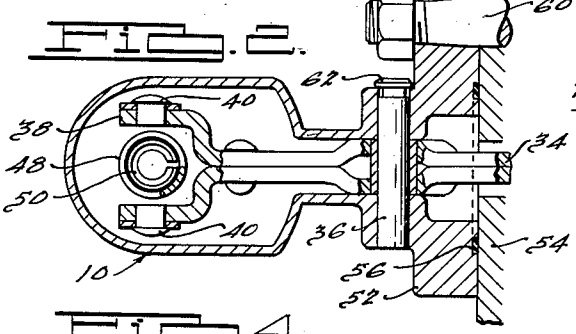


FIG. 2.

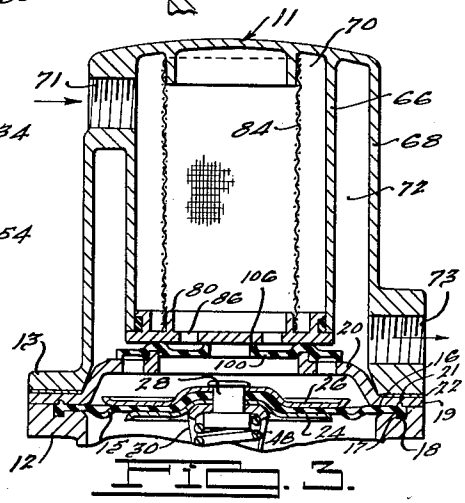


FIG. 3.

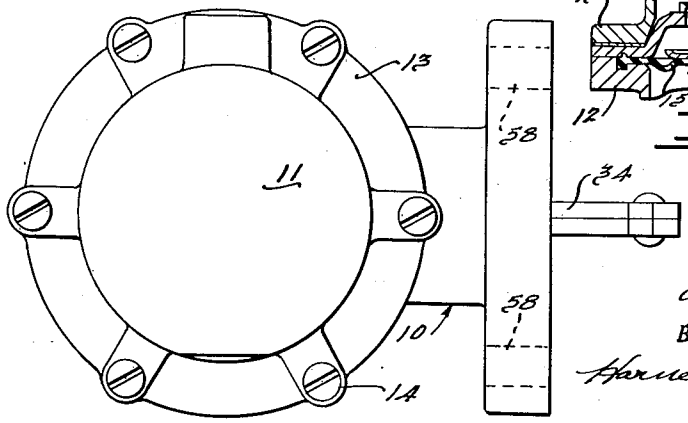


FIG. 4.

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FUEL PUMP

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8 Claims. (Cl. 103—150)

1

The present invention relates generally to internal combustion engines and it has particular relation to a fuel pump.

Fuel pumps employing pulsating diaphragms are generally used in motor vehicles for the purpose of supplying fuel to the carburetor. These pumps are operated, as a rule, by cam means on the engine cam shaft, and the present invention is concerned with a fuel pump of this general character.

One object of the present invention is to provide an improved fuel pump of the above generally indicated type employing a pulsating diaphragm, which is simple in construction, economical of manufacture and assembly, and which is reliable and efficient in operation.

It is also an object of this invention to provide a fuel pump having an improved and highly durable diaphragm, and improved means mounting the diaphragm in the pump.

Another object of this invention is to provide a fuel pump having improved means for pulsating the diaphragm thereof.

Another object of the present invention is to provide a fuel pump having improved means by which the extent of movement of the diaphragm is varied in response to the fuel pressure within the pump and in which the fuel pressure acts to limit the engagement between the engine cam shaft and the fuel pump bell crank operated thereby.

A further object of this invention is to provide a fuel pump having an improved casing construction eliminating the need for a cover and securing means therefor.

It is also an object of this invention to provide a fuel pump having an improved construction which eliminates the possibility of accidental disassembly of the diaphragm pulsating means as a result of the vibration and jarring incurred in normal operation.

Other objects of the invention will become apparent from the following specification, the drawings related thereto, and the claims hereinafter set forth.

For a better understanding of the invention reference may be had to the drawings wherein:

Figure 1 is a sectional view of a fuel pump constructed according to one form of the invention;

Figure 2 is a reduced sectional view of the structure shown in Figure 1 taken substantially along the line 2—2 thereof;

Figure 3 is a reduced fragmentary sectional view of the structure of Figure 1 taken substantially along the line 3—3 thereof; and

2

Figure 4 is a reduced plan view of the structure shown in Figure 1.

Referring to the drawings, the fuel pump comprises a casing having a lower part 10 and an upper part 11 having flanges 12 and 13 respectively formed thereon and fastened together by screws 14. The casing thus provided is divided by a diaphragm 15 having a marginal portion 16 having an enlarged anchoring bead 17 integrally formed on its periphery. The marginal portion 16 and bead 17 are received in a complementary recess 18 formed in the flange 12 of the lower part of the casing. The marginal portion 16 is slightly thicker than the central portion of the diaphragm and thicker than the depth of the recess 18 in which it is received, such that prior to assembly it extends a little above the upwardly presenting face of the flange 12.

When the pump is assembled, the marginal portion is compressed into the recess 18 by the marginal portion 19 of a metal disk 20, the construction and function of which will be hereinafter described. The engagement of the bead 17 in the recess 18 serves to locate the diaphragm. This construction provides a metal to metal contact, outwardly of the diaphragm, between the marginal portion 19 of the disk and the flange 12 of the lower part of the casing. This contact limits the clamping force which may be applied to the marginal portion of the diaphragm and thereby prevents excessive flattening and hence weakening thereof. For this reason, this construction prevents careless workers from improperly assembling the pump by applying too great a pressure to the diaphragm. The thickness of the marginal portion of the diaphragm and the depth of the recess 18 in which it is received, are such that when the diaphragm is clamped in position, the thickness of marginal portion remains at least as great as that of the central portion of the diaphragm.

An annular sealing bead 21 is formed on the upper surface of the marginal portion of the diaphragm and is received in a groove formed in the lower surface of the disk 20, to provide a seal at the lower side of the disk. For providing a seal at the upper side of the disk, a gasket 22 is disposed between the marginal portion of the disk and the flange 13 on the upper part of the casing.

The diaphragm is constructed of suitable material such as synthetic rubber having high resistance to the action of hydrocarbon fuel and it is flexible so that it may be moved relative to its marginal portion. At its center the diaphragm

is held between two disks 24 and 26 which are connected at their centers by a pin 28.

During operation of the pump the diaphragm moves upwardly and downwardly or in other words, pulsates. This movement is imparted to the diaphragm 15 through a U-shaped bracket 30 the base of which is securely held against the lower surface of the disk 24 by the pin 28 which extends through an aperture in the bracket 30 and has a shoulder 32 which engages the bracket. A bell crank 34 is pivotally mounted on the lower part 10 of the casing by a pin 36 and has its inner end 38 bifurcated and pivotally connected to the depending arms of the U-shaped bracket 30 by rivets 40. The outer end of the bell crank 34 extends upwardly from its pivotal connection to the casing and is adapted to engage a cam 44 formed on the engine cam shaft 46.

A spring 48 is disposed between the depending arms of the bracket 30 and between the bifurcated ends 38 of the bell crank 34 and normally urges the diaphragm upwardly and the bell crank in a clockwise direction as viewed in Figure 1. The upper end of the spring 48 encircles the pin 28 and engages the base of the bracket 30, and its lower end engages the wall of the lower part 10 of the casing and is held in position by an annular boss 50 integrally formed thereon and which it encircles.

The lower part 10 of the casing has a base portion 52 adapted to engage and be secured to engine block 54, and carrying a sealing ring 56 which engages said engine block to form a tight seal between the engine block and the base. For securing the fuel pump to the engine, the base portion 52 is provided with apertures 58 adapted to receive studs 60 mounted in the engine block. One of these apertures 58 is disposed so that its axis intersects the axis of the pin 36 with the result that when the base portion 52 is mounted on the engine block 54, the nut 61 received on the stud limits the movement of the pin in one direction. For limiting movement of the pin in the opposite direction a slightly enlarged head 62 is integrally formed thereon. When the pin is assembled, the head is disposed to engage the nut 61 to limit movement outwardly and to engage the casing to limit movement inwardly. This construction prohibits removal of the pin 36 while the fuel pump is mounted on the engine and therefore eliminates all possibility of the pin 36 falling out as the result of the vibration or jarring incident to operation of the engine.

The upper part 11 of the casing includes an inner cylindrical wall 66 and an outer cylindrical wall 68. The inner wall 66 divides the upper part 11 into an inner vapor and fuel chamber 70 and an outer vapor and fuel chamber 72. An inlet connection 71 opens into the inner chamber 70, and the outer chamber 72 is provided with an outlet connection 73 through which the pump supplies fuel to the carburetor.

A circular plate or valve seat 74 has an annular projection 76 on one side thereof which carries a sealing ring 78 and is received in the lower end of the inner cylindrical wall 66 with which it has a press fit. Inwardly of the projection 76 the plate 74 has a second annular projection 80 formed thereon which co-operates with a similar projection 82, formed on the upper part 12 of the casing, inwardly of the inner wall 66, to position and support a screen 84 disposed within the inner vapor and fuel chamber 70. Internally of the projection 80 the plate 74 is provided with a plurality of openings 86 for allowing the flow of fuel from one chamber to the other.

The disk 20 is mounted between the flanges 12 and 13, as described above, and extends across the casing. Its central portion is upwardly offset and is provided with a large central opening 94 and smaller marginal openings 96. At its upper side, the disk 20 has an annular rib 98 located between the opening 94 and the marginal openings 96. This rib serves as an anchor for a disk-like rubber valve 100 which has an annular downwardly opening channel portion 102 fitting the rib and also sealing against the valve seat 74, outwardly of openings 86. The valve 100 has an opening 104 at its center and around this opening it has an upwardly extending annular sealing bead 106 adapted to engage the under side of the valve seat 74, inwardly of openings 86. Outwardly of the channel 102, the valve 100 has a similar annular bead 108 on its under side which is adapted to engage the disk 20 outwardly of the openings 96. The valve 100 may be composed of any of the synthetic rubbers which are resilient and flexible and highly resistant to the action of hydrocarbon fuel as well as resistant to corrosion.

During the operation of the pump, the downward movement of the diaphragm 15 causes the central portion of the resilient valve 100 to be flexed downwardly unseating the sealing bead 106 from the valve seat 74 and causing fuel to flow into the inner fuel and vapor chamber 70 through the inlet opening 71 and then downwardly through the openings 86 in the valve seat, the central opening 104 in the valve, and through the opening 94 to the lower side of the metal disk 20. During this movement of the diaphragm, the sealing bead 108 is held firmly against the disk 20 to close the openings 96 therein. Upon upward movement of the diaphragm 15, the sealing bead 106 seats against the valve seat 74 and closes the openings 86, while the outer marginal portion of the valve 100 is flexed upwardly unseating the sealing bead 108 from the disk 20 and uncovering the openings 96. During this upward movement of the diaphragm, fuel flows upwardly through the openings 96 into the outer vapor and fuel chamber 72 and to the carburetor through the outlet connection 73. The resiliency of the valve 100 causes the sealing beads 106 and 108 to return to their sealing position in which they engage the valve seat 74 and the disk 20 respectively, at all times when they are not unseated by the action of the diaphragm 15.

Although only one specific embodiment of the invention has been illustrated and described in detail, it will be apparent to those skilled in the art that various modifications and changes may be made without departing from the spirit of the invention and from the scope of the appended claims.

What is claimed is:

1. In a fuel pump, a casing, means including valves defining an inlet chamber and an outlet chamber, a diaphragm operable to pump fuel through said chambers, means for pulsating said diaphragm, said last named means being responsive to variations in the fuel pressure within said chambers to vary the extent of movement of said diaphragm and including a depending element connected to said diaphragm, a bell crank pivotally mounted on said casing having one end pivot-

ally connected to said element and the other end adapted to engage a cam, and spring means urging said bell crank into engagement with said cam, said last named means being responsive to said variations in the fuel pressure within said chambers to vary the contact between said other end of said bell crank and said cam and thereby to vary the stroke of said diaphragm.

2. In a fuel pump, a casing, means including valves defining an inlet chamber and an outlet chamber, a diaphragm operable to pump fuel through said chambers, means for pulsating said diaphragm including a depending element connected to said diaphragm, a bell crank pivotally mounted on said casing and having one end pivotally connected to said element and its other end adapted to engage a rotary cam, and a spring biasing said other end of said bell crank toward said cam, said last named means being responsive to variations in the fuel pressure in said chambers to vary the extent of movement of said diaphragm by varying the contact between said cam and said bell crank.

3. In a fuel pump, a casing, means including valves defining an inlet chamber and an outlet chamber, a diaphragm operable to pump fuel through said chambers, means for pulsating said diaphragm including a U-shaped bracket connected to said diaphragm, a bell crank pivotally mounted on said casing and having one end bifurcated and pivotally connected to said U-shaped bracket and its other end adapted to engage a rotary cam, and a spring disposed between the arms of said U-shaped bracket and engaging said bracket at one end and said casing at the other end to bias said other end of said bell crank toward said cam, said last named means being responsive to variations in the fuel pressure in said chambers to vary the extent of movement of said diaphragm by varying the contact between said cam and said bell crank.

4. In a fuel pump, a casing comprising an upper part and a lower part, said upper part comprising a cup-shaped element having inner and outer downwardly extending walls integrally formed thereon, a valve seat plate mounted in the lower end of the inner of said walls and extending across the opening at the lower end of said inner wall, a diaphragm extending across said casing between said parts, means including valves dividing said upper part into an inlet chamber and an outlet chamber, and means for pulsating said diaphragm.

5. In a fuel pump, a sub-assembly comprising a diaphragm, a U-shaped bracket secured to said diaphragm, a bell crank having one end bifurcated and pivotally connected to said bracket and its other end adapted to engage a cam, said bell crank being apertured intermediate its ends for pivotally supporting said bell crank on the casing of said fuel pump.

6. In a fuel pump, a casing, means including valves defining an inlet chamber and an outlet chamber, a diaphragm operable to pump fuel through said chambers, means for pulsating said diaphragm, said last named means being responsive to variations in the fuel pressure at one side of said diaphragm to vary the extent of movement of said diaphragm, said last named means including a bellcrank pivotally mounted on said casing and having one end operatively connected to said diaphragm and the other end adapted to engage a cam, and said last named means being responsive to said variations in said fuel pressure to vary the contact between said other end of said bellcrank and said cam to effect said variations in the extent of movement of said diaphragm.

7. In a fuel pump, a casing including an upper member and a lower member, said upper member having integrally formed inner and outer annular wall portions and an upper end wall portion, a valve plate member mounted in the lower end of said inner annular wall portion, a diaphragm extending across said casing between said members, means including valves dividing said upper member into an inlet chamber and an outlet chamber, and means for pulsating said diaphragm to effect a pumping action, said upper end wall portion closing both said chambers at their upper ends.

8. In a fuel pump, a casing including an upper member and a lower member, said upper member having integrally formed inner and outer annular wall portions and an upper end wall portion defining a central chamber and an annular chamber surrounding said central chamber, an element disposed within said central chamber for removing foreign substances from fuel passing therethrough, an apertured plate member mounted in the lower end of said inner annular wall portion and supporting said element, a diaphragm extending across said casing between said members, means including valves dividing said upper member into an inlet chamber and an outlet chamber, and means for pulsating said diaphragm to effect a pumping action, said upper end wall portion closing both said chambers at their upper ends.

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