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FUEL PUMP

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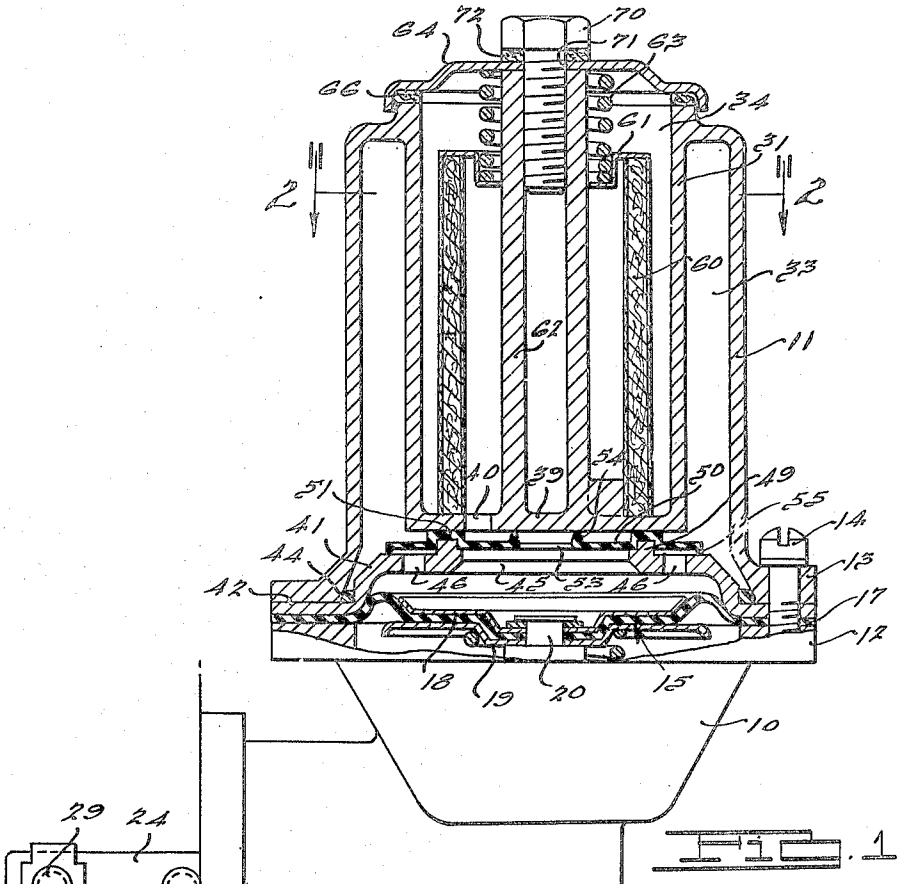

Fig. 1.

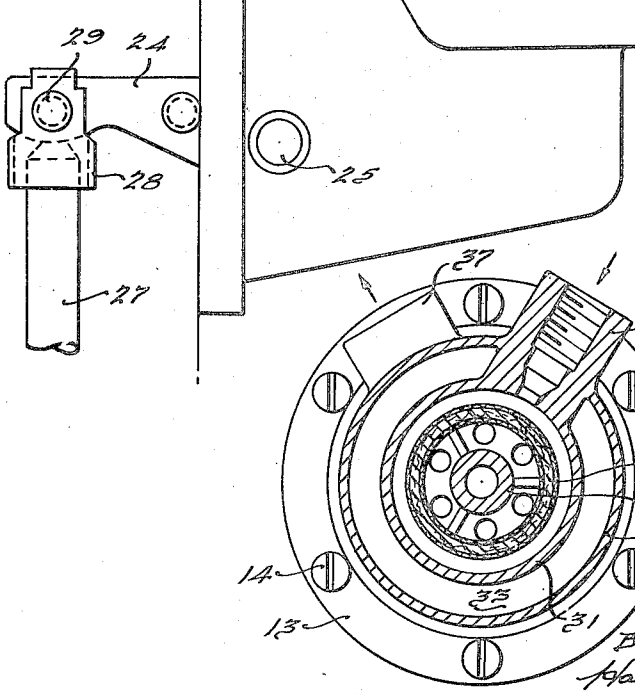

Fig. 2.

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FUEL PUMP

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The 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 type of fuel pump employing a pulsating type of diaphragm wherein an improved and very efficient resilient valve element is used for controlling the flow of fuel through the pump.

Another object of the invention is to provide an improved type of valve for this purpose which comprises a rubber disk acting to control both the inlet and the outlet openings in the pump.

Another object of the invention is to provide a fuel pump of this character wherein the valve is of inexpensive construction and can be readily installed and replaced.

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

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

Figure 1 is an elevational view partly in cross section showing a fuel pump constructed according to one form of the invention; and

Fig. 2 is a cross-sectional view taken substantially along the line 2—2 of Fig. 1.

Referring to Fig. 1, the pump comprises a casing having a lower part 10 and an upper part 11, and these parts of the casing have flanges 12 and 13, respectively, fastened together by screws 14. The casing thus provided is divided by a diaphragm 15 having a marginal portion 17 clamped between the flanges. The diaphragm is constructed of suitable material such as of synthetic rubber having high resistance to the action of hydrocarbon fuels, 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 18 and 19 which are connected at their centers by a pin 20.

During operation of the pump the diaphragm moves upwardly and downwardly or in other words, pulsates, and this movement of the diaphragm may be effected by any suitable means including, for instance, an arm 24 pivoted intermediate its ends on a pin 25 in the casing part 10 and having an operative connection at its inner end with the pin 20. This connection at the inner end of arm 24 is such as to allow the stroke of the diaphragm and pin 20 to vary in accordance with fuel pressures above the diaphragm, or in other words, if the pressure above the diaphragm increases, the stroke will be shortened whereas if the pressure above the diaphragm decreases, the stroke will be lengthened. Movement of the arm 24 may be effected by a stem 27 operating from the engine cam shaft and which seats in a socket element 28 pivoted as indicated at 29 on the outer end of the arm.

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The upper part 11 of the casing includes an inner wall 31 which forms an outer vapor and fuel chamber 33 and an inner vapor and fuel chamber 34. Fuel enters the inner chamber by means of a fuel inlet 35, shown in Fig. 2, and then flows from the inner chamber to the outer chamber by means presently to be described, and from the outer chamber it flows through a connection 37 leading to the engine carburetor.

Now directing attention to Fig. 1, in particular, the base or bottom of the inner chamber 31 is separated from the outer chamber by a bottom wall 39 having a plurality of openings 40 for allowing the fuel to flow from one chamber to the other. A metal disk 41 extends across the casing immediately above the diaphragm 15 and this disk has a marginal flange 42 disposed between the flanges 12 and 13 so as to secure the disk rigidly in position. It might be mentioned that the margin of the diaphragm seals the casing at the underside of the disk margin 42, while at the upper side of the disk a rubber sealing ring 44 is provided for this purpose.

The central portion of the disk 41 is upwardly off-set and is provided with a central large opening 45 and smaller, marginal openings 46. At its upper side the disk has an annular rib 49 located between the opening 45 and the series of openings 46, and this rib serves as an anchor for a disk-like, rubber valve 50 which has an annular downwardly open channel portion 51 fitting the rib and also sealing against the bottom 39. The valve 50 has an opening 53 at its center and around this opening it has an upwardly extending sealing bead 54 adapted to contact the underside of the base 39, and it might be noted that this bead 54 is generally wedge shape in cross section so as to present a relatively narrow edge for contacting the base. Outwardly of the channel 51, the disk has a similar annular bead 55 on its underside which is adapted to contact the disk 41 out-

wardly of the openings 46. The valve 50 may be composed of any of the synthetic rubbers which are resilient and flexible and highly resistant to the action of hydrocarbon fuels and also resistant to corrosion.

Within the inner chamber 34, a cylindrical filter 60 is provided which rests on the bottom wall 39 radially beyond the openings 40 and this filter is maintained in position by an upper disk element 61 slidably disposed on a tubular projection 62 extending upwardly from the base. A coil spring 63 around the projection 62 urges the disk 61 and filter downwardly and the upper end of the spring is engaged by a closure or cap 64 which extends over the upper end of the projection 62 and at its outer margin engages a sealing ring 66 on the casing. The cap 64 is anchored on the projection 62 by means of a bolt 70 extending through an opening 71 in the cap and threaded into the upper end of projection 62, and a sealing ring 72 is provided under the head of the bolt so as to prevent fuel leakage.

During operation of the pump, downward movement of the diaphragm 15 causes the central portion of the valve 50 to move downwardly while at the same time the outer marginal portion of the valve is maintained in tight sealing engagement with the disk 61. Movement downwardly of the central portion of the valve allows fuel to flow through the openings 40 and 53 and into the space between the disk 41 and the diaphragm, and then upon upward movement of the diaphragm, the central portion of the valve is held in sealing engagement with the bottom 39 while pressure on the fluid causes it to flow upwardly through the openings 46 and to escape past the bead 55. It should be understood that the movement of the fuel will lift the marginal portion of the valve and allow it to flow under the bead 55, and this is true also in connection with the bead 54 during flow of fuel downwardly through openings 40. Also it is to be understood that the resiliency of the rubber naturally tends to cause the beads to return to seating contact with the metal surfaces which they are adapted to contact.

Attention is directed to the fact that in assembling the pump, the contact between the margin 42 on the disk 41 and the flange 13 on the casing definitely locates the rib 49 on the disk with respect to the bottom 39 of the casing, and the relation of parts is such that the rubber valve between the rib 49 and bottom 39 is sealingly clamped in place, but without such pressure as to cause any deformation in either the central portion of the valve or in its outer marginal portion. At the same time by having projection 62 limiting the extent to which the bolt 70 can be tightened, any tendency of the bottom 39 to be deformed through tightening of the bolt is eliminated. Thus if the bolt is tightened in one case more than in another, the variation will have no effect on the bottom 39. As a result the rubber valve will not be altered in shape or position at any time.

From the foregoing, it should be appreciated that the rubber valve 50 may be accurately constructed and shaped and accurately located in position and that its condition will not be altered such as by deformation through any tightening of the screws 13 or tightening of the bolt 70. Hence, the valve may be rapidly and accurately arranged and with such relation of parts that its efficient and proper operation will be assured at all times.

Although only one form of the invention has been illustrated and described in detail, it will be

apparent to those skilled in the art that various modifications may be made without departing from the scope of the claims.

What is claimed is:

1. In a fuel pump, a casing, a wall in the casing and forming a part thereof, a plate spaced outwardly from and parallel to the wall, means releasably securing the plate to the casing, said plate having a central opening and an outer opening spaced from the central opening, the wall having an opening adapted to communicate with said central opening in the plate, and rubber valve means including a central portion and an outer portion and annularly gripped and sealed between the plate and wall intermediate said central portion and said outer portion, said central portion controlling communication between the opening in the wall and the central opening in the plate and the outer portion being arranged to flex and thereby cover and uncover the outer opening in the plate.

2. In a fuel pump, a casing, a plate extending across the casing and having a first opening and an additional opening between said first opening and the periphery of the plate, a wall above the plate and substantially parallel thereto and having an aperture disposed to communicate with said first opening, a rubber valve disk between the wall and plate and having an opening normally closed by said wall and adapted to connect said aperture and said first opening to allow fluid to flow therethrough, and means sealing the rubber valve disk between the wall and plate, said means being arranged around said first opening to prevent the flow of fluid between said wall and said plate from one of said openings in said plate to the other, said rubber valve disk being in normal covering relation to said additional opening and said aperture and being free to flex to alternately uncover said additional opening and said aperture.

3. In a fuel pump, a casing, a plate extending across the casing and having a first opening and an additional opening between said first opening and the periphery of the plate, a wall above the plate and substantially parallel thereto and having an aperture disposed to communicate with said first opening, a rubber valve disk between the wall and plate and having an opening normally closed by said wall and adapted to connect said aperture and said first opening to allow fluid to flow therethrough, and means sealing the rubber valve disk between the wall and plate, said means being arranged around said first opening to prevent the flow of fluid between said wall and said plate from one of said openings in said plate to the other, said rubber valve disk being in normal covering relation to said additional opening and said aperture and being free to flex to alternately uncover said additional opening and said aperture, and beads on the flexing portions of said rubber valve disk adapted to contact the plate and wall respectively.

4. In a fuel pump, a pump diaphragm, a lower casing member secured to the lower side of the pump diaphragm, an upper casing member, a plate interposed between said upper casing member and the pump diaphragm, said plate being recessed to form a pumping chamber, a vapor dome extending upwardly from said pumping chamber, a plurality of radially spaced openings in said plate, and an annular flexible disc secured to the upper side of said plate and having a radially outer peripheral portion overlying the radially outer of said radially spaced openings and

effective in one position to prevent fluid flow therethrough and having a radially inner peripheral portion overlying the radially inner of said radially spaced openings and effective in one position to prevent fluid flow therethrough, at least one of said openings communicating with said vapor dome.

5. A fuel pump comprising an upper housing member having an outlet chamber portion, an inlet chamber portion and a transversely extending wall portion comprising the lower wall of said inlet chamber portion and having an aperture comunicating with said inlet chamber portion, a lower housing member, a pumping diaphragm extending transversely of said pump intermediate said housing members, an apertured plate member extending transversely of said pump intermediate said pumping diaphragm and said upper housing member and cooperating with the former to define a pumping chamber, said plate having an annular upwardly extending portion projecting toward said wall portion outwardly of said aperture, and inlet and outlet valve means for controlling the flow of fluid through said aperture and said apertured plate from said inlet chamber portion to said pumping chamber and from said pumping chamber to said outlet chamber portion and comprising an annular flexible valve member mounted on said plate member and having an annular wall portion cooperating with said upwardly extending portion of said plate member to position said valve member, said valve member forming an annular seal between said annular upwardly extending portion and said transversely extending wall portion.

6. A fuel pump comprising an upper housing member having an outlet chamber portion, an inlet chamber portion and a transversely extending wall portion comprising the lower wall of said inlet chamber portion and having an aperture communicating with said inlet chamber portion, a lower housing member, a pumping diaphragm extending transversely of said pump intermediate said housing members, an apertured plate member extending transversely of said pump intermediate said pumping diaphragm and said upper housing member and cooperating with the former to define a pumping chamber, said plate having an annular upwardly extending portion projecting toward said wall portion outwardly of said aperture and inlet and outlet valve means for controlling the flow of fluid through said aperture and said apertured plate from said inlet chamber portion to said pumping chamber and from said pumping chamber to said outlet chamber portion and comprising an annular flexible valve member mounted on said plate member and having an annular wall portion cooperating with said upwardly extending portion of said plate member to position said valve member, said valve member providing an annular seal between said upwardly extending portion of said plate member and said wall portion of said upper housing member, said plate member cooperating with said upper housing member to define an outlet chamber, and said valve member being adapted to control communication between said inlet chamber portion, said pumping chamber and said outlet chamber.

7. In a fuel pump, a casing, a plate and wall extending transversely of said casing and disposed in substantially parallel, spaced relation, said plate and wall being apertured; a rubber valve disk disposed between the wall and plate and having an opening therethrough; and means

supporting the disk and sealing the wall and plate to the disk annularly about said opening and spaced inwardly of the outer margin of the disk, said aperture in said wall being disposed inwardly of the annular seal of said plate and said wall to said disk, said plate having a first opening inwardly of the annular seal of said plate and said wall to said disk and a second opening outwardly of said annular seal, the disk including a portion inwardly of said sealing means and a portion outwardly of said sealing means, one of which portions in its free position covers said opening in said wall to prevent the flow of fluid therethrough and the other of which portions in its free position covers said second opening in said plate to prevent the flow of fluid therethrough and both of which portions are free to flex from said positions.

8. A fuel pump comprising means defining an inlet chamber and an outlet chamber, a transversely extending wall having an aperture communicating with said inlet chamber, a transversely extending plate disposed in generally spaced parallel relation to said wall and having a first opening adapted to communicate with said aperture and a second opening adapted to communicate with said outlet chamber, a transversely extending diaphragm operable to effect a flow of fluid through said pump, and a valve disk comprising an annular flexible disk disposed between said wall and said plate and having a central aperture adapted to communicate with said aperture and communicating with said first opening, an inner annual marginal portion adjacent said central aperture adapted to sealingly engage said wall to close said central aperture, an outer annular marginal portion adapted to sealingly engage said plate outwardly of said second opening, and an intermediate annular portion sealingly engaging said wall outwardly of said aperture and sealingly engaging said plate outwardly of said first opening and inwardly of said second opening, said disk, inwardly of said intermediate portion, being adapted to flex to move said inner marginal portion out of engagement with said plate and establish communication between said aperture and said first opening through said central aperture, and said disk, outwardly of said intermediate portion, being adapted to flex to move said outer marginal portion out of engagement with said plate and establish communication between said second opening and said outlet chamber.

9. In a fuel pump, a casing part having an open end, a rigid plate extending across the casing part and fastened thereto in direct contact with the end of the casing so as to fix the plate in position, a wall forming part of the casing and extending in spaced relation to and substantially parallel to the plate, said wall having an opening therein, a rubber valve disk between the plate and wall having an opening adapted to permit fluid to flow therethrough, and means supporting said disk and sealing the wall and plate to the disk annularly about said opening in the disk intermediate said opening in said disk and the outer margin of the disk, said opening in said wall being disposed inwardly of the annular seal of said wall and said plate to said disk, said plate having a first opening inwardly of the annular seal of said plate and said wall to said disk and a second opening outwardly of said annular seal, the disk including a portion inwardly of said sealing means and a portion outwardly of said sealing means, one of which portions in its free position covers

said opening in said wall to prevent communication thereof with said opening in said disk and the other of which portions in its free position covers said second opening in said plate to prevent fluid flow therethrough and both of which portions are free to flex from said positions.

10. In a fuel pump, a casing part having an open end, a rigid plate member extending across the casing part and fastened thereto in direct contact with the end of the casing so as to fix the plate member in position, a wall member forming part of the casing and extending in spaced relation to and substantially parallel to the plate member, said wall member having an opening therein, a rubber valve disk between the plate member and wall member having an opening adapted to permit fluid to flow therethrough, and means supporting said disk and sealing the wall member and plate member to the disk annularly about said opening in the disk intermediate said opening in said disk and the outer margin of the disk, said opening in said wall being disposed inwardly of the annular seal of said wall and said plate to said disk, said plate member having a first opening inwardly of the annular seal of said plate member and said wall member to said disk and a second opening outwardly of said annular seal, the disk including a portion inwardly of said sealing means and a portion outwardly of said sealing means, one of which portions has a first sealing bead which in the free position of said one of said portion engages one of said members to prevent communication between said opening in said wall member and said opening in said disk and the other of which portions has a second bead which in the free position of said other of said portions engages the other of said members to prevent fluid flow through said second opening in said plate member, and both of which portions are free to flex from said positions.

11. A valve disk for a pump having an inlet chamber and an outlet chamber, a transversely extending wall member having an aperture communicating with one of said chambers, a transversely extending plate member disposed in generally spaced parallel relation to said wall member and having a first opening adapted to communicate with said aperture and a second opening adapted to communicate with the other of said chambers, said valve disk comprising an annular flexible disk adapted to be disposed between said wall member and said plate member and having a central aperture adapted to communicate with one of said openings, an inner annular

marginal portion adjacent said central aperture adapted to sealingly engage one of said members to close one of said openings, an outer annular marginal portion adapted to sealingly engage the other of said members to close the other of said openings, and an intermediate annular portion adapted to sealingly engage said members intermediate said openings, said disk, inwardly and outwardly of said intermediate annular portion, being adapted to flex to move said inner marginal portion to permit the flow of fluid through said one of said openings and to move said outer marginal portion to permit the flow of fluid through said other of said openings.

12. In a fuel pump, a resilient unitary annular valve disk having an annular bead disposed adjacent its inner periphery at one side of said valve disk and a second annular bead disposed adjacent the outer periphery of said valve disk and at the opposite side of said disk, said valve disk having an annular supporting portion disposed intermediate said annular beads and said annular valve disk, inwardly and outwardly of said annular supporting portion being free to flex to move said annular beads relative to said annular supporting portion.

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