Aug. 17, 1965 J. L. GRABIEL 3,200,758

DIAPHRAGM FUEL PUMP WITH VENT

Filed Aug. 15, 1963

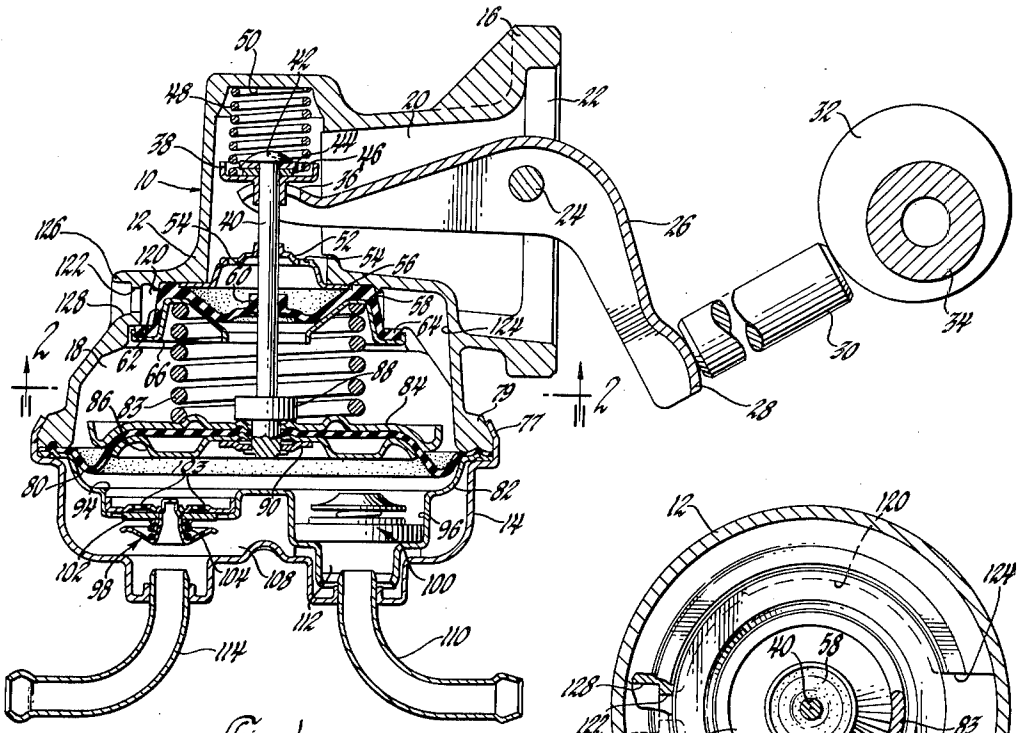


Fig. 1

Fig. 2

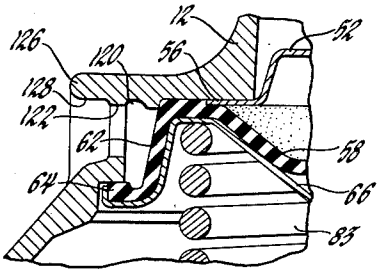


Fig. 3

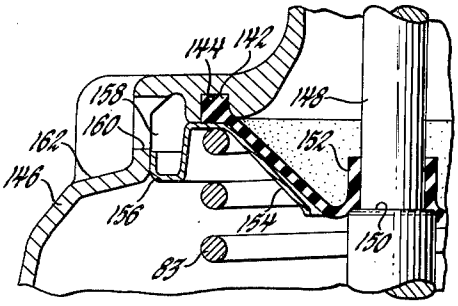


Fig. 4

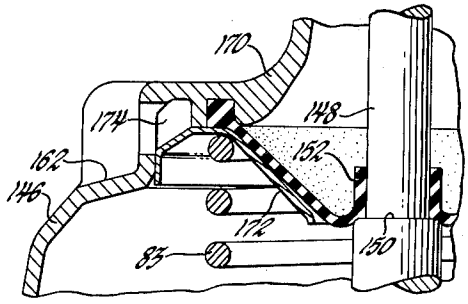


Fig. 5

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DIAPHRAGM FUEL PUMP WITH VENT

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This invention relates to pumps and more particularly to diaphragm type fuel pumps for serving internal combustion engines.

An automotive fuel pump is disclosed in the United States Patent 2,139,347 granted December 6, 1938 in the names of A. M. Babitch and G. W. Harry. That pump is provided with a pumping diaphragm actuated during the pumping stroke by a coil spring located in a spring chamber. The spring chamber wall has a vent or opening leading to the atmosphere to prevent a sealing diaphragm for a push rod from wearing out and to prevent loss of pump efficiency. Such a vent has become conventional in the field of automotive fuel pumps.

It has become desirable to improve the venting of the spring chambers in diaphragm type pumps. If a vent is made directly through the pump body wall as taught in the patent above referred to and particularly if it is made too large, foreign matter may enter the spring chamber and eventually adversely affect the oil seal diaphragm and the pumping diaphragm. Also, a too large vent allows noises produced by the pumping diaphragm, when stroking at peak pressures and vacuums, to escape from the pump. If a straight through vent is made too small, it would prevent the escape of noise but it would be so restrictive that there would be a loss in pump performance and the useful life of an oil seal around the conventional pumping diaphragm plunger as well as the life of the pumping diaphragm would be shortened.

An object of the present invention is to provide an improved diaphragm type pump in which a spring chamber is adequately vented without admitting foreign matter or emitting noises generated by pump operation.

To this end, a feature of the present invention is a pump body having a channel indirectly extending through the spring chamber wall of the body with the inside and outside ends of the channel angularly spaced about the axis of the pump or pump diaphragm.

This and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawings:

FIGURE 1 is a sectional view through a fuel pump disclosed as an embodiment of the present invention, an engine camshaft drive for the pump also being shown in operative relation to the pump;

FIGURE 2 is a sectional view looking in the direction of the arrows 2—2 in FIGURE 1;

FIGURE 3 is a sectional view of a detail shown in FIGURE 1 and drawn to a larger scale;

FIGURE 4 is a view similar to that of FIGURE 3 but showing another form of vent channel and seal construction; and

FIGURE 5 is another view similar to that of FIGURE 3 but showing a third form of vent passage and seal construction.

The pump disclosed in the drawing includes a pump body generally indicated at **10** and this body is in the form of two parts—a casting **12** and a sheet metal cover **14**. The casting **10** bears a flange **16** which is adapted to be attached in a well known manner to the side of an internal combustion engine. The casting **10** is also recessed to form a spring chamber **18** and an L-shaped rocker arm chamber **20**. The latter chamber is formed with an open end **22** adapted to be placed in communication with the

interior of the engine being served and is fitted with a pin **24** about which a conventional rocker arm **26** is adapted to oscillate. In a typical engine installation one end **28** of the rocker arm is adapted to bear against one end of a rod **30** and the latter is conventionally held by a fixed bearing arrangement to reciprocate longitudinally and with its other end in constant contact with the peripheral surface of a cam **32** forming an integral part of an engine crankshaft **34**. The other end **36** of the rocker arm **26** is notched to fit an annular member **38** which encircles the upper end of a diaphragm plunger or rod **40**. The latter bears a head **42** and between the head **42** and the member **38** are two washers **44** and **46**. The washer **46** forms a cushion to prevent noise. A coil spring **48** acts between the member **38** and an inside top surface **50** within the casting **12** in such a way that the member **38** constantly acts on the end **36** of the rocker arm **26**. This assures a constant engagement of the rod or plunger **30** with the cam **32** regardless of the variation in pump stroke length.

Surrounding the plunger **40** is a sheet metal annular member **52** which is made slidingly to receive the plunger and is also apertured as at **54**. The member **52** bears an annular flange **56** so that the member is held in position with respect to the casting **12** by engagement with a rubber sealing means or diaphragm **58**. The latter is flexible and is formed with a hub **60** engaging the rod **40** and adapted to move with the rod. A marginal portion **62** of the sealing means **58** is frusto-conical and terminates in a peripheral flange **64**. The latter is fixed in position between shoulder portions formed on the casting **12** and an annular sheet metal seal protector element **66**.

A top peripheral flange **77** of the cover **14** is crimped about an annular rim **79** of the casting **12** with a pumping diaphragm **80** and a sheet metal member **82** interposed. The diaphragm **80** is clamped between two metal protector plates **84** and **86** which are held together by means of annular members **88** and **90** retained on the lower end of the plunger **40**.

The sheet metal element **82** is formed with a shallow recess **94** and a deeper recess **96**. These are utilized to retain one way valve arrangements at **98** and **100** respectively. The valve arrangement **98** is similar to many now in use and comprises a movabl valve disk **102** held in position to close ports **103** by action of a spring **104**. A space **108** in the cover **14** and surrounding the valve structures is in communication with an outlet tube **114**. A much smaller space **112** beneath the inlet valve **100** and within the member **82** is in communication with an inlet tube **110**.

The structure thus far described pertains mostly to details which are not essential insofar as the present invention is concerned and these details can be varied considerably without departing from the spirit of the present invention as will be seen as the description proceeds.

The present invention relates particularly to the means for venting the spring chamber **18**. In this regard, the body casting **12** of FIGURES 1 to 3, inclusive, is shown to be provided with a channel **120**. This channel is preferably made annular and forms a passage or vent extending indirectly with the aid of inside and outside openings through the wall of the casting **12**. The outside opening of the channel **120** is shown at **122** and diagonally opposite to this opening and with respect to the pumping diaphragm **80** and the plunger **40** is an inside opening **124**. The latter is formed in the casting **12** so that it extends around the peripheral edge of the sheet metal member **66** to provide a connection from the spring chamber **18**. Venting of the latter is by way of the opening **124** and then through the annular channel **120** to the outside opening **122**. It will be noted that the channel **120** is largely

defined by the casting 12 and partially by the flexible sealing means 58. A lip 126 overhangs the outside opening 122 to give additional protection against the admission of foreign matter and, conveniently, this lip is made due to a cast recess 128.

In the operation of the pump, the plunger 40 will be reciprocated by virtue of the action of the cam 32 and the spring 83. The sealing means or sealing diaphragm 58 will flex up and down with the plunger 40 and no stresses or strains will be placed on the diaphragm 58 because of the venting of the spring chamber 18 through the channel 120. The admission of dirt and the emission of noises are considerably reduced by virtue of the indirect path and also the length of the channel.

In FIGURE 4 an annular channel of a different form is shown. In addition, the push-rod sealing means is modified to include an annular and peripheral rib 142 adapted to be seated and held within a special recess 144 formed in the special pump casting 146. A special plunger 148 is used having a shoulder 150 to aid in the retention of a hub portion 152 of the flexible sealing diaphragm. In this case, a sheet metal shield 154 is used which has a trough-like periphery 156 cooperating with the inside surface of the wall of the casting 146 to define the annular channel 158. This channel has an outside opening as at 160 and the walls of a recess 162 protect or shield the latter. An inside opening is not disclosed in FIG. 4 but it will be appreciated that it may be similar to the opening 124 of FIGURE 1.

Another or third modification is depicted in FIGURE 5 wherein a body casting 170 is recessed to hold the thickened periphery of a sealing member like in the case of FIGURE 4 but in this instance a shield 172 is made of different form to cooperate with the casting 170 in defining the arcuate or annular vent channel 174. As in FIGURE 4, the spring 83 is employed to hold the shield and sealing means in proper position with respect to the casting.

I claim:

1. A pump having a pumping diaphragm and a body enclosing a spring chamber and a pumping chamber separated by said pumping diaphragm, one-way valves serving said pumping chamber, a rod in said spring chamber and connected to said diaphragm, sealing means between said body and said rod and in a plane normal to said rod, spring means in said spring chamber and adapted to cooperate with said rod for actuating said diaphragm, and a vent channel extending through the wall of said spring chamber with inside and outside ends of the channel angularly spaced about the axis of the pump diaphragm and in said plane.

2. A pump having a pumping diaphragm and a body, a spring and pumping chambers enclosed in said body and separated by said pumping diaphragm, one-way valve means adapted to control flow through said pumping chamber, a rod in said spring chamber and having one end connected to said diaphragm, sealing means between said body and said rod and located in a given plane, spring means in said spring chamber and cooperating with said rod for actuating said diaphragm, a vent channel formed in said body, and the said channel having outside and inside openings angularly spaced in said plane about the axis of the said rod whereby said spring chamber is indirectly vented.

3. A pump as set forth in claim 2, said vent channel being defined by said body wall and said sealing means.

4. A pump as set forth in claim 2, said vent channel being arcuate and partially defined by said sealing means.

5. A fuel pump having a body and a pumping diaphragm, a spring chamber and a pumping chamber in said body and separated by said pumping diaphragm, one-way pressure actuated valve means serving said pumping chamber to control flow therethrough, a rod in said spring chamber with one end connected to said diaphragm and the other end being adapted to be exteriorly actuated, annular sealing means fixed in position between said body and said rod and permitting reciprocation of the latter, spring means in said spring chamber and cooperating with said rod for actuating said diaphragm, an annular channel extending around the center line of said rod and defined by said sealing means and pump body, and the said channel being provided with inside and outside openings diametrically opposed with respect to the axis of said rod and diaphragm whereby said spring chamber is vented.

6. A fuel pump having a body, a pumping diaphragm and a sealing diaphragm, said body defining a pumping chamber and a spring chamber separated by said pumping chamber and a spring chamber separated by said pumping diaphragm, one-way pressure actuated valve means serving said pumping chamber to control flow therethrough, a rod extending through said spring chamber and sealing diaphragm with one end fixed to said pumping diaphragm, a spring in said spring chamber and acting between said sealing and pumping diaphragms to urge said pumping diaphragm toward said pumping chamber, a channel at least partially defined by said body and located between the latter and said sealing diaphragm, inside and outside openings angularly spaced about said rod and connected to said channel, and said inside opening being connected to said spring chamber.

7. A fuel pump as set forth in claim 6, said channel being partially defined by said sealing diaphragm.

8. A pump having a pumping diaphragm, a body defining a pumping chamber and a spring chamber on opposite sides of said pumping diaphragm, valve means adapted to serve said pumping chamber, spring means in said spring chamber urging said pumping diaphragm toward said valve means, a channel within the confines of said body, an outside opening defined by said body and connecting said channel to the atmosphere, an inside opening connecting said spring chamber to said channel, and said outside and inside openings being angularly spaced about the axis of the said pumping diaphragm and located radially outward of said spring means whereby an indirect vent passage for said spring chamber is achieved.

9. A pump as set forth in claim 8, said body having a recess on its exterior and into which said outside opening is connected.

10. A fuel pump as set forth in claim 8, a shield interposed between said spring and said sealing diaphragm, and said channel being defined by said body and shield.

References Cited by the Examiner

UNITED STATES PATENTS

1,742,746	1/30	Zubaty	103—150 X
3,036,524	5/62	Johnson	103—150 X

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