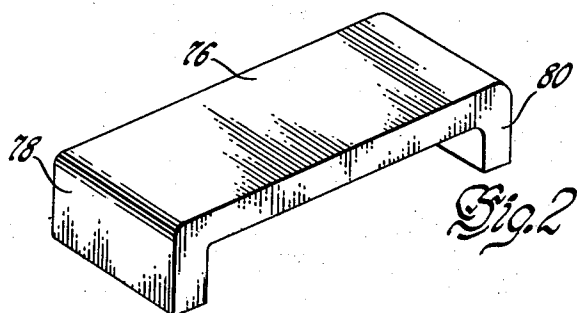
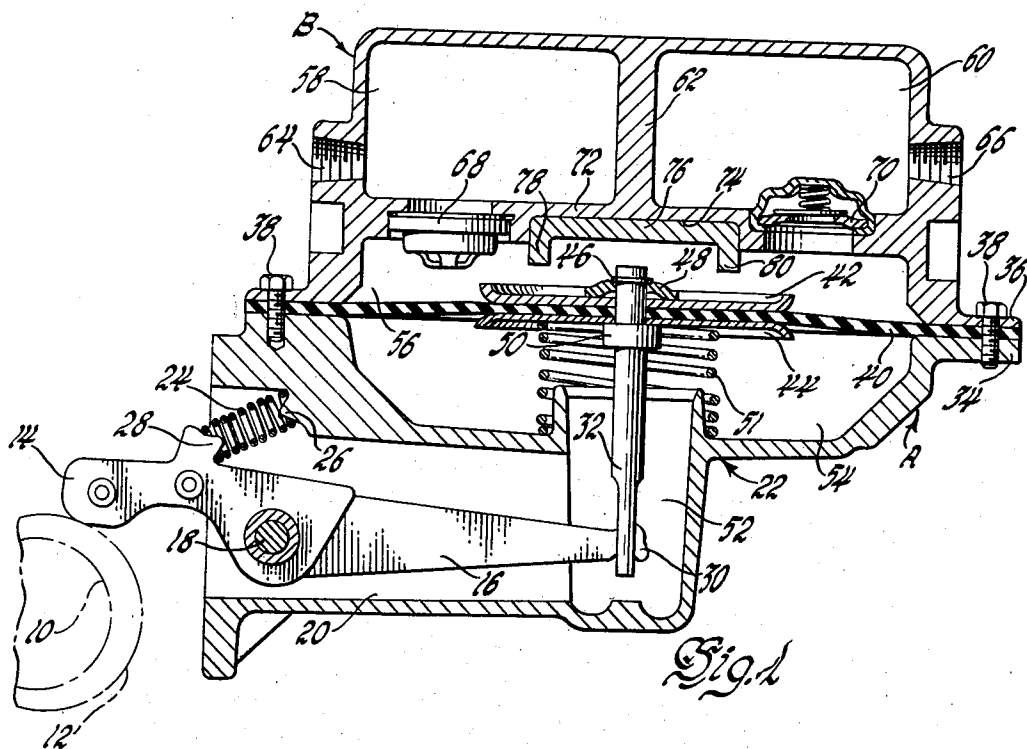


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FUEL PUMP WITH MAGNET
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1

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FUEL PUMP WITH MAGNET

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This invention relates to fuel pumps and more particularly to fuel pumps of the diaphragm type in which the discharge rate is variable dependent upon the demand.

In fuel pumps of the diaphragm type as employed with gasoline engines it is conventional to effect the pumping stroke of the diaphragm by means of a resiliently operable mechanical structure in the form of a spring. It has been found, however, that in such pumps the pumping stroke is not as effective as would be desirable because a spring actuating the diaphragm must necessarily exert less force at the end of the stroke than at the beginning of the stroke. The spring, having expanded in performing the major portion of a pumping cycle, will have expended its greatest potential force with the result that the last portion of a discharge stroke is carried out during the time that the spring force is relatively weak. It would be well if a means were provided whereby the force of the spring would be supplemented when needed, such as during the end portion of a pumping stroke.

To this end, an object of the present invention is to provide an improved fuel pump of the diaphragm type having a strong discharge substantially throughout its pumping stroke.

A feature of the invention is a fuel pump having a pumping chamber defined by a diaphragm and mechanical means arranged to actuate said diaphragm with magnetic means supplementing the mechanical means for effecting pump action. Another feature is a fuel pump employing a permanent magnet together with a cooperative armature arranged in a pumping chamber to cooperate with a spring in providing the potential energy for actuating a diaphragm. Another feature is a fuel pump employing mutually and magnetically attracted bodies and a spring cooperatively associated to effect pumping action.

These 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:

Fig. 1 is a sectional view taken through a diaphragm pump presenting one embodiment of the present invention; and

Fig. 2 is a perspective view of a magnet employed in the structure of Fig. 1.

The fuel pump shown in Fig. 1 is adapted to be mounted in a conventional manner on the side of an engine of which a cam shaft 10 and cam 12 are parts. The latter are drawn in dot-and-dash lines in the drawings as they form no part of the present invention. As is conventional, the cam 12 is adapted to engage one end of a fuel pump driving lever 14 which is adapted to impart movement to a second lever 16. Details regarding this lever arrangement are not explained herein as they also form no part of the present invention, but it will suffice herein to state that the levers 14 and 16 are pivoted on a shaft 18 supported in a passage 20 formed in a pump casing generally indicated at 22. The passage is adapted to communicate with the engine crankcase. A spring 24 is interposed between a seat portion 26 of the casing and a

2

projection 28 formed on the lever 14 so that the one end of this lever is maintained in contact with the surface of the cam 12 in the crankcase. The end 30 of the lever 16 within the casing 22 passes through a slot in a vertical shaft 32 for pivotal engagement with the latter.

The casing 22 comprises a lower body portion A and an upper body portion B. These portions are flanged at 34 and 36 for joinder by means of fastenings or screws 38.

Clamped between the flanges 34 and 36 is the peripheral margin of a pumping diaphragm 40. This diaphragm is made of material resistant against the chemical action of the fuel being handled. The casing 22 and the diaphragm 40 are elements which cooperate to form a pumping chamber 56. A central portion of the diaphragm 40 is clamped between two dished plates 42 and 44 and the upper end of the stem 32 is utilized to hold these parts together. This is accomplished by employing a snap ring 46 near the upper end of the stem 32 for retaining a dished washer 48 firmly against the upper cupped plate 42. An intermediate shoulder portion 50 is formed on the stem 32 to cooperate with the washer 48.

The stem 32 extends upwardly from a vertical chamber 52 in the casing which connects the chamber 20 to a chamber 54. The latter is separated from the pumping chamber 56 in the casing by means of the diaphragm 40.

The upper portion B of the casing is a die-casting of non-magnetic metal or a metal having poor magnetic properties and not only contains the pumping chamber 56, but also an inlet chamber 58 and an outlet chamber 60. The latter two chambers are separated by a partition 62. A threaded opening 64 is provided for connection with an inlet line leading from the supply of fuel. The chamber 60 is provided with a threaded outlet 66 to which a line may be connected for communication with the carburetor of the engine. Conventional one-way valves 68 and 70 are associated with the chambers of the upper part B so that fuel may be caused to flow through the chambers 58, 56 and 60 in series as is conventional with diaphragm type fuel pumps.

A partition 72 of the part B aids in defining the aforesaid chambers and is recessed at its underside as at 74 firmly to receive a permanent magnet 76. The latter is in the form of a shallow inverted U with depending legs or end portions 78 and 80 extending toward the cupped plate 42. The latter is made of iron thereby constituting an armature attracted by the permanent magnet 80. It will be appreciated that the magnet and the armature could be reversed in their positions insofar as effectiveness is concerned, as will further appear. The metal of part B may be upset mechanically to hold the magnet in place.

In operation of the pump, rotation of the cam 12 will cause actuation of the diaphragm 40 against the action of the spring 51. The action of the pump is, therefore, positive as to the suction portion of the pumping cycle. When that portion is completed, the cam then permits the spring 51 to expend its potential energy and the diaphragm 40 will rise to force fuel through the valve 70 and out the discharge opening 66. As the diaphragm passes through the upper portion of its fuel discharge stroke, the spring 51 is further expanded and its force or potential energy is lessened. At this time, however, the armature 42 proceeds further into the field produced by the permanent magnet 76 so that the two bodies 76 and 42 mutually attract each other. This magnetic force supplements the action of the spring 51 and the pumping stroke of the diaphragm is strengthened thereby. The concurrent actions of the magnet 76 and the spring 51 in effecting pump discharges alternate with the intermittent actions of the arm 16 and cam 12 in effecting pump suction.

I claim:

1. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, said casing having an inlet and an outlet chamber, one-way valves arranged in said casing controlling a fuel passage leading through said pumping chamber by way of said inlet and outlet chamber, two mutually and magnetically attracted bodies at one side of said diaphragm, one of said bodies being fixed to said diaphragm for movement with a portion of the latter, the other of said bodies being fixed to said casing, a spring interposed between a portion of said casing and said diaphragm and arranged to urge the latter and one body toward said other body, and means connected to said diaphragm for intermittently moving said diaphragm portion and one body away from said other body.

2. A fuel pump including a casing and diaphragm cooperating to form a pumping chamber, two mutually and magnetically attracted bodies in said chamber, one of said bodies being fixed to a central portion of said diaphragm and the other being fixed to said casing, means connected to said diaphragm for intermittently actuating said diaphragm to effect pump suction, and a spring mounted to exert a force upon said central portion and cooperatively arranged with said bodies to urge the latter toward each other in effecting pump discharge.

3. A fuel pump including a casing and diaphragm forming elements cooperating to form a pumping chamber, two mutually and magnetically attracted bodies arranged on one side of said diaphragm, one of said bodies being a permanent magnet fixed to one of said elements, the other of said bodies being fixed to the other of said elements, means connected to said diaphragm for intermittently actuating the latter in one direction to effect pump suction, and a spring arranged on the other side of said diaphragm and acting on the latter and in cooperation with said bodies to urge said diaphragm intermittently in the opposite direction to effect pump discharge.

4. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, two mutually and magnetically attracted bodies in said chamber, one of said bodies being fixed to said diaphragm, the other of said bodies being a permanent magnet fixed to said casing, means for actuating said diaphragm in one direction to effect pump suction, and a spring acting on said diaphragm and cooperatively arranged and associated with said bodies intermittently to urge said diaphragm in the opposite direction to effect pump discharge.

5. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, two mutually and magnetically attracted bodies in said casing, one of said bodies being of magnetic material and fixed to one side of said diaphragm, the other of said bodies being a magnet fixed to said casing and facing said one body, means connected to said diaphragm for intermittently actuating the latter to effect pump suction, and a spring arranged on the other side of said diaphragm intermittently to cooperate with said magnet to effect pump discharge.

6. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, said casing having an inlet and an outlet chamber, one-way valves arranged in said casing controlling a fuel passage leading through said casing by way of said inlet, pumping and outlet chambers, two mutually and magnetically attracted bodies in said pumping chamber, one of said bodies being of magnetic material and fixed to said diaphragm, the other of said bodies being a permanent magnet and fixed to said casing and facing said one body, means for intermittently moving said diaphragm and one body to effect pump suction, and a spring arranged in said casing urging said diaphragm and one body toward said magnet.

7. A fuel pump comprising a casing and diaphragm

cooperating to form a pumping chamber, two mutually and magnetically attracted bodies in said casing, one of said bodies being fixed to said diaphragm for movement therewith and the other being fixed to said casing, means connected to said diaphragm for intermittently actuating the latter in one direction to effect suction, and a spring acting on said diaphragm and cooperatively arranged with said bodies to discharge fuel by intermittent actuation of said diaphragm in the opposite direction.

8. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, means for intermittently actuating said diaphragm to effect pump suction, two mutually and magnetically attracted bodies in said casing, one of said bodies being associated structurally with said actuating means and diaphragm for movement with the latter and the other being fixed to said casing, and a spring interposed between a portion of said casing and said diaphragm and arranged to act on the latter to cooperate with said actuating means and bodies in effecting pump cycles of operation.

9. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, spring means arranged within said casing to actuate said diaphragm intermittently in one direction for effecting pump discharge action, and magnetic means within said casing simultaneously supplementing its potential energy to that of said spring means in producing said action.

10. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, mechanical means arranged on one side of said diaphragm intermittently to actuate the latter in one direction, and magnetic means within said casing on the other side of said diaphragm exerting its potential force on the latter, and part of said magnetic means being supplemental and connected to said mechanical means for effecting pump discharge action.

11. A fuel pump comprising a casing and diaphragm cooperating to form a pump chamber, mechanical means arranged to actuate said diaphragm intermittently in one direction to effect pump discharge action, magnetic means in said chamber and associated with and supplemental to said mechanical means for effecting said action, and said magnetic means comprising one body of magnetic material fixed to and movable with said diaphragm and a permanent magnet fixed to said casing.

12. A fuel pump comprising a casing and diaphragm cooperating to form a pumping chamber, mechanical means connected to said diaphragm for positively and intermittently actuating the latter in one direction to effect pump suction, spring means interposed between said casing and diaphragm to actuate the latter in the other direction to effect pump discharge, magnetic means in said chamber and associated with said diaphragm urging the latter to move in said other direction, and said spring means and magnetic means being arranged to act concurrently to effect pump discharge alternately with effecting actuation of said mechanical means.

13. A pump including a casing, a diaphragm in said casing, said casing and diaphragm cooperating to form a pumping chamber, spring means and magnetic means in said casing positioned yieldingly and cooperatively to urge said diaphragm in one direction, positive drive means connected to said diaphragm for intermittently urging the latter in the opposite direction, said positive drive means extending to the exterior of said casing for exterior power application.

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