Sept. 22, 1959 E. A. JOHNSON 2,905,097

MECHANICAL FUEL PUMP

Filed June 30, 1958

FIG. 1.

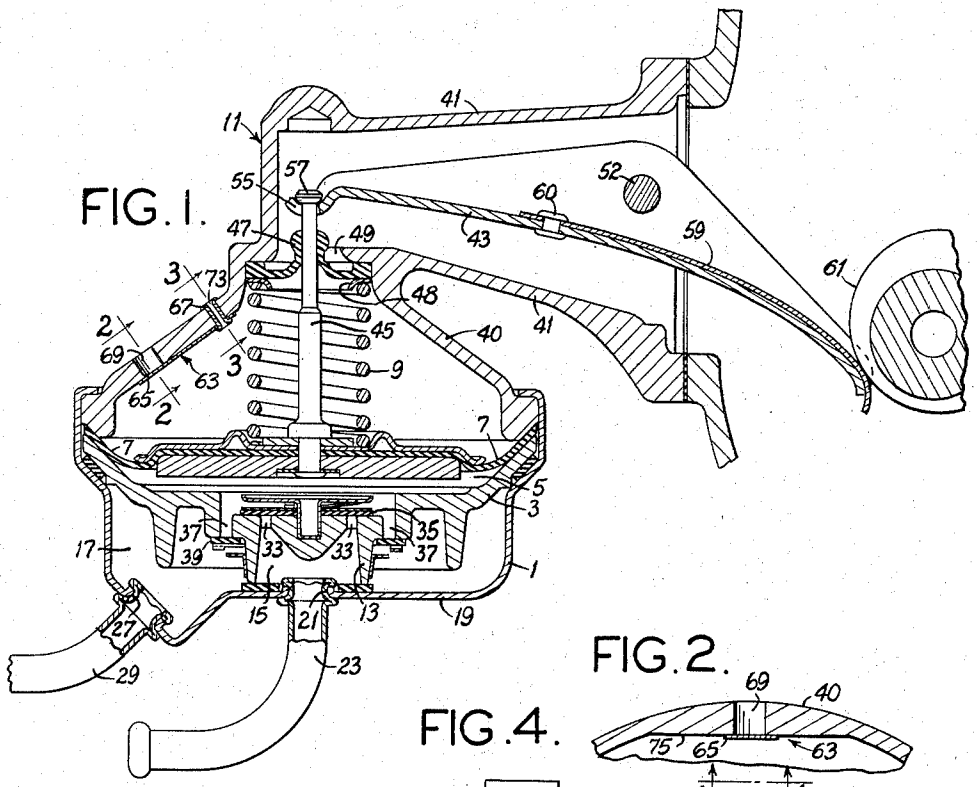


FIG. 2.

FIG. 4.

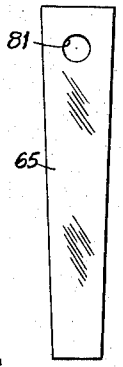


FIG. 5.

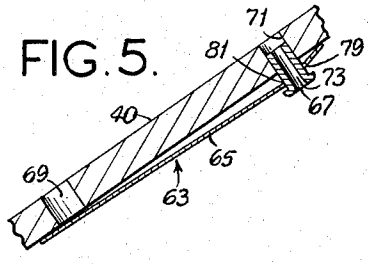


FIG. 3.

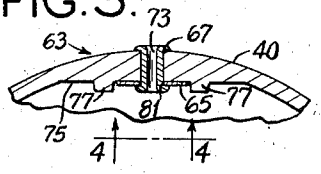


FIG. 6.

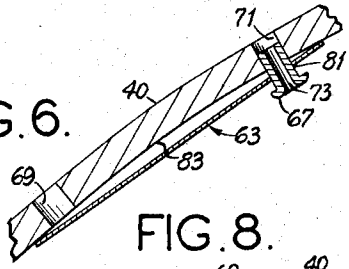


FIG. 7.

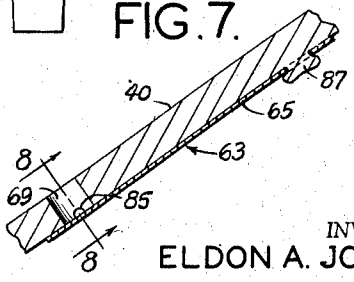
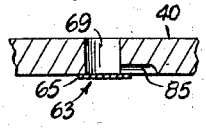


FIG. 8.



INVENTOR.
ELDON A. JOHNSON
BY
Laurence M. Goodridge
ATTORNEY

United States Patent Office

2,905,097

Patented Sept. 22, 1959

2,905,097

MECHANICAL FUEL PUMP

Eldon A. Johnson, St. Louis, Mo., assignor to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

Application June 30, 1958, Serial No. 745,350

14 Claims. (Cl. 103—150)

The invention relates to pumps, and more particularly to a diaphragm pump of a type especially suitable for pumping fuel to the carburetor for an internal combustion engine, the diaphragm of the pump being operable by a drive from the engine.

A diaphragm pump of the class described conventionally comprises means defining a pumping chamber, a diaphragm closing the pumping chamber and adapted for movement in one direction through a discharge stroke and back in the opposite direction through an intake or suction stroke, and means for driving the diaphragm. The driving means conventionally comprises a spring for driving the diaphragm through a discharge stroke, and an engine-driven cam means for driving the diaphragm back through a suction stroke. The action of this type of pump is such that there is apt to be a thump on the suction stroke of the diaphragm, and the thumping needs to be muffled. A pump of this class usually has a housing enclosing the diaphragm and the spring. This housing is adapted to act as a muffle, and the principal object of this invention is to provide a construction for so utilizing the housing without substantially impeding the action of the pump. In general, this object is attained by providing the housing with check valve means which acts upon a suction stroke of the diaphragm to allow only restricted venting of air from the housing, but which acts on a discharge stroke of the diaphragm to allow relatively unrestricted admission of air to the housing. With this arrangement, the thumping on suction strokes may be effectively muffled so that it is substantially inaudible from outside the housing, without building up such air pressure in the housing on a suction stroke of the diaphragm as would adversely affect the suction stroke, and without developing such vacuum in the housing on a discharge stroke of the diaphragm as would adversely impede the discharge stroke. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

Fig. 1 is a vertical section of a pump constructed in accordance with this invention as it appears when installed with an engine, parts being shown in their position adjacent the end of a discharge stroke;

Figs. 2 and 3 are sections taken on lines 2—2 and 3—3, respectively, of Fig. 1;

Fig. 4 is a view of a check valve member as it appears from line 4—4 shown in Figs. 2 and 3;

Fig. 5 is an enlarged fragment of Fig. 1 showing one way in which the check valve member may be installed;

Fig. 6 is a view similar to Fig. 5 showing another way in which the check valve member may be installed;

Fig. 7 is a section illustrating a modification; and,

Fig. 8 is a section taken on line 8—8 of Fig. 7.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, a pump of this invention is shown generally to comprise a bowl 1, a cup-shaped body 3 which serves the dual purpose of closing the bowl 1 and providing a pumping chamber 5, a diaphragm 7 closing the cups-haped body 3, a coil compression spring 9 for biasing the diaphragm in discharge direction, and a cast casing 11. The space within the bowl 1 is divided by an annular partition 13 constituted by a tubular projection extending from body 3 into a central intake chamber 15 and a surrounding discharge chamber 17. The base 19 of bowl 1 has a central inlet port 21 in which is secured an inlet nipple 23. The bowl has a discharge port 27 in which is fixed a discharge nipple 29. Body 3 is formed with a circular series of slots such as indicated at 33 constituting intake valve ports providing for communication from intake chamber 15 to the pumping chamber 5 under control of an intake check valve 35. The body is also formed with a circular series of slots such as indicated at 37 surrounding slots 33 and constituting discharge valve ports providing for communication from pumping chamber 5 to discharge chamber 17 under control of a discharge check valve 39.

The casing 11 comprises a conical portion 40 constituting a housing for the diaphragm 7 and spring 9, and a flaring portion 41 extending laterally from the small end of spring housing 40 constituting a housing for a rocker arm 43. The diaphragm 7 is fixed on the lower end of a stem 45 which extends slidably through a packing member 47 held in the upper end of housing 40. Spring 9 surrounds stem 45, reacting from a gland 48 bearing against packing member 47. Stem 45 extends up into the inner end of rocker arm housing 41 through an opening 49. A pivot pin for the rocker arm 43 is indicated at 52. The rocker arm has a slot 55 extending outward from its inner end receiving the stem 45. The latter has a head 57 at its upper end engageable by the rocker arm.

A leaf spring 59 has one end secured as by a rivet 60 to the rocker arm 43 and extends towards the outer end of the rocker arm. Its free end is normally spaced from the outer end portion of arm 43. When the pump is installed on an engine, the free end portion of the spring 59 is engaged by an engine driven cam 61. The action of the cam is such that during a part of its cycle, the rocker arm 43 is free to rock counterclockwise from a retracted position (not shown) to the advanced position in which it is shown in Fig. 1. With the rocker arm freed for such movement, the stem 45 is freed to enable spring 9 to drive the diaphragm 7 down through a discharge stroke if fuel is free to flow out of pumping chamber 5 and discharge chamber 17 (as determined by the requirements of a carburetor supplied by the pump). When the rocker arm rocks counterclockwise from its retracted position, leaf spring 59 remains in engagement with the cam 61 flexing in the direction toward the rocker arm. During another part of the cycle, the cam 61 is adapted to act through the leaf spring 59 to drive the rocker arm back to the stated retracted position, thereby pulling up the stem 45 and driving the diaphragm up through a suction stroke. Upon a suction stroke, the diaphragm thumps. Further details of the pump construction may be ascertained, if needed, from the application of Eldon A. Johnson and Donald R. Compton, Serial No. 739,241, filed June 2, 1958 (case 973).

In accordance with this invention, check valve means indicated at 63 is provided acting on a suction stroke (upstroke) of the diaphragm 7 to allow only restricted venting of air from housing 40 and acting on a discharge

stroke (downstroke) of the diaphragm to allow relatively unrestricted admission of air to the housing **40**. As illustrated in Figs. 1–4, this check valve means comprises a check valve member **65** constituted by a sheet metal leaf spring or reed, held in position on the inside of the conical wall of housing **40** by a tubular rivet **67** and normally closing a relatively large port **69** in the wall. Rivet **67** extends through a relatively small hole **71** in the wall above the port **69**. The hole **73** through the rivet constitutes a restricted orifice for restricted or throttled venting of air from the housing **40** on a suction stroke (upstroke) of the diaphragm. The reed **65** extends down from the rivet past the port **69**. It may be of tapering form as shown in Fig. 4, with its side edges converging from its fixed end to its free end. The reed is mounted in such manner that it is prestressed so as to be inherently biased toward closed position engaging the inside of the wall of housing **40** around the port **69**. The inside of the wall of housing **40** may be made flat as indicated at **75** in the region of the reed (see Figs. 2 and 3) for flatwise engagement of the reed with the inside of the wall. The wall may also be provided on the interior thereof with lugs **77** (see Fig. 3) on opposite sides of the reed at its fixed end for purposes of locating the reed and holding it against swinging.

One mode of prestressing the reed, as shown in Fig. 5, is intially to form it with a bend as indicated at **79** in the region of the hole **81** in the reed which receives the rivet, then flattening it out by means of the rivet when the latter is set.

Another possible mode of prestressing the reed is to form housing **40** in such manner that its interior surface is made concave as indicated at **83** in Fig. 6 between hole **71** and port **69**, and to use an initially flat reed. Then when the rivet is set, the reed is constrained to follow the concave surface **83** for prestressing.

In operation of the above-described pump, upon a suction stroke (upstroke) of diaphragm **7**, the reed **65** is pressed firmly against the flat surface **75** to close the port **69**, and air escapes from within the housing **40** through the restricted hole or orifice **73** in the rivet **67**. This hole or orifice is so small that the thump which occurs on the suction stroke is effectively confined within the housing **40** for muffling purposes. While the hole or orifice **73**, in being sufficiently small for this purpose, may not vent the housing **40** so rapidly as to avoid some build-up of air pressure in the housing **40**, this pressure is not such as to be disadvantageous, and actually may have an advantage in that it may reduce the tendency toward vapor lock.

On the discharge stroke (downstroke) of the diaphragm **7**, the reed **65** is bent away from the surface **75** to open up the port **69** and allow relatively unrestricted admission of air to the housing **40**. This avoids development of vacuum in the housing **40** such as would impede the downstroke of the diaphragm.

In the event that fluttering of the reed may cause detectable noise at idle speeds, the construction may be made such that the admission of air to the housing on discharge strokes of the diaphragm is taken care of by the orifice **73** without actuation of the reed **65**. At higher speeds, noise due to fluttering of the reed is not noticeable.

Under some circumstances, the venting of the housing **40** on suction strokes of the diaphragm may be taken care of without the use of a vent such as the orifice **73** by having the reed seat so lightly that air may escape through port **69**. Or, as shown in Figs. 7 and 8, the construction may be such as to allow for venting through port **69** via a groove **85** in the interior surface of housing **40** extending from port **69** beyond the reed to provide for escape of air through the groove and port **69** on suction strokes of the diaphragm. In this case, the reed may be fastened to the wall of the housing as by casting a stud **87** on the wall entrant in the hole **81** in the reed, and heading over the stud to hold the reed in place.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a diaphragm pump comprising means defining a pumping chamber and a diaphragm closing the chamber, a housing enclosing the diaphragm, the diaphragm being movable away from the housing through a discharge stroke and back through a suction stroke, said housing having an air inlet check valve and an air vent orifice acting on a suction stroke of the diaphragm to allow only restricted venting of air from the housing through said orifice and acting on a discharge stroke of the diaphragm to allow relatively unrestricted admission of air to the housing through said inlet check valve.

2. In a diaphragm pump comprising means defining a pumping chamber and a diaphragm closing the chamber, a housing enclosing the diaphragm and provided with a port, the diaphragm being movable away from the housing through a discharge stroke and back through a suction stroke, said housing having an air inlet check valve and an air vent orifice acting on a suction stroke of the diaphragm to allow only restricted venting of air from the housing through said orifice and acting on a discharge stroke of the diaphragm to allow relatively unrestricted admission of air to the housing through said inlet check valve, said check valve comprising a check valve member mounted on the inside of the housing in association with said port in the housing, said member normally engaging the housing around the port, and being movable inwardly to open the port for said relatively unrestricted admission of air to the housing on a discharge stroke of the diaphragm.

3. In a diaphragm pump comprising means defining a pumping chamber and a diaphragm closing the chamber, a housing enclosing the diaphragm and provided with a port, the diaphragm being movable away from the housing through a discharge stroke and back through a suction stroke, said housing having an air inlet check valve and an air vent orifice acting on a suction stroke of the diaphragm to allow only restricted venting of air from the housing through said orifice and acting on a discharge stroke of the diaphragm to allow relatively unrestricted admission of air to the housing through said inlet check valve, said check valve comprising a resilient reed fastened at one end to the inside of the housing and having its other end free and extending over said port in the housing, said reed normally engaging the housing around the port, and being movable inwardly to open the port for said relatively unrestricted admission of air to the housing on a discharge stroke of the diaphragm.

4. In a diaphragm pump as set forth in claim 3, said reed being of decreasing width from its said one end to the other.

5. In a diaphragm pump as set forth in claim 3, said housing having a flat interior surface engageable by the reed, said reed, when unstressed, being bent and fastened to the housing in flattened-out form so that it is stressed to lie flat against said flat surface.

6. In a diaphragm pump as set forth in claim 3, said housing having a concave interior surface engageable by the reed, said reed, when unstressed, being flat, and being fastened to the housing so that it is stressed to be curved to lie against said concave surface.

7. In a diaphragm pump comprising means defining a pumping chamber and a diaphragm closing the cham-

ber, a housing enclosing the diaphragm and having a port, the diaphragm being movable away from the housing through a discharge stroke and back through a suction stroke, and check valve means acting on a suction stroke of the diaphragm to allow only restricted venting of air from the housing and acting on a discharge stroke of the diaphragm to allow relatively unrestricted admission of air to the housing, said check valve means comprising a reed, a tubular fastener extending through the wall of the housing and said reed whereby said reed normally engages the wall of the housing to close the port and is movable inwardly to open the port for said relatively unrestricted admission of air to the housing on a discharge stroke of the diaphragm, said tubular fastener providing a restricted opening for said restricted venting of air.

8. In a diaphragm pump as set forth in claim 7, said reed being of decreasing width from its said one end to the other.

9. In a diaphragm pump as set forth in claim 7, said housing having a flat interior surface engageable by the reed, said reed, when unstressed, being bent and fastened to the housing in flattened-out form so that it is stressed to lie flat against said flat surface.

10. In a diaphragm pump as set forth in claim 7, said housing having a concave interior surface engageable by the reed, said reed, when unstressed, being flat, and being fastened to the housing so that it is stressed to be curved to lie against said concave surface.

11. In a diaphragm pump as set forth in claim 7, said housing having lugs extending on opposite sides of the reed holding it against swinging on said fastener.

12. In a diaphragm pump comprising means defining a pumping chamber and a diaphragm closing the chamber, a housing enclosing the diaphragm and provided with a port, the diaphragm being movable away from the housing through a discharge stroke and back through a suction stroke, and check valve means acting on a suction stroke of the diaphragm to allow only restricted venting of air from the housing and acting on a discharge stroke of the diaphragm to allow relatively unrestricted admission of air to the housing, said check valve means comprising a reed fastened at one end to the inside of the housing and having its other end free and extending over said port in the housing, said reed normally engaging the housing around the port with the engagement such as to allow for said restricted venting through said port on a suction stroke of the diaphragm, and being movable inwardly to open the port for said relatively unrestricted admission of air to the housing on a discharge stroke of the diaphragm.

13. In a diaphragm pump as set forth in claim 12, said reed is of decreasing width from its said one end to the other.

14. In a diaphragm pump as set forth in claim 12, said housing having a groove in the interior thereof extending laterally from said port providing for said restricted venting.

References Cited in the file of this patent

UNITED STATES PATENTS

1,883,459	Avigdor	Oct. 18, 1932
2,801,594	Lewis	Aug. 6, 1957