Feb. 17, 1959 G. B. ELDER 2,873,688

PUMP WITH OBLIQUE PULSATOR DIAPHRAGM

Filed Nov. 18, 1955

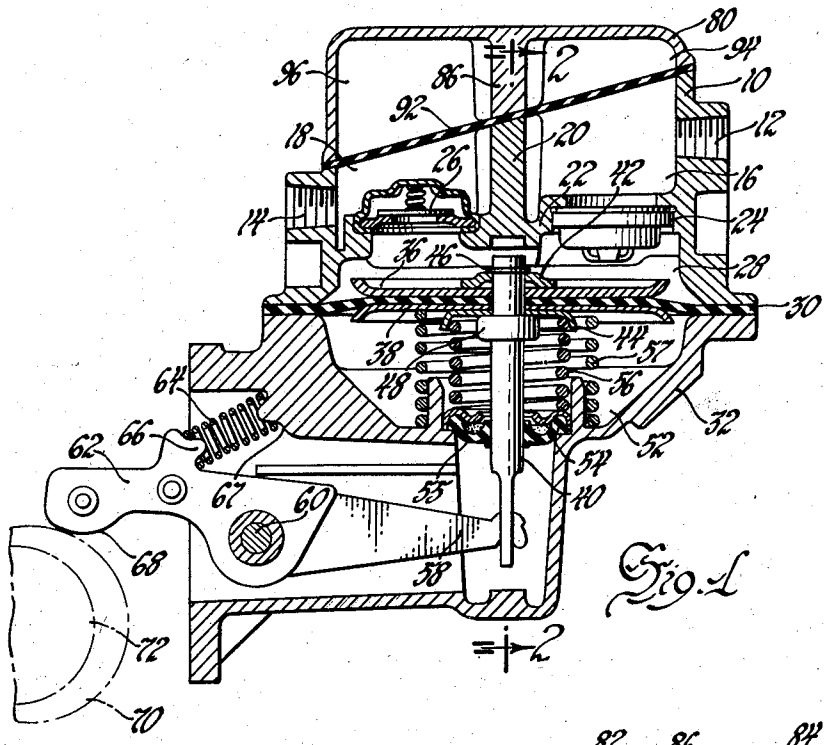


Fig. 1

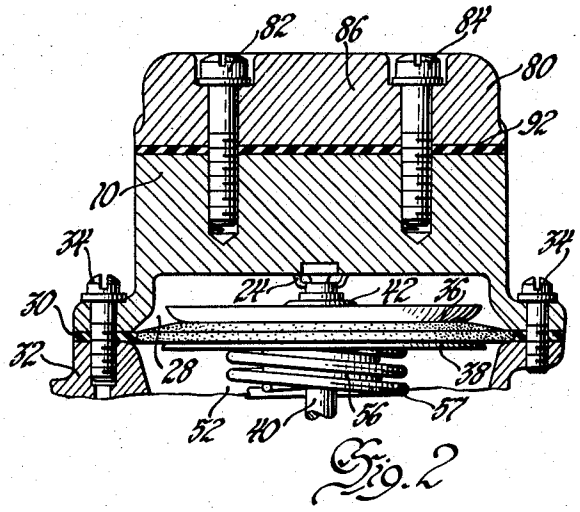


Fig. 2

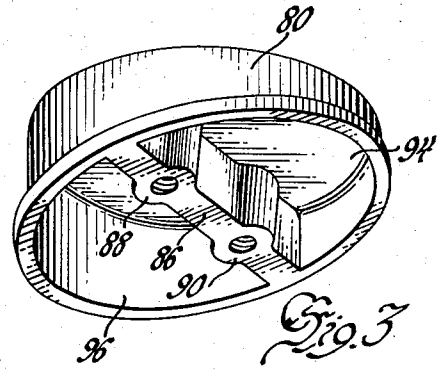


Fig. 3

INVENTOR
Gordon B. Elder
BY J. W. Lovett
ATTORNEY

United States Patent Office

2,873,688

Patented Feb. 17, 1959

2,873,688

PUMP WITH OBLIQUE PULSATOR DIAPHRAGM

Gordon B. Elder, Flint, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application November 18, 1955, Serial No. 547,807

8 Claims. (Cl. 103—150)

This invention relates to pumps and more particularly to pumps such as utilized to supply fuel for internal combustion engines and employing oscillatable diaphragms effectively to obtain the flow of volatile fluid.

Fuel pumps of the diaphragm type are generally driven by an arm or lever adapted to be oscillated by the cam shaft of the engine served by the pump. Inherently, pumps of the diaphragm type are characterized by producing a pulsative or non-uniform pressure in the discharge of fuel. In order to cause the pressure and also the volume of fluid discharge to be more uniform, so called "pulsator chambers" have been employed and intimately associated with the pump structures. These chambers have been partially defined by yielding diaphragms subjected to the fuel pressure existent on either or both sides of the pumps in the flow system concerned. A device of this nature which has been very effective in service is disclosed in the United States Patent 2,640,424 granted June 2, 1953, in the name of Abraham M. Babitch.

In the use of pumps of the type described above as well as pumps having no pulsator chambers, a difficulty has been experienced, precedent to the present invention, in that vapors often are entrapped in the fluid line on the discharge side of the pump particularly when elevated temperatures and highly volatile fluids are involved. Accordingly, a need has arisen for a fuel pump in which effective and uniform pumping action is maintained simultaneous with a definite minimizing of vapor formation or the commonly so called "vapor lock" often encountered in the motor car field.

It has now been found that vapor lock or undue vapor formation may be prevented or effectively minimized and discharge pressure may be made uniform in an improved type of fuel pump utilizing a novel arrangement involving a pulsator diaphragm.

An object of the present invention is to provide an improved pump of the oscillatable diaphragm type characterized by uniformity in discharge and effective in minimizing vapor lock in the discharge of volatile fluid.

A feature of the invention resides in a pump having a pulsator diaphragm lying in a plane oblique to a partition defining a pumping chamber in which pressure is imparted to a fluid by impulses. Another feature pertains to a fuel pump of the diaphragm type and in which a pulsator diaphragm is arranged in an oblique position so that the capacity of the pump inlet chamber exceeds the outlet chamber capacity.

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 elevational view of a fuel pump in which features of the present invention are embodied;

Fig. 2 is a sectional view of a portion of the structure shown in Fig. 1 and taken along the line 2—2 in Fig. 1; and

Fig. 3 is a perspective view of recessed means or a cap shown in the assembly of Fig. 1.

Fig. 1 of the drawings depicts a pump body 10 having a threaded inlet 12 and a threaded outlet 14 communicating with inlet and outlet chambers 16 and 18 respectively. These chambers are separated by a vertical wall 20 which extends upwardly from a horizontal partition 22 formed in the pump body. The partition supports an inlet check valve 24 and an outlet check valve 26 as is customary in such pumps.

Beneath the chambers 16 and 18 and the partition 22 a pumping chamber 28 is defined by the pump body 10. The valves 24 and 26 are of conventional construction and are adapted to control the flow of fuel from the chamber 16 into the pumping chamber 28 and then into the outlet chamber 18 for discharge through the outlet or connection 14, as will be understood.

A pumping diaphragm 30 is provided with its margin clamped between a pump support body 32 and the peripheral bottom margin of the pump body 10. These parts are held together by means of screws 34. The central portion of the diaphragm 30 is clamped between two discs 36 and 38 which are held together on the upper end portion of a plunger 40. This plunger passes through the diaphragm 30 and the discs 36 and 38 and holds the latter with the aid of washers 42 and 44 as well as shoulder portions 46 and 48 formed on the plunger. A chamber 52 is defined by the body 32 and is adapted to accommodate a disc 54 coaxially arranged with a sealing and resilient washer 55 engaging the plunger. A spring 56 surrounds the plunger 40 and is confined between the washer 44 and the disc 54. A second spring 57 is arranged around the spring 56 to supplement the action of the latter and this spring 57 is confined between a horizontal wall of the chamber 52 in the body 32 and the disc 38. The springs 56 and 57 serve to actuate the pumping diaphragm 30 as will further appear. Connected to the lower end of the plunger 40 is one end of a lever 58. This lever is pivoted to a shaft 60 mounted in the sides of the lower body 32. A second lever 62 is also pivoted on the shaft 60 and is so arranged as to actuate lever 58. The action of the two levers 58 and 62 is assisted by a helical spring 64 interposed between a protuberance 66 on the lever 62 and a shoulder 67 formed within and upon the body 32. A curved surface 68 on the lever 62 is adapted to be held by the spring 64 in engagement with a cam 70 formed on the cam shaft 72. The cam shaft 72 is a part of the internal combustion engine to be served by the fuel pump. As is conventional in such pumps, the cam 70 rotates with the result that the levers 62 and 58 cooperate to move the plunger 40 downwardly against the compression of the springs 56 and 57 and upward motion of the plunger 40 is caused by the action of those springs to bring about the pumping action of the diaphragm 30.

Details of the pump mechanism within the body 32 need not be further described herein as they are conventional, but it will be understood that fuel entering through port 12 into the chamber 16 is caused to flow downwardly through the check valve 24 into the chamber 28 when the pumping diaphragm 30 is flexed downwardly. As this occurs the valve 26 is closed. When the diaphragm 30 is flexed upwardly, the valve 24 will close and the valve 26 will open causing a discharge of fuel, previously

admitted to the chamber 28, to the chamber 18 and then from the port 14.

The top of the pump body 10 is provided with recessed means or a cap 80 which is affixed to the body 10 by means of two screws 82 and 84. The recessed means is provided with a central and transverse web 86 with enlarged portions 88 and 90 (Fig. 3) bored to receive the two screws 84 and 82 respectively. The recessed means 80 is so made as to present a contour with a bottom surface oblique to the partition 22. The construction is best visualized by consideration of Fig. 3 in the drawings. The cap 80 is so made that its bottom surface lies in a single plane and in the pump assembly that surface extends at an angle with the partition 22 and transverse to the web 86. The central web 86 corresponds with and lies in the plane of the vertical wall 20 of the body 10. Interposed between the body 10 and the cap 80 is a yieldable diaphragm 92 which closes off two pulsator chambers 94 and 96 which are recesses in the cap 80. When the parts are in assembly as shown in Fig. 1, the pulsator chambers 94 and 96 register or correspond with the inlet and outlet chambers 16 and 18 respectively but are sealed therefrom by the diaphragm 92.

In the arrangement shown, the inlet port 12 is located further from the partition 22 than is the case with the outlet port 14. It is also to be noted that with the inclined or oblique position assumed by the pulsator diaphragm 92 with respect to the partition 22, the inlet chamber 16 is larger than the outlet chamber 18. With such an arrangement, the capacity of the pump inlet chamber exceeds the outlet chamber capacity and, as a consequence, a squeezing action takes place with respect to the fluid (liquid plus air or vapor) passing through the pump and the formation of vapor on the discharge side is minimized considerably if not eliminated entirely despite the volatility of any fluid handled by the pump. It is also to be noted that the effective area of the diaphragm 92 causing uniform fluid flow is larger than would be the case if it were parallel with the partition 22.

The diaphragms 30 and 92 may be made from resin impregnated fibrous material as commonly used in pumps of this type.

Not only does the action of the diaphragm 92 act to stabilize the flow of fuel through the pump as such devices have done heretofore, but it does so to a greater extent because of its greater effective area and, as stated above, it definitely minimized the tendency of vapor formation in the discharge line. The flat nature of the surfaces engaging the diaphragm 92 gives rise to excellent sealing and contributes to ease and low cost in manufacture. The chamber 16 provides a large reservoir of fluid available when the inlet valve 24 opens. The reduced volume of the outlet chamber 18 and the lower discharge outlet 14 gives a high flow rate. This reduces the time required for the fluid to clear the pump outlet chamber 18 and promotes clearance of vapor which may be formed so that liquid will be delivered.

The pump is depicted in the drawings with the recessed cap 80 uppermost but it is to be understood that the pump may be installed for operation with the cap down or to one side without departing from the principles thereof.

I claim:

1. A pump having a pump body with a pump chamber and inlet and outlet chambers, a pumping diaphragm partially defining said pump chamber, a partition separating said pump chamber from the said inlet and outlet chambers and provided with ports connecting the latter chambers to said pumping chamber, one-way valves arranged to control said ports, recessed means fixed to said pump body and defining pulsator chambers, diaphragm means extending obliquely with respect to said partition and through said pump to separate said body from said recessed means, and said inlet chamber being larger than said outlet chamber.

2. A pump having a pump body with a pump chamber and associated inlet and outlet chambers, a partition separating said pump chamber from the latter chambers, an inlet port and an outlet port in the outer walls of said inlet and outlet chambers respectively, recessed means fixed to said pump body and defining a pulsator chamber corresponding with each of said inlet and outlet chambers, diaphragm means interposed between said body and said recessed means and lying wholly in a plane oblique to said partition and said inlet chamber being larger than said outlet chamber.

3. A pump having a pump body defining a pump chamber and inlet and outlet chambers, a partition separating said pump chamber from the latter chambers, ports in said partition and one-way valves arranged to control flow therein between said inlet and outlet chambers by way of said pump chamber, recessed means fixed to said pump body and defining pulsator chambers, diaphragm means extending obliquely with respect to said partition and through said pump in one plane to separate said body from said recessed means, and said partition and diaphragm means extending toward each other in defining opposed walls of said outlet chamber.

4. A pump having a pump body defining a pump chamber and associated inlet and outlet chambers, said inlet chamber being larger than said outlet chamber, a partition separating said pump chamber from the latter chambers and provided with ports and valves, recessed means fixed to said pump body and defining a pulsator chamber corresponding with each of said inlet and outlet chambers, and diaphragm means interposed between said body and said recessed means and lying wholly in a plane oblique to said partition to aid in defining said inlet and outlet chambers.

5. A fuel pump of the diaphragm type including a pump body defining a pump chamber and inlet and outlet chambers, a pumping diaphragm partially defining said pump chamber, a partition separating said pump chamber from the said inlet and outlet chambers and provided with ports, one-way valves arranged to control said ports and placed with their axes parallel to each other and perpendicular to said pumping diaphragm, recessed means fixed to said pump body and defining pulsator chambers substantially corresponding with said inlet and outlet chambers, a diaphragm extending in a single plane obliquely with respect to said partition and through said pump to separate said pulsator chambers from said inlet and outlet chambers, the partition port for said outlet chamber being close to said single plane diaphragm, and the partition port for said inlet chamber being further from said single plane diaphragm.

6. A pump of the diaphragm type including a pump body defining a pump chamber and inlet and outlet chambers, a partition separating said pump chamber from the latter chambers and provided with ports, one-way valves controlling said ports, recessed cap means fixed to said pump body and defining pulsator chambers, and a diaphragm interposed between said body and said recessed cap means and extending from said inlet chamber and toward said partition to cause said outlet chamber to be smaller than said inlet chamber.

7. A fuel pump of the diaphragm type including a pump body defining a pump chamber and inlet and outlet chambers, a partition separating said pump chamber from the latter chambers, means for controlling the flow of fluid through said chambers in series, recessed cap means fixed to said pump body and defining pulsator chambers, a diaphragm interposed between said body and said recessed cap means and arranged oblique to said partition, inlet and outlet connections leading to said inlet and outlet chambers respectively, said diaphragm being inclined toward said outlet connection, and said inlet connection being spaced further from said partition than said outlet connection.

8. A fuel pump including a pump body defining inlet and outlet chambers, a pumping diaphragm cooperating with said pump body to define a pumping chamber, a partition in said pump body separating the pumping chamber from said inlet and outlet chambers, one-way valves supported on said partition with annular seats lying parallel to the latter to control flow through said inlet, pumping and outlet chambers in series, recessed cap means fixed to said pump body, a pulsator diaphragm interposed between said body and said recessed cap means and lying wholly in a plane oblique to said partition, and

said recessed cap means cooperating with said pulsator diaphragm in defining a small pulsator chamber in registry with said inlet chamber and a large pulsator chamber in registry with said outlet chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

2,625,114	Coffey	Jan. 13, 1953
2,640,424	Babitch	June 2, 1953