

June 11, 1957

D. F. THOMAS ET AL

2,795,236

VACUUM PRIMER

Filed Oct. 18, 1954

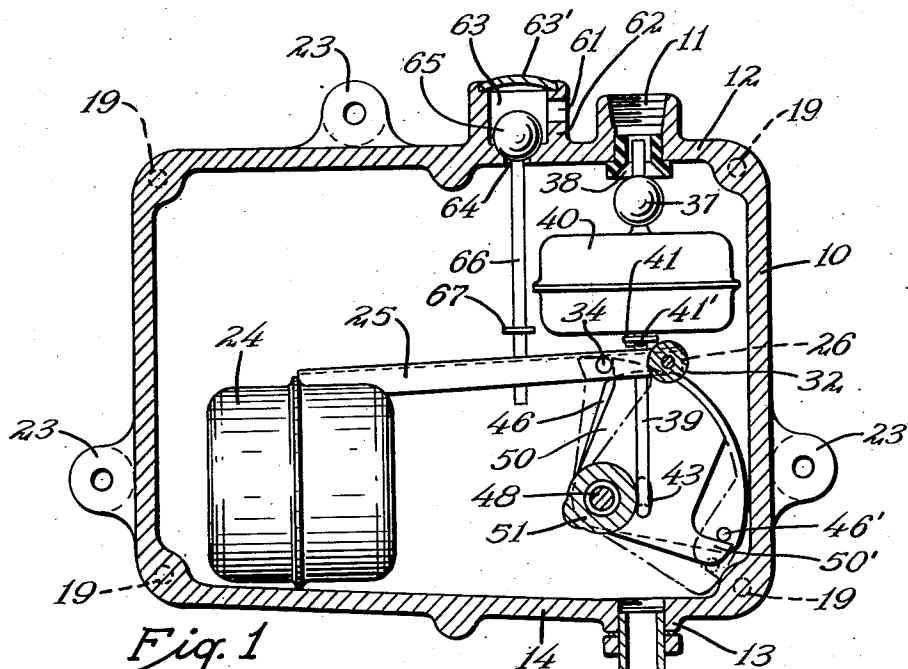


Fig. 1

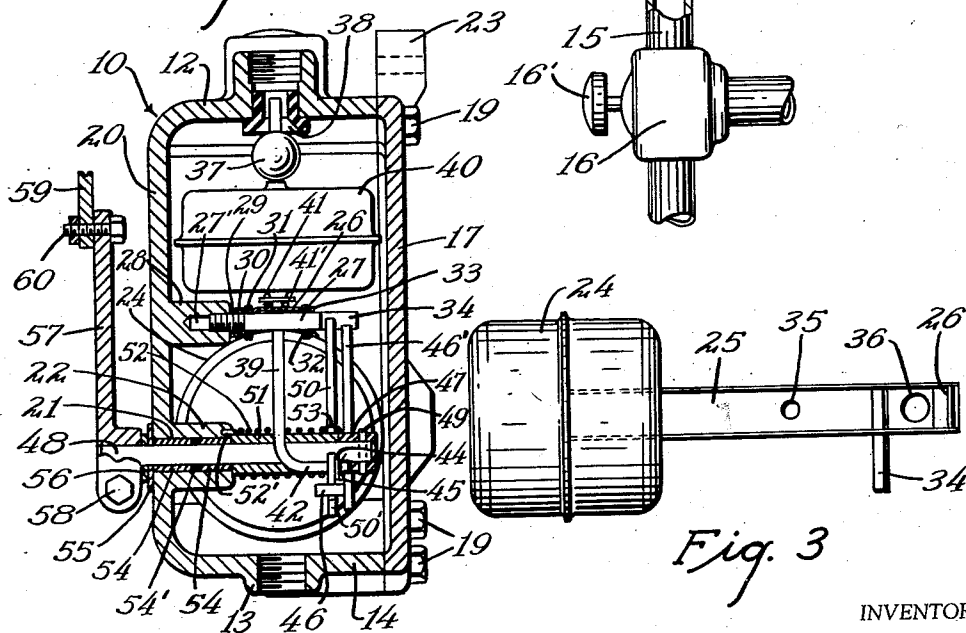


Fig. 2

Fig. 3

INVENTOR

David F. Thomas
Robert A. Hill

BY

Robert M. Dunning

ATTORNEY

1

2,795,236

VACUUM PRIMER

David F. Thomas, West St. Paul, and Robert A. Hill, Minneapolis, Minn., assignors to Waterous Company, Ramsey County, Minn., a corporation of Minnesota

Application October 18, 1954, Serial No. 462,769

12 Claims. (Cl. 137—202)

This invention relates to a method and apparatus for priming a pump.

Where pumps are operated by an internal combustion engine, such as in the case of most fire engine pumps, it is possible to employ the vacuum created in the intake manifold of the engine for evacuating the air from the pump. Such a system, however, requires a positive means of preventing liquid from being drawn into the engine intake. The present invention deals with such a device.

An object of the present invention lies in the provision of a primer chamber including a float valve incorporated in the suction line between a centrifugal pump or other pump of the non-self-priming type and the engine intake. This float chamber includes means for automatically stopping the flow of liquid into the float chamber when the liquid level reaches a predetermined height, and providing a positive closure of the passage to the engine intake.

A further feature of the present invention lies in the provision of a primer chamber having an air vent therein. This vent is normally closed during the pump evacuation but is automatically opened to allow liquid to drain from the primer chamber at the conclusion of the priming operation.

Other objects and advantages will be apparent from the following description of the accompanying drawings, wherein:

Fig. 1 is a side view of the internal arrangement of the primer assembly as viewed from an open cross sectional side of the primer casing.

Fig. 2 is an end view of the internal arrangement and hand control of the primer assembly in partial cross section as viewed from an open cross sectioned end of the casing.

Fig. 3 is a bottom plan view of the main float structure used in the primer assembly shown in Figures 1 and 2.

Referring to the drawings a casing 10 encloses the primer structure, as hereafter described. This casing 10 is provided with a pipe tapped port 11 on its level top side 12 to which is preferably attached a rubber hose suitable for vacuum service and adapted to connect the primer casing 10 to the intake manifold of an engine (not shown). The pipe tapped port 13, on the inclined bottom side 14 of primer casing 10, is connected to a pump priming port (not shown) through a copper or other tubing 15. A priming valve consisting of a conventional vented cock or three way valve 16 is installed in the tubing 15, intermediate the primer casing 10 and the pump, to drain the primer when the valve 16 is shut off, for example, by a conventional dial or valve turning handle 16'. A cover 17 is secured by screw caps 19 to the casing 10. The back wall 20 of casing 10 is provided with opening 21 and a bearing housing 22 through which extends a control for the primer mechanism as hereinafter described. The mounting flanges 23 on casing 10 are used to secure the primer casing 10 as high as possible above the pump and at some convenient location near the engine compartment of, for example, a fire or other type truck carrying a centrifugal pump or

2

other fluid pump requiring a priming action as provided by the structure herein described.

The vacuum primer assembly is essentially a semi-automatic air valve which consists of a main float 24 on one end of arm 25. The opposite end of arm 25 is pivotally mounted on a holding pin 27 screwed into hole 27' in the portion 28 of wall 20. A lock washer 29 and nut 30 locks the screw threaded end of pin 27 in the portion 28 of wall 20. The brass washers 31 and 32 hold the pivotal end 26 of arm 25 from shifting along pin 27 and the washers 31, end 26 and washers 32 are locked on pin 27 by cotter pin 33. The arm 25 of float 24, as shown in Fig. 3, is provided with a trip or trigger pin 34 and apertures 35 and 36 as cooperative parts with other elements hereinafter more fully described.

A ball or valve closure member 37 serves to seat in the main valve seat 38 to make and break the vacuum seal of the primer. Rod 39 extends through the ball 37; the upper end of rod 39 extends a sufficient distance to assure guidance of the ball 37 into its seat 38, while the lower end of rod 39 extends downward through an auxiliary float 40 and washer 41 held by cotter pin 41', terminating in curved portion 42, which extends through a substantially vertical slot 43 in a lock plate assembly hereinafter described, and is retained in the slot 43 by washer 44 and cotter pin 45. While ball 37 is secured to rod 39 by an interference fit, float 40 and washer 41 are free to move on rod 39, and are held in juxtaposition to ball 37 by cotter pin 41'.

The lock plate assembly is a manual and automatic control feature wherein an assembly release plate 46, in which is mounted a pin 46', is secured to sleeve ring 47. The sleeve ring 47 is fastened to a manually operable shaft 48 by lock pin 49, and an assembly lock plate 50 is secured to a rotatable sleeve ring 51 on shaft 48. A torsion spring 52 is wrapped around the ring 51 with one end 52' secured in the housing 22 and the opposite end 53 hooked through a hole in plate 50 to provide counter-clockwise rotation to the plates 46 and 50. The shaft 48 is supported in housing 22 by two Oilite bearings 54 between which is O ring 54' and extends outside of casing 10. The bearings 54 provide a noncorrosive support for the shaft 48, while the O ring 54' provides the vacuum seal. A washer 55, held by roll pin 56, and ring 51, which bears against housing 22, form thrust absorbing means for the shaft 48.

A lever arm 57 is clamped by a suitable bolt 58 to the end shaft 48 and a hand control push and pull rod 59 is fastened, for example, by bolt 60 to the opposite end of the lever arm 57. This push and pull rod 59 is adapted to be mounted in a conveniently operable position with suitable "on and off" markings indicating the on and off condition of the primer. The lever arm 57 rotates shaft 48 and this in turn rotates the release plate 46 carrying pin 46' against an end 50' of plate 50 causing plate 50 to rotate clockwise until its upper rear edge portion is locked by trigger pin 34 in a "cocked" position against the tension of torsion spring 52. The clockwise rotation of plate 46 and pin 46' causes the plates 46 and 50 to move from under pin 34 and the float member 24 and arm 25 to drop into the "cocked" position, as described.

An air vent 61 is provided in the wall 62 of the small chamber 63 formed integral with, or mounted upon, top 12 of the casing 10. An aperture 64 in the top 12 forms a valve seat for the ball closure member 65. Mounted in the aperture 35, in arm 25, is a rod 66 fastened to and depending from ball 65 which when moved upwardly by the raising of float 24 and arm 25 unseats the ball 65 to open aperture 64. A washer 67 is fastened to rod 66, or otherwise forms a stop on rod 66. The washer 67 provides a means for arm 25 to lift the rod 66 and unseat

the ball 65 and vent the casing 10 to the atmosphere. A spring cap 63' closes the upper end of chamber 63.

The substantially vertical slot 43 in the lock plates 46 and 50, through which passes the curved lower end 42 of the auxiliary float rod 39, serves several purposes. When the lock plate assembly is in the "cocked" position as shown in Fig. 1, the length of the slot extending above the auxiliary float assembly rod is long enough to permit the auxiliary float assembly to float up and force valve 37 against valve seat 38 to seal off the passageway leading to the engine intake manifold, in the event that the main float 24 sticks or freezes or for some other reason fails to function when the water level rises in the vacuum primer tank. This is purely a safety feature, and one which is not utilized in normal operation of the primer. The lock plate assembly positioned as shown by the solid lines in Fig. 1 is not in its extreme clockwise position. It can be rotated further by the operating handle 57 until the bottom right hand corner of the lock plate assembly touches the bottom of the tank as illustrated by the dotted lines indicating the plates in this position. This is sufficient over-travel to insure that the top of the aforementioned vertical slot 43 will engage the auxiliary float rod 39 and pull the auxiliary float and valve 37 off of its seat in the event that the engine vacuum against the upper exposed area of the valve 37 is sufficient to overcome the weight of the auxiliary float assembly and hold it in the closed position.

When the main float 24 rises and the lock plate 50 and release plate 46 assemblies trip, they rotate counter-clockwise from the position shown in Fig. 1 a distance under pin 34 sufficient to move the auxiliary float 40 upwards to force the ball 37 into valve seat 38 to close port 11 and stop the vacuum or priming action. This closed position of the auxiliary float assembly is the only thing that limits further counter-clockwise movement of the lock plate and release plate assemblies. The design of the existing mechanism is such that the lock plate assembly can be rotated clockwise from the position shown approximately 22° to break the vacuum seal of the auxiliary float assembly, and when the mechanism trips, will rotate approximately 25° from the position shown in a counter-clockwise direction to seal off the main valve at the top of the primer.

In order to illustrate more fully, the present vacuum primer is designed to facilitate priming centrifugal fire pumps by utilizing the aspirating or breathing capacity of internal combustion engines to withdraw the air from the pump and suction hose. The maximum lift at which this type of priming system is capable of producing a prime is, therefore, directly dependent on the available intake manifold vacuum of the engine. Maximum intake manifold vacuum occurs at a "no load" engine condition over a rather broad speed range from idling to approximately thirty to forty percent of maximum rated engine speed. If the engine ignition, carburetion or condition of the valves is poor, resulting in a "rough" running engine, the "vacuum producing" ability of the engine will be impaired considerably. Most gasoline engines in good mechanical condition will produce a maximum intake manifold vacuum of between 18" and 22" Hg. An engine capable of producing 20" Hg vacuum would theoretically be able to prime a pump at a maximum lift of 22 feet, provided there were no air leaks in the pump, suction hose, fittings, valves, etc. The shortest priming time will be obtained at an engine speed approximately thirty to forty percent of maximum engine speed, rather than at idle speed because, although the engine will not produce a greater gauge vacuum at this higher speed with the primer turned off, it does have greater vacuum with the primer on. If the priming operation is performed at engine idling speed, the available engine vacuum will drop, when the primer is turned on, from the original gauge vacuum of 20" Hg to some lesser value.

Opening the priming valve 16 and rotating the locking assembly plates 46 and 50 to a "cocked" position allows raw air to enter the engine intake manifold, increasing the air-fuel ratio to a leaner condition, which causes the engine to run "rough." This "rough" engine operation results in a lesser vacuum and increases the priming time. If the engine speed is increased above idling, the air-fuel ratio is reduced toward the normal "richer" condition, which results in smoother engine operation and greater intake manifold vacuum, thus reducing the required priming time. It is not true, however, that operating the engine at thirty to forty percent of rated speed will allow priming from greater lifts than when operating at idle speed. As the maximum lift is approached, the vacuum inside the pump approaches the vacuum in the engine intake manifold, gradually reducing the rate at which the air flows from the pump through the primer and into the engine. This reduction in air flow rate to the engine restores the normal air-fuel ratio in the engine and allows the engine to produce approximately the same vacuum at idle speed as it would at some higher speed.

The following brief description will indicate the operation and describe the functions of the various parts of the vacuum primer structure as above set forth. To begin the priming cycle priming valve 16 is turned to the "on" position which opens the conduit 15 from a pump (not shown) to the vacuum primer. Then the operating rod 59 is pulled to rotate lever 57 causing rotation of plates 46 and 50 from under pin 34 and all the way back against base 14 of casing 10. This rotation of plates 46 and 50 opens valve seat 38, in the manner as herein described. The rod 59, lever 57 and plates 46 and 50 are then allowed to return to the midway or "cocked" position with plate 50 locked by pin 34 and plate 46 rocked from under pin 34 and held stationary at a designated "on" position of the rod 59 and lever 57.

As illustrated in Fig. 1, the main float is shown in a dropped position, thus allowing rod 66 to drop and ball 65 to close air passageway 64. The rocking or rotary movement of plates 46 and 50 forces the auxiliary float assembly down, breaking the vacuum seal at the valve seat 38 and opens the port 11 to the engine. With the motor running all the air is evacuated from the pump and the water level rises in the primer body. Then the main float rises until the "trigger" pin 34 releases the lock plate 50. When this occurs the lock plate 50 and the release plate 46 rotate together due to the torsional force of the torsion spring 52, to the "off" position. This spring movement causes the plate 46 and plate 50 to ride under the pin 34 and lift the main float 24 out of the water, due to the fact that the radius of the lower part of the curve of plate 46, as shown in Figure 1, is larger than the radius of the upper part of the curve, and also is larger than the radius of plate 50. The rise of lever 25 opens the air vent (passageway 64), closes main valve seat 38, and pulls the operating rod 59 and lever 57 into the "off" position, indicating to the operator that a prime has been obtained. When the pump is primed and the water rises to a predetermined level in the primer, lifting float 24, the operating rod 59 and lever 57 will jump to a designated "in" (off) position indicating that the pump is primed. The priming valve 16 is then immediately turned to an "off" position to prevent the pump from losing its prime.

In the event the primer should fail to automatically shut off, a further rise in the water level in the primer casing 10 causes the auxiliary float 37 to rise and close the main valve seat 38, thus preventing water from entering the port 11 and the engine.

If the operator should desire to stop the priming cycle or return the primer to its "off" condition once the plates 46 and 50 have been locked into "cocked" position by pin 34, it is only necessary to turn the operating rod 59. This action rotates the release plate 46

5

so that its outer periphery serves as a cam which lifts the float 24 and pushes the "trigger" pin 34 up out of engagement with lock plate 50, allowing the assembly mechanism to rotate to the "off" position. With the release plate 50 riding as a cam under pin 34 the main float 24 cannot be damaged by vibrating or bumping against the bottom. Further, the float 24 cannot freeze to the bottom to render the primer unoperative and the air vent is kept open to insure drainage of the primer casing 10. The structural elements as indicated are formed of noncorrodible materials as brass and copper and the float structures are capable of withstanding 28" Hg vacuum with sudden release to atmospheric pressure, and thirty pounds p. s. i. gauge pressure without leakage or deformation.

Having thus indicated our invention in, and improvements to, a vacuum primer for a pump it will be recognized that many useful advantages may be obtained by its application in the manner as described.

We claim:

1. A primer structure comprising a casing, an inlet port and an outlet port in said casing, a main float in said casing, an arm pivotally attaching said float to said casing, a trip pin extending from said arm, an auxiliary float in said casing, a valve closure member carried by said auxiliary float in its upper side, a downwardly extending rod carried by said float on its underside, a manual lever, a pivotal shaft attached to said manual lever and extending into said casing, a release plate mounted on said shaft and pivotal therewith, a projecting pin carried by said release plate, a locking plate mounted on a sleeve ring, said sleeve ring being rotatably mounted in parallel relationship to said locking plate on said shaft, a torsion spring mounted on said sleeve ring and adapted to be placed under tension upon movement of said locking plate by said projecting pin from under said trip pin on said floating arm, a substantially vertical slot in said locking plate, said downwardly extending rod being provided with its one end secured in said substantially vertical slot, and an air vent comprising a valve seat and valve closure member, said valve closure member being provided with a downwardly extending rod adapted to be lifted by said float arm.

2. A primer structure for priming pumps comprising a casing, a main float in said casing, an arm connected to said float pivotally attached to said casing, a trigger pin on said arm, a fluid inlet port and a fluid outlet port in said casing, a main control valve for opening and closing said outlet port, an auxiliary float connected to said control valve, a lever arm, a rotatable shaft attached to said lever arm and extending into said casing, a control assembly on said shaft in said casing for cooperating with said trigger pin to lock said main float and hold said main control valve in operative pump evacuating condition, and an air vent means closing said casing to atmospheric pressure when said control valve opens said inlet port and opening said casing to atmospheric pressure when said control valve closes said inlet port.

3. In the structure of claim 2, the locking assembly comprising a locking plate and a release plate mounted on said rotatable shaft and moveable under said trigger pin to lift said main float.

4. In the structure of claim 3, a torsion spring mounted on the said shaft and holding said locking plate under rotatable tension.

5. A primer structure adapted to be connected between the intake manifold of a gasoline engine and a centrifugal pump comprising a casing containing an evacuating control system, said evacuating control system including a liquid inlet port, a liquid feed conduit connected to said inlet port, a drain and flow control in said conduit, an outlet port in said casing for connection to the intake manifold of a gasoline engine,

6

a valve seat in said outlet port, a valve for controlling fluid flow through said outlet, float means for closing said outlet port, a second float mounted in said casing, a locking plate assembly for holding said second float in raised and lowered positions, a connecting linkage between said float means and said locking plate assembly to automatically control the said valve for controlling fluid flow through said outlet, an air vent and valve closure control therefor operable to open said casing and close said casing to atmospheric pressure, and a lever control connected to said locking plate assembly.

6. A vacuum primer assembly comprising a mountable casing, a cover for said casing, fluid inlet and outlet ports in the walls of said casing, a valve and float means for controlling one of said outlet ports adapted to be connected to an aspirator, a second valve for controlling another of said ports adapted to open the casing to atmospheric pressure, a second float for controlling the operation of said second valve, a rotatable control plate assembly operable to lock said second float in a dropped position and close said second valve, a connecting linkage between said first float means and said rotatable plate assembly to actuate said first mentioned valve and float means, and lever means connected to said rotatable plate assembly to manually control the closure and opening of said valve through said linkage, the raising and lowering of said second float and the relative opening and closing of said other of said ports open to atmospheric pressure.

7. In the structure of claim 6, a torsion spring holding said rotatable plate assembly under retractable tension upon locking said second float in a dropped position.

8. A vacuum primer assembly for a pump comprising a casing, fluid inlet and outlet ports in said casing, a valve in said outlet port, a valve closing member within said casing cooperable with said valve to close the same, means resiliently urging said valve closing member toward valve closing position, trigger means engageable with said valve closing member to hold said member from closing said valve, and float means in said casing controlling the position of said trigger means, whereby when liquid rises in said casing, said float disengages said trigger from said valve closing member whereupon said resilient means actuates said valve closing member to close said valve.

9. The structure described in claim 8 and including a resetting lever connected to said valve closing member and extending from said casing for resetting said trigger means when the liquid level drops in said casing.

10. The structure described in claim 8 and including a second float connected to said valve and operable to close said valve upon rise in liquid level within said casing in the event said first mentioned float fails to release said trigger.

11. The structure of claim 8 and in which said valve closing member includes a member movable with said valve, and a pivotal member engageable with said member movable with said valve upon pivotal movement in one direction.

12. The structure of claim 8 and in which the valve moving member includes a valve rod movable with said valve, a pivotally supported member engageable with said trigger means in one pivoted position thereof, said pivotally supported member engaging said valve rod to move the same into valve closing position when pivoted in one direction, and an auxiliary float on said valve rod operable, upon the rise of liquid level in said casing, to close said valve in the event said trigger means fails to function.

References Cited in the file of this patent

UNITED STATES PATENTS

1,682,331 Goyne et al. ----- Aug. 28, 1928