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M. K. BENNETT
PRIMING DEVICE

2,470,232

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2 Sheets-Sheet 1

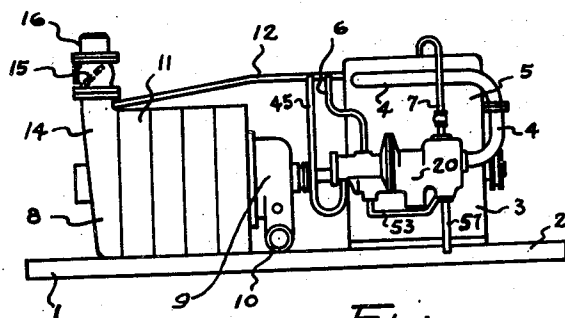


Fig. 1.

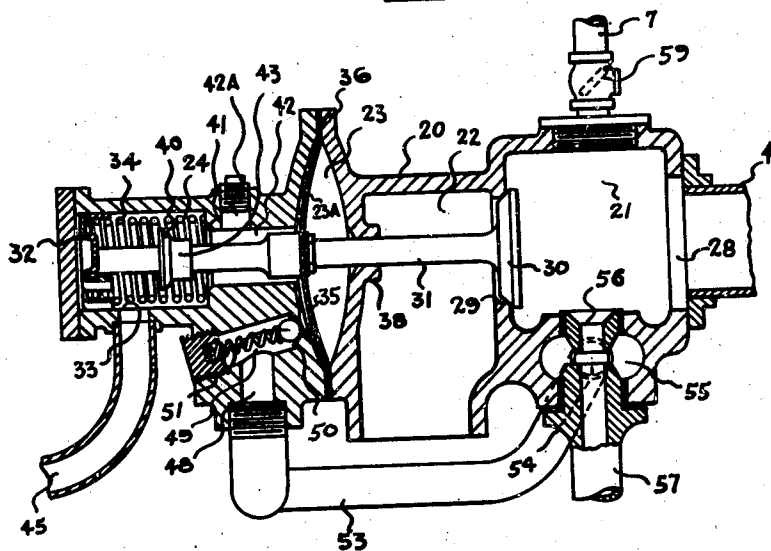


Fig. 2.

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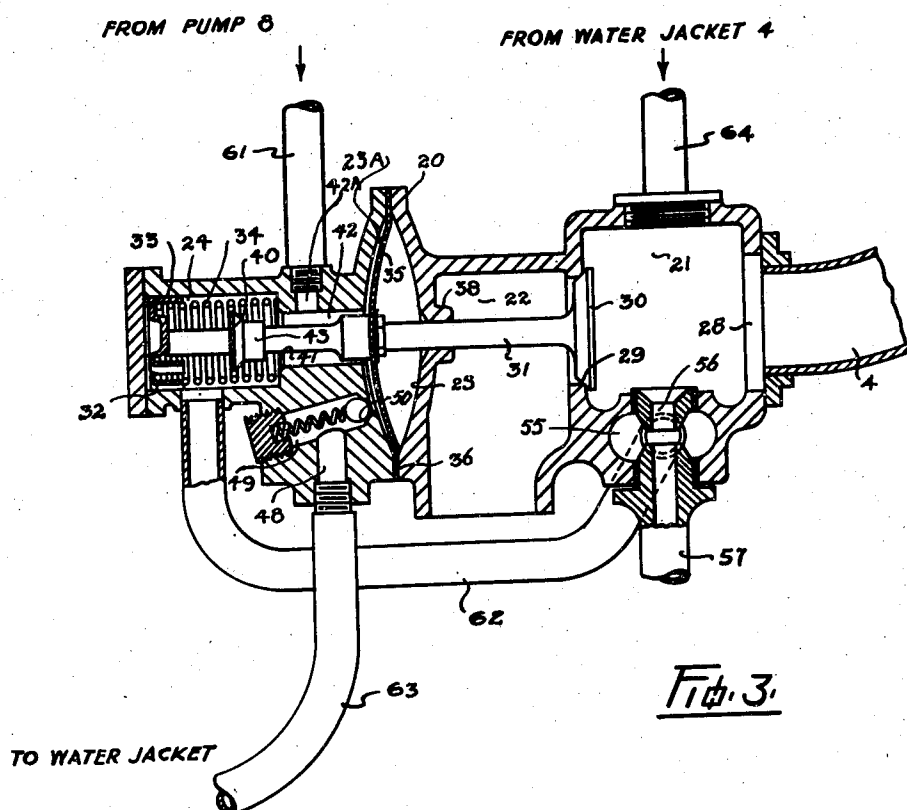


Fig. 3.

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PRIMING DEVICE

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7 Claims. (Cl. 103-113)

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My invention relates to improvements in priming devices which are particularly adapted for priming centrifugal pumps which are driven by internal combustion engines. The principal object of the invention is to effect the priming of the engine as quickly as possible.

With portable pumps of the above type, especially those used for fire fighting purposes, the water for cooling the engine is supplied by the pump and drains off through the exhaust as soon as the engine starts, consequently unless the pump is primed within a very short time after the engine has started to run, said engine, lacking cooling water circulation becomes extremely hot and serious internal damage is likely to occur, which would impair the delivery of the pump.

The present invention is designed as a single unit adapted to be interconnected between the pump casing, the engine exhaust manifold and the water jacket of said engine, which automatically primes the pump by exhausting the air from the pump casing by an ejector and diverts the flow of exhaust gas to an open exhaust as soon as a pressure is developed in the pump casing due to the water entering the pump, as will be more fully described in the following specification and shown in the accompanying drawings, in which:

Fig. 1 is a general view of a portable multi-stage pump directly connected to an internal combustion engine and the invention connected therewith.

Fig. 2 is a longitudinal sectional view of the invention showing one method of connecting same to the pump-engine assembly.

Fig. 3 is a longitudinal sectional view of the invention showing a second method of connecting same to the pump-engine assembly.

In the drawings like characters of reference indicate corresponding parts in each figure.

The numeral 1 indicates generally a portable fire pump consisting of a frame 2 which supports an internal combustion engine 3 having an exhaust manifold or pipe 4, a water jacket 5, a water supply pipe 6 to the jacket and a cooling water outlet pipe 7.

The engine 3 is direct coupled to a multi-stage centrifugal pump 8 having a suction casting 9 fitted with a suction hose fitting 10, a pump casing 11 having a priming pipe 12 and an outlet scroll 14 terminating with a check valve 15 and a discharge hose fitting 16 to which a fire hose is adapted to be fitted.

Mounted upon the frame adjacent the engine 3 is the priming device 20 which consists of a

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casting divided into an exhaust receiving chamber 21, an exhaust outlet passage or chamber 22, a diaphragm housing 23 and a water inlet chamber 24. The exhaust receiving chamber 21 is provided with a port 28 to which the exhaust pipe 4 from the engine is fitted, opposite said opening a valve seat 29 communicates with the exhaust outlet passage 22. A mushroom valve 30 normally closes off the opening 29 when the pump is not in operation. The valve 30 is formed upon an elongated stem 31 which extends through the housing 23 and to a point adjacent the outer end of the chamber 24, the outer end being fitted with a spider or guide 32 which engages the cylindrical wall 33 of said chamber to assist in keeping the stem in alignment within its operating spaces. A spring 34 engages the spider 32 to the left to close the valve 30. Within the housing 23 is a diaphragm 35 which is connected to the walls of the housing along its peripheral edge as at 36 and to the valve stem at its centre. The wall between the chamber 22 and housing 23 is provided with a boss 38 which forms a bearing for the valve stem 31. Between the diaphragm 35 and the spider 32 a water valve 40 is formed, which is integral with the stem 31 which is adapted to close against a seat 41 at the entrance to an axial passage 42 communicating with the outer side 23A of the housing, the passage is provided with a normally closed port 42A. The valve 40 is provided with a cylindrical portion 43 which is in effect a slack piston which serves to constrict the passage 42 during a portion of the valve movement. The chamber 24 is connected by a pipe 45 which connects with the pipe 12 leading from the pump casing 11. A port 48 communicates with a valve chamber 49 which communicates through a valve seat 50 with the side 23A of the housing 23 and a spring loaded ball valve 51 normally closes off said seat.

A pipe 53 connects the port 48 through a port 54, shown in dotted line in Figure 2, with an annular passage 55 in which a Venturi jet 56 leading from the exhaust chamber 21 is provided. The Venturi jet 56 is aligned with and adapted to pass exhaust gas from the engine through a discharge nozzle 57 and create a suction in the annular passage 55.

The pipe 7 from the water jacket is normally fitted with a check valve 59 and communicates with the chamber 21 so that the water discharging from the jacket may serve to keep the valve 30 cool when the exhaust from the engine is flowing past it. A pet cock, not shown, may be pro-

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vided to drain the water from the device when not in use.

The operation of the device 20 is as follows: When the pump is at rest and no fluid pressure is on the priming device 20, the parts will be in the position shown with the valve 30 closed upon its seat and so held by the spring 34. The water jacket 5 of the engine 3 is drained and the centrifugal pump 8 is also without sufficient water to operate. As soon as the engine 3 is started, the exhaust gases flow through the pipe 4 into the chamber 21 which is of sufficient size to smooth out the flow and pass a substantially non-pulsating stream through the Venturi jet 56 and the discharge nozzle 57, thus creating a suction through the outer side 23A of the housing 23, the passage 42, the chamber 24 and the pipe 45 and to the pump casing 11 and also to the jacket 5 of the engine 3. Since the check valves 15 and 59 are closed against return flow, the sub-atmospheric pressure developed in the pump and engine will cause water to be drawn up through a suction hose, not shown, through the suction casting 9 into the casing of the pump 8. As soon as water is received in the casing in sufficient volume to cause the pump impellers to take hold and develop more than atmospheric pressure, the check valves will open to deliver water through a hose, not shown, but connected to the hose fitting 16, and the check valve 59 will open to allow water to flow through the engine jacket 5 and simultaneously the water will flow under head pressure through the pipe 45, the chamber 24 and to the outer side of the diaphragm 35, forcing the diaphragm to the right as seen in Figure 2, against the pressure of the spring 34 and the valve 30 off its seat 29, so that the exhaust gas entering the chamber 21 will flow from the chamber 21 into the chamber 22 and to discharge therefrom. When sufficient pressure is built up in the space 23A to move the spring loaded valve 51 off its seat, water will flow therethrough and discharge through the annular passage 55 and the discharge nozzle 57.

Since no manipulation is required from the operator, the functions of the device follow in rapid succession and the engine is supplied with cooling water before any appreciable heat transfer has taken place between the hot cylinder gases and the engine parts, consequently no damage can occur to the engine.

With the device connected as shown in Figures 1 and 2, it will be noticed that the air is exhausted from the engine jacket until the pump is primed and that said water jacket is filled with water simultaneously with the entrance of water to the priming device 20.

In the modified or alternative connection of the device to a centrifugal pump and internal combustion engine water jacket, as shown in Figure 3, a stage, preferably the last stage of the pump 8, is connected by a pipe 61 to the port 42A leading to the axial passage 42 between the chamber 24 and the diaphragm housing 23. The chamber 24 is connected by a pipe 62 which leads to the annular passage 55 surrounding the Venturi jet 56. The port 43 communicating with the diaphragm housing 23 is connected by a pipe 63, which communicates with the bottom or inlet of the water jacket 5, and the top of the water jacket is connected by a pipe 64 directly to the exhaust chamber 21. In this case the check valve 59 previously referred to would be removed as it does not here serve any useful purpose.

As above connected the exhaust gas flows

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through the chamber 21 and the venturi 56 draws air from the pump 8 through pipe 61, along the axial passage 42, past the valve 40, through chamber 24, the pipe 62 and the annular passage 55 for discharge through the outlet nozzle 57, when the air is exhausted and water pressure reaches the axial passage 42 from the pump the force is exerted on the diaphragm, moving it to the right and causing the cylindrical portion 43 to enter said passage and constrict it, so that the outflow of water through the pipe 62 is limited and the speed of valve movement is unimpaired. As soon as the valve 40 is seated, the water flow to the venturi is stopped and the flow is diverted through the spring loaded valve 50, which is driven off its seat by the pressure, and continues to flow at a restricted or reduced pressure proportionate to the spring loading of the valve 50, through the pipe 63, the water jacket 5, the pipe 64 and through the exhaust chamber 21 and the exhaust outlet chamber 22 to discharge. With this installation, the pressure within the water jacket is appreciably less than the pump pressure and the water which enters the chamber 24 during the valve opening movement is drained off immediately thereafter into the pipe 62.

What I claim as my invention is:

1. A primer for gas engine driven centrifugal pumps having a non-return valve on the delivery outlet comprising a casing including an exhaust receiving chamber, an exhaust outlet chamber, a diaphragm housing and a pressure chamber, said pressure chamber being adapted to be connected to the pump delivery and said exhaust chamber being adapted to be connected to the exhaust manifold, a normally closed valve forming communication between the exhaust chamber and the exhaust outlet chamber, a diaphragm in the diaphragm housing for opening said normally closed valve, an ejector in open communication with the exhaust chamber and adapted to be operated by exhaust gas entering said chamber, a suction passage forming part of the ejector, a pipe connecting the suction passage with one side of the diaphragm housing and a water passage between said side of the diaphragm housing and the pressure chamber.

2. A primer for gas engine driven centrifugal pumps having a non-return valve on the delivery outlet comprising a casing including an exhaust receiving chamber, an exhaust outlet chamber, a diaphragm housing and a pressure chamber, said pressure chamber being adapted to be connected to the pump delivery and said exhaust chamber being adapted to be connected to the exhaust manifold, a normally closed valve forming communication between the exhaust chamber and the exhaust outlet chamber, a diaphragm in the diaphragm housing for opening said normally closed valve, an ejector in open communication with the exhaust chamber, and adapted to be operated by exhaust gas entering said chamber, a suction passage forming part of the ejector, a pipe connected with the suction passage and having a spring loaded valve, said pipe connecting the suction passage and a water passage between said side of the diaphragm housing with the pressure chamber.

3. A primer for gas engine driven centrifugal pumps having a non-return valve on the delivery outlet comprising a casing including an exhaust receiving chamber, an exhaust outlet chamber, a diaphragm housing and a pressure chamber, said pressure chamber being adapted to be con-

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ected to the pump delivery and said exhaust chamber being adapted to be connected to the exhaust manifold, a normally closed valve forming communication between the exhaust chamber and the exhaust outlet chamber, said normally closed valve having a stem extending through the exhaust outlet chamber, the diaphragm housing and into the pressure chamber, a diaphragm in the diaphragm housing connected to the valve stem, spring means for normally holding the valve closed, an ejector in open communication with the exhaust chamber and adapted to be operated by exhaust gas entering said chamber, a suction passage forming part of the ejector, a pipe connecting the suction passage with one side of the diaphragm housing, a water passage between said side of the diaphragm housing and the pressure chamber and means for closing off the water passage between the diaphragm housing and the pressure chamber as the diaphragm is moved in response to positive pressure being developed within the pressure chamber following the priming of the pump.

4. A primer for gas engine driven centrifugal pumps having a non-return valve on the delivery outlet comprising a casing including an exhaust receiving chamber, an exhaust outlet chamber, a diaphragm housing and a pressure chamber, said pressure chamber being adapted to be connected to the pump delivery and said exhaust chamber being adapted to be connected to the exhaust manifold, a normally closed valve forming communication between the exhaust chamber and the exhaust outlet chamber, said normally closed valve having a stem extending through the exhaust outlet chamber, the diaphragm housing and into the pressure chamber, a diaphragm in the diaphragm housing connected to the valve stem, spring means for normally holding the valve closed, an ejector in open communication with the exhaust chamber and adapted to be operated by exhaust gas entering said chamber, a suction passage forming part of the ejector, a pipe connecting the suction passage with one side of the diaphragm housing, a water passage between said side of the diaphragm housing and the pressure chamber, and means for closing off the water passage between the diaphragm housing and the pressure chamber as the diaphragm is moved in response to positive pressure being developed within the pressure chamber following the priming of the pump, said means being a valve secured to the valve stem.

5. A primer for gas engine driven centrifugal pumps having a non-return valve on the delivery outlet comprising a casing including an exhaust receiving chamber, an exhaust outlet chamber, a diaphragm housing and a pressure chamber, said pressure chamber being adapted to be connected to the pump delivery and said exhaust chamber being adapted to be connected to the exhaust manifold, a normally closed valve forming communication between the exhaust chamber and the exhaust outlet chamber, a diaphragm in the diaphragm housing for opening said normally closed valve, an ejector in open communication with the exhaust chamber and adapted to be operated by exhaust gas entering said chamber, a suction passage forming part of the ejector, a pipe connecting the suction passage with

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one side of the diaphragm housing and a water passage between said side of the diaphragm housing and the pressure chamber, and means for admitting water to the exhaust chamber to cool and combine with the gases passing into the exhaust outlet passage and to cool the valve.

6. A primer for gas engine driven centrifugal pumps comprising a casing including an exhaust receiving chamber adapted for pipe connection to the engine exhaust, an exhaust outlet chamber, a diaphragm housing, a diaphragm in the housing, a pressure chamber, a water passage between the diaphragm housing and the pressure chamber, a valve stem passing through the diaphragm housing and the water passage and adapted to be actuated in one direction by the diaphragm and by spring means in the opposite direction, a valve on the stem normally closing communication between the exhaust receiving chamber and the exhaust outlet passage, a second valve, normally open, adapted to close off the pressure chamber from the water passage, an outlet port from the diaphragm housing having a spring loaded valve, an ejector in communication with the exhaust chamber adapted to be operated by exhaust from the engine, said spring loaded valve being adapted for connection to the engine water jacket, said pipe connection to the pressure chamber being adapted for connection to the suction connection of the ejector and said water passage pipe connection being adapted for connection to the centrifugal pump.

7. A primer for gas engine driven centrifugal pumps comprising a casing including an exhaust receiving chamber adapted for pipe connection to the engine exhaust, an exhaust outlet chamber, a diaphragm housing, a diaphragm in the housing, a pressure chamber, a water passage between the diaphragm housing and the pressure chamber, a valve stem passing through the diaphragm housing and the water passage and adapted to be actuated in one direction by the diaphragm and by spring means in the opposite direction, a valve on the stem normally closing communication between the exhaust receiving chamber and the exhaust outlet passage, a second valve, normally open, adapted to close off the pressure chamber from the water passage, an outlet port from the diaphragm housing having a spring loaded valve, a pipe connection with the exhaust receiving chamber, a pipe connection in communication with the pressure chamber, a pipe connection in communication with the water passage, an ejector in communication with the exhaust chamber adapted to be operated by exhaust from the engine and a suction connection in communication with the ejector adapted for communication with the water passage.

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