May 16, 1944. E. A. WILHELM 2,349,029

PRIMING SYSTEM FOR CENTRIFUGAL PUMPS

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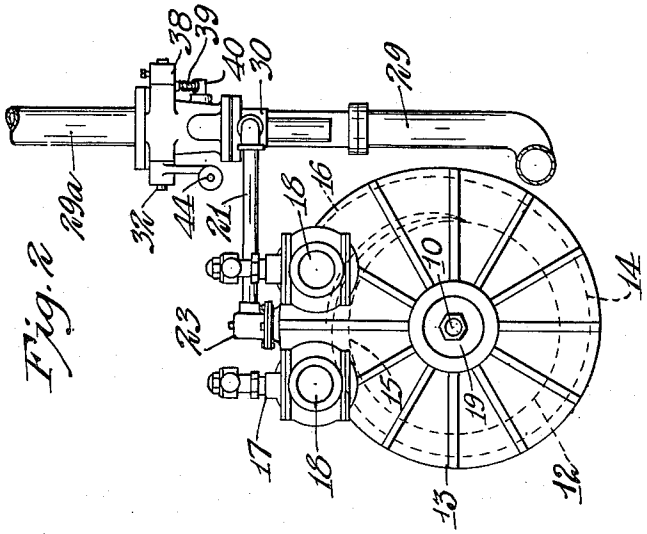


Fig. 2

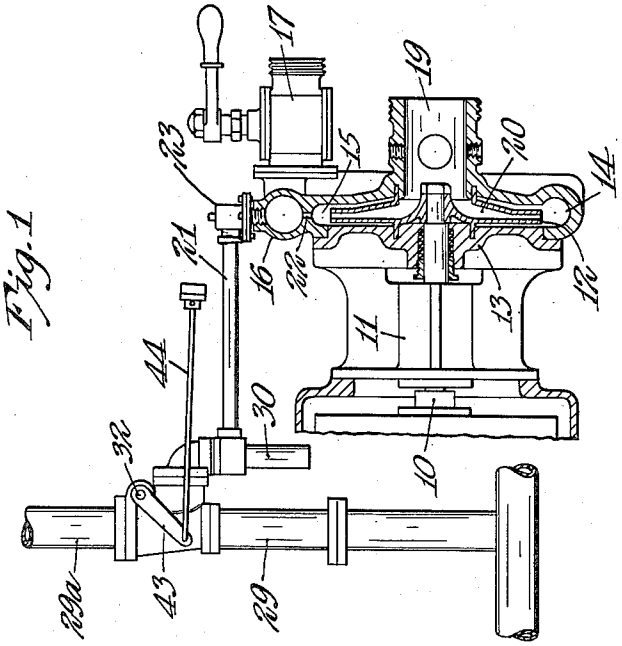


Fig. 1

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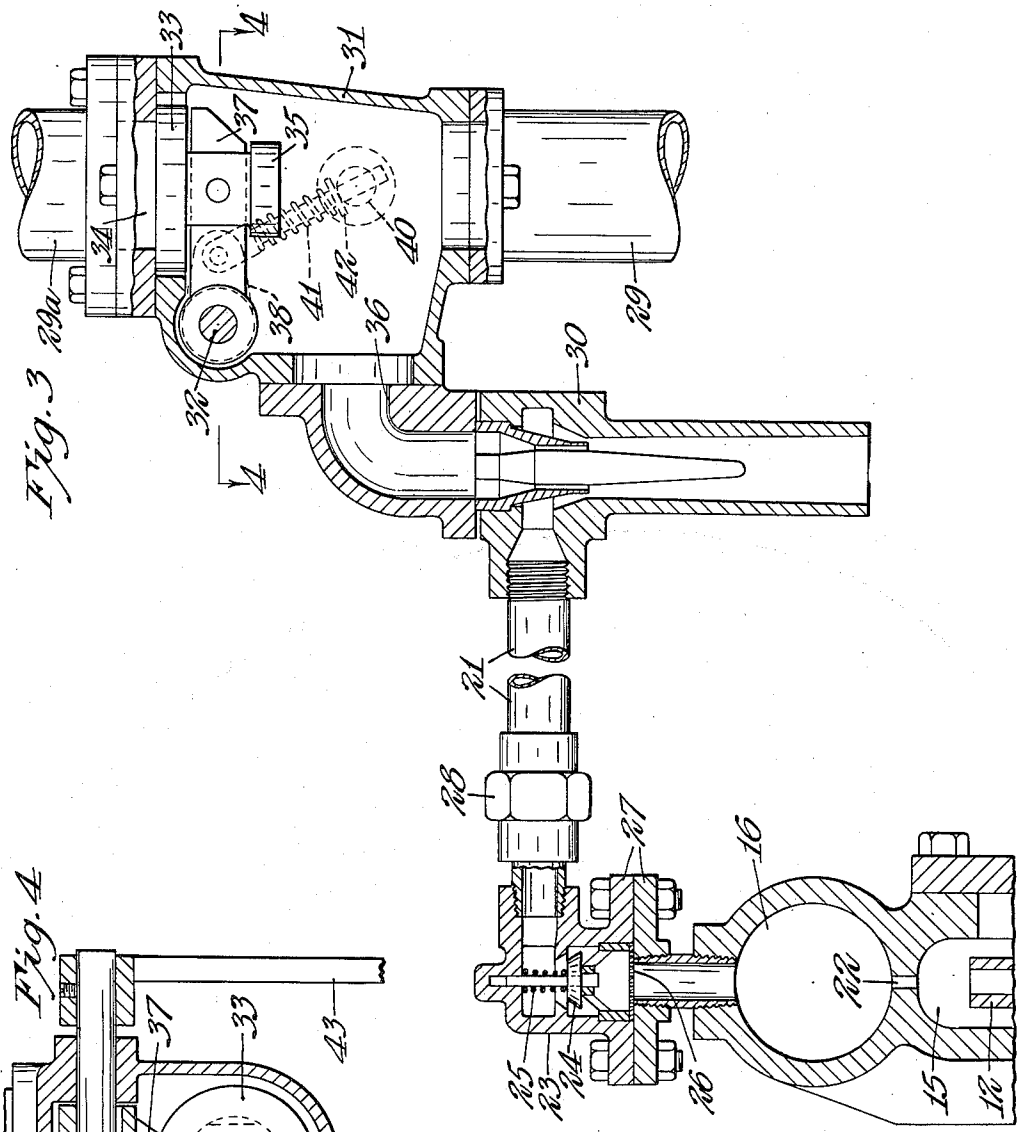


Fig. 3

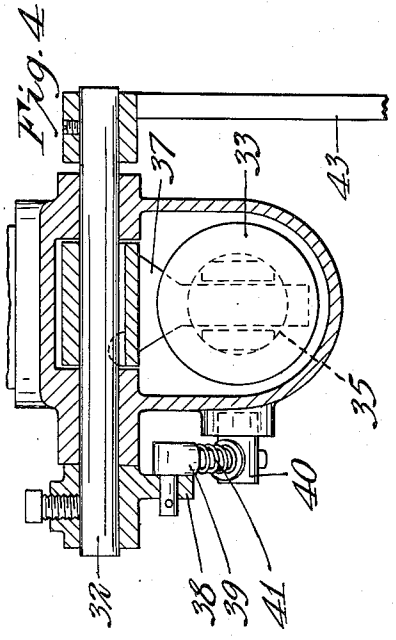


Fig. 4

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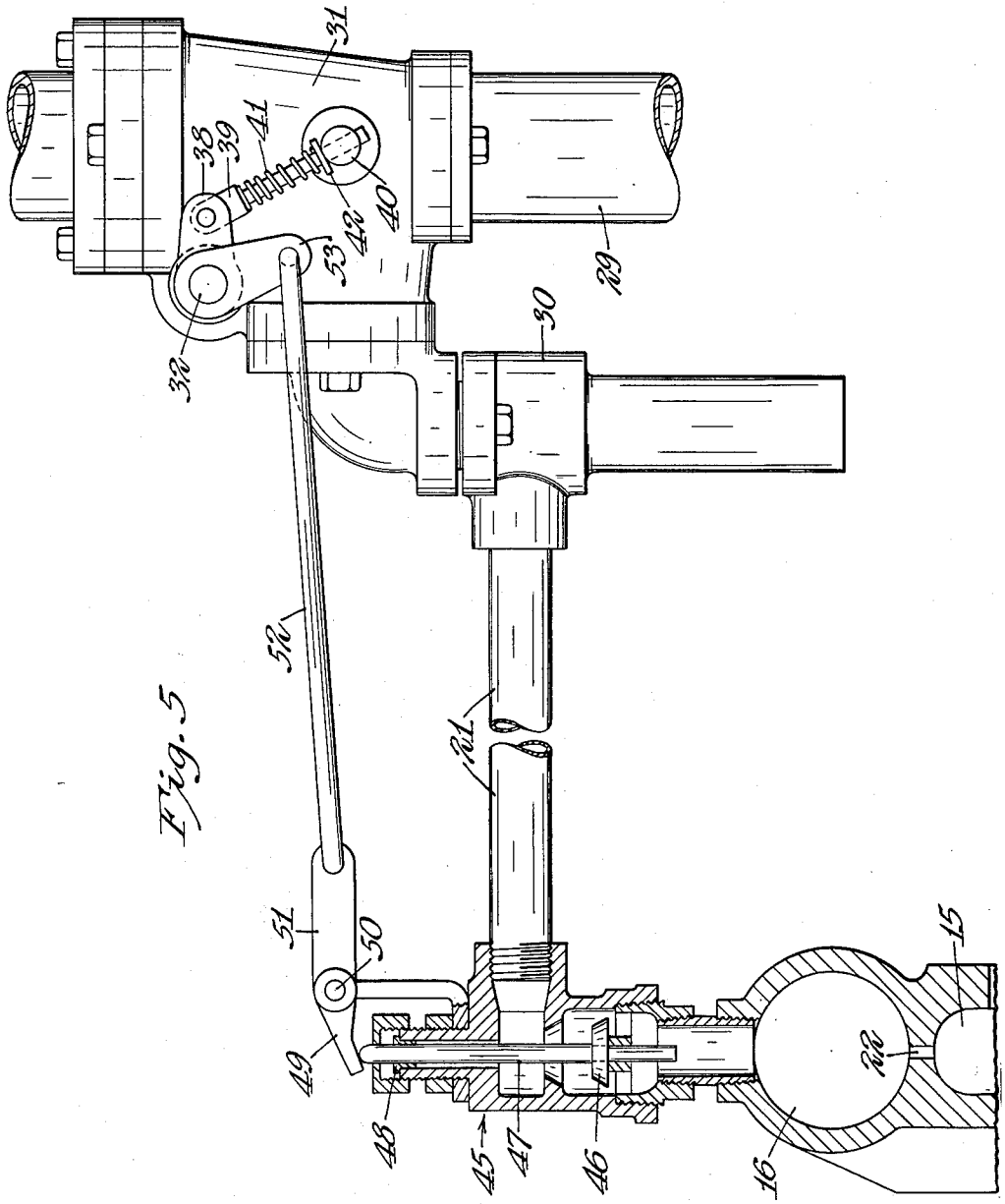


Fig. 5

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Fig. 7

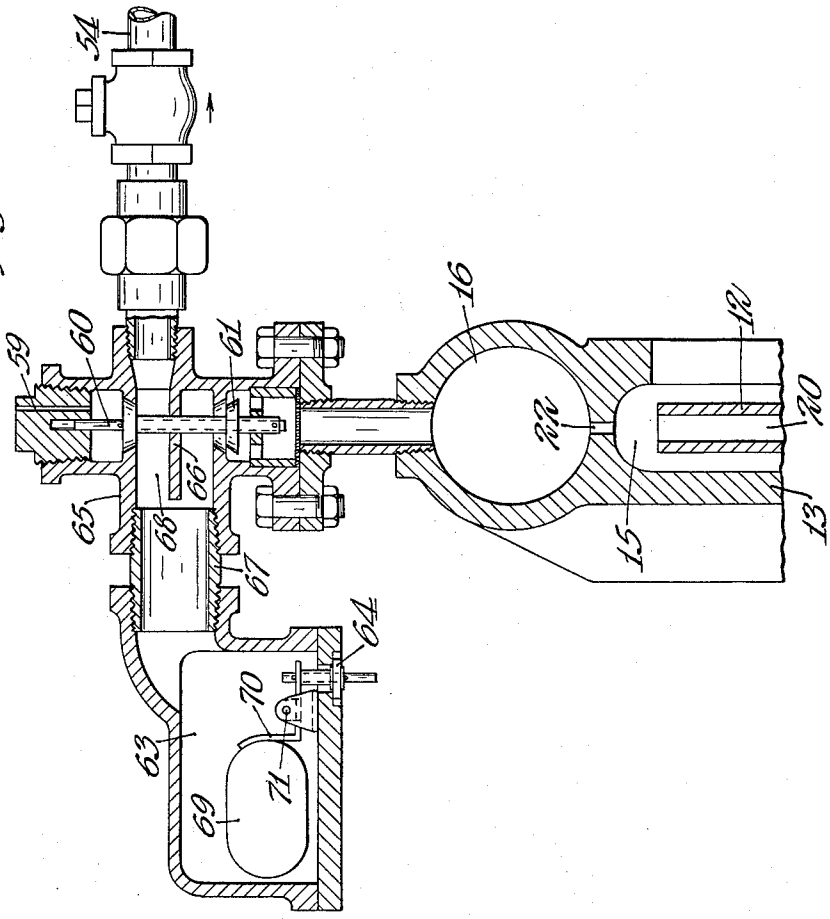
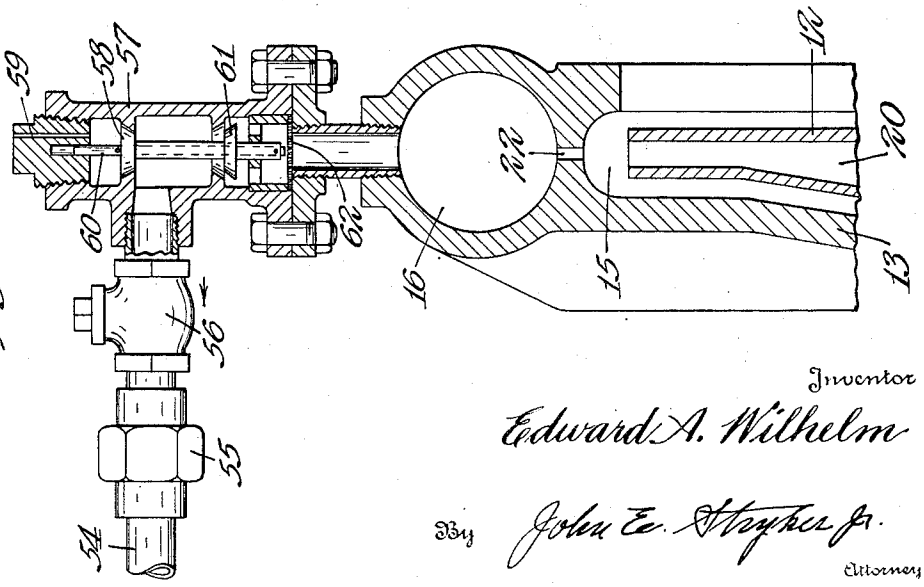


Fig. 6



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UNITED STATES PATENT OFFICE

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PRIMING SYSTEM FOR CENTRIFUGAL PUMPS

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Application March 2, 1942, Serial No. 433,013

8 Claims. (Cl. 103—113)

This invention relates particularly to centrifugal pumps of the types ordinarily driven by internal combustion engines and used as fire fighting equipment.

It is an object of this invention to provide a novel priming system for centrifugal pumps whereby the time required for priming is reduced and the operation of the pump is so simplified that considerably less skill and experience is required on the part of the operator.

A further object is to provide a priming system adapted to be operated by suction created either by an engine exhaust ejector device or by connection with the intake manifold of an engine or by other suction-creating apparatus where flow of substantial quantities of water into the suction pipe must be prevented.

A particular object is to provide a priming system wherein the primer suction pipe is connected to the upper portions of the discharge passage, volute and impeller chamber of the pump thus avoiding the disadvantages of conventional priming systems wherein the suction is applied directly to the intake passage of the pump.

A still further object is to provide a priming system wherein a suction pipe is connected to the discharge passage of the pump and a valve is arranged in this pipe to close the priming connection automatically upon the development of pressure in the discharge passage.

Other objects will appear and be more fully pointed out in the following specification and claims.

Referring to the accompanying drawings:

Figure 1 is a side elevation of my improved priming system as applied to a centrifugal pump and connected to a suction device of the engine exhaust ejector type, the pump being shown in central vertical section;

Fig. 2 is an end view of the pump and priming system shown in Fig. 1;

Fig. 3 is an enlarged part side elevation and part vertical section illustrating the form of my invention shown in Figs. 1 and 2.

Fig. 4 is a fragmentary horizontal section taken approximately on the line 4—4 of Fig. 3;

Fig. 5 shows an alternate form of the invention wherein the exhaust ejector valve may be automatically operated by a pressure controlled primer valve; and

Figs. 6 and 7 illustrate applications of my invention wherein the primer suction pipe is connected to the intake manifold of an internal combustion engine.

As shown in Figs. 1 and 2, my invention is applied to a centrifugal pump having an engine driven shaft 10 supported in a bearing 11 and a pump impeller 12 mounted on the shaft to rotate in a housing 13. Formed in this housing at the outer periphery of the impeller is a volute passage 14, the size of which, in cross sectional area, progressively increases from its inner and upper end portion 15 to a discharge passage 16 extending above the volute and communicating with a pair of valves 17 having outlet ports 18. An intake or suction passage 19 communicates at its inner end with the impeller passages 20 and is adapted to be connected by a suitable hose to a water supply pool or hydrant. It will be understood that the pump shaft 10 is normally driven by an engine (not shown) to draw water into the passage 19 and discharge it at high pressure through the valves 17.

In order to start the supply of high pressure water when the intake, impeller and volute passages contain air, it is necessary to prime the pump by drawing the air from these passages and filling them with water. To accomplish this withdrawal of air quickly and easily I connect a suction pipe 21 to the top of the pump casing so that this pipe is adapted to communicate with the discharge passage 16 and also with the top of the volute passage 14 through a small perforation 22 in the wall of the pump casing separating the passage 14 from the passage 16. This opening 22 is preferably small—approximately ⅛ inch in diameter.

I provide a valve 23 to control communication between the pipe 21 and pump discharge passage. As shown in Fig. 3, this valve has a closure member 24 mounted on a guide stem and a small spring 25 which normally holds it in open position. A strainer 26 may be positioned in the passage between the pump and valve but this strainer is of less importance than in ordinary priming systems which discharge considerable quantities of water through the primer pipes. To facilitate access to this strainer for cleaning, the valve is made readily detachable from the pump by providing the bolted flange connection 27 below the valve and a pipe union 28 in the pipe 21.

Suction may be created in the pipe 21 by various means. As shown in Figs. 1 to 4, inclusive, suction is created by utilizing exhaust gases from the engine exhaust pipe 29 in an ejector 30 which is connected to the exhaust pipe by a valve casing 31. Within this casing and pivoted on a shaft 32 are a head 33 adapted to close the main exhaust port 34 and a head 35 adapted to close the ejector port 36. These heads are mounted

on an arm 37 which is keyed to the valve shaft 32, as shown in Fig. 4. Spring-actuated toggle members are provided to resiliently retain the head 33 in closed position when the head 35 is open and to retain the latter closed when head 33 is open. The toggle members comprise a member 38 fixed on the shaft 32 and a member 39 pivotally connected to the member 38 at one end and slidably fitting in a bearing formed in a short rock shaft 40 mounted on the casing 31. A coiled spring 41 is confined on the member 39 between a shoulder formed thereon and a washer 42 which is slidable on the member 39 and arranged to engage the periphery of the shaft 40.

As best shown in Fig. 1, a small lever 43 is fixed on an end of the valve shaft 32 and a manually operable rod 44 is connected to the free end of the lever 43 to facilitate operation of the valve to and from the priming position shown in Figs. 1 and 3. Assuming that the pump engine is in operation and the intake passage 19 is connected to a source of water supply, the primer is operated to exhaust air from the pump passages merely by moving the valve lever 43 to close the head 33 at the port 34. This by-passes the exhaust gases through the ejector 30 and creates suction in the pipe 21 to thereby exhaust air from the impeller passages 20 and volute passage through the small perforation 22 as well as from the top of the discharge passage 16 through the screen 26 and valve 23. Water from the intake passage 19 is thus drawn up into the several passages 14, 16 and 20 and the pump operated to deliver water under pressure at the valves 17. The resulting pressure in the discharge passage closes the valve member 24 quickly so that only a small amount of water escapes into the suction pipe and ejector. Now either or both of the valves 17 may be opened to supply high pressure water. It will be understood that the exhaust valve head 35 is now closed at port 36 by operating the lever 43 to cut off the exhaust gases for the ejector and allow them to pass through the extension 29a of the exhaust system.

The small perforation 22 does not interfere materially with the normal operation of the pump and it will be evident that leakage at the primer valve and suction connections cannot operate to destroy the prime of the pump as in systems where the primer connection is made with the pump intake. My primer valve closure 24 remains in closed position as long as substantial pressure is maintained in the pump discharge passages.

In Fig. 5 I have shown a connection between the primer valve and exhaust valve whereby the closing of the former operates automatically to return the exhaust valve to normal position when the pump has been primed and is in normal operation. In this arrangement a valve 45 of a different type is used in place of the valve 23. A valve head 46 has a long stem 47 which projects through a packing gland 48 at the top of the valve casing and the upper end of the valve stem engages a lever 49 having a pivotal support 50 mounted on the valve casing. An arm 51 of lever 49 is connected by a link 52 to an arm 53 fixed on the exhaust valve shaft 32. When the valve 45 is open the exhaust valve is closed at its port 34 so that the ejector 30 is in operation. Upon the development of water pressure in the discharge passage 16 of the pump the head 46 is moved upward to closed position and the stem 47 actuates the lever 49 to swing the arm 51 downward. This causes the link 52 and arm 53 to actuate the toggle members 38 and 39 to a position beyond their aligned or dead center positions. From this position the spring 41 actuates the valve head 35 to close the port 36 and thereby restores the engine exhaust valve to its normal operating position.

Referring to Fig. 6, I have illustrated a form of my invention wherein a pipe 54 is connected at one end to the intake manifold of the engine and at the other end to the top of a centrifugal pump so that the pump may be primed by utilizing the suction produced by the engine in its fuel intake manifold. A union 55 and a check valve 56 are provided along the pipe 54 which communicates with a valve casing 57. Within this casing is a head 58 adapted to close downward and having an upper surface exposed to atmospheric pressure, a small vent passage 59 being provided at the top. The head 58 is mounted on a valve stem 60 which also has fixed thereon a second head 61 adapted to close upward against its seat to close communication between the suction pipe 54 and pump discharge passage 16. Mounted in the passage below the valve head 61 is a strainer 62. After each priming operation pressure is developed in the discharge passage 16 so that the head 61 is forced upward and closes against its seat while the head 58 is moved to open position. This action takes place so rapidly that only a small amount of water escapes past the valve into the engine intake manifold. The check valve 56 guards against loss of the priming of the pump in the event of a back fire in the engine, this valve being arranged to close upon the creation of pressure in the pipe 54 in excess of that in the valve casing 57.

In Fig. 7 I have shown a modification of the valve illustrated in Fig. 6 whereby any water that may escape past the valve head 61 is trapped in a chamber 63 and allowed to escape through a float operated valve 64. The valve casing 65 is formed with a baffle 66 extending above the seat for the head 61. Any fluid that enters the casing 65 above the head 61 is deflected laterally into a passage 67 extending to the float chamber 63 while the air is drawn through a passage 68 above the baffle extending to the suction pipe 54. Within the chamber 63 is a float 69 attached to a lever 70 having a pivotal support 71, the lever being arranged to actuate the stem of the valve 64. This valve opens downward and is normally held in closed position by the weight of the float 69. It is opened automatically by accumulations of water in the chamber sufficient to raise the float 69.

It will be evident that the forms of my invention illustrated in Figs. 5, 6 and 7 operate in the same manner as those illustrated in Figs. 1 to 4, as far as exhausting air from the pump passages is concerned. With all forms of the invention, the operator merely delays the opening of the outlet valves 17 until the water pressure has developed in the discharge passages.

My system may be used in connection with centrifugal pumps of two or multiple stage types either connected in parallel or in series. For such use, branches of the priming pipe are connected to the outlet passages of the several pump casings and automatically operating check valves are provided for controlling communication between the several pipe branches and pump outlet passages.

With the ordinary priming system having a priming pipe connected to the pump intake and a manually operable valve controlling communication through this pipe, any leakage in the connections or valve causes a loss of the pump prime. Moreover, the operation of the several valves of the common priming systems requires considerable knowledge and skill such as that demanded for the gradual opening of the outlet valves at the proper moment to avoid loss of prime. Such skill is not required for the practical operation of my improved priming system. The present invention has the further advantages of reducing the time required to pump water and of preventing the passage of substantial amounts of water into the primer pipe.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. The combination with a centrifugal pump having a discharge passage and a wall separating said passage from an impeller chamber, of a suction pipe communicating with said discharge passage, a restricted passageway connecting the top of said impeller chamber with said discharge passageway and means for closing said suction pipe.

2. The combination with a centrifugal pump having a discharge passage within the upper portion of the pump and a wall separating said passage from an impeller chamber below, of a suction priming pipe adapted to communicate with said discharge passage, said wall being formed with a minute perforation connecting the top of said chamber with the discharge passage and means for closing said suction pipe.

3. The combination with a centrifugal pump having a discharge passage, of a wall separating said passage from an impeller chamber a suction priming pipe communicating with said discharge passage, a restricted passageway connecting the top of said chamber with the discharge passage and means for closing said suction pipe upon the development of fluid pressure in said discharge passage.

4. The combination with a centrifugal pump having a discharge passage within the upper portion of the pump, of a wall separating said passage from an impeller chamber below, a suction priming pipe connected to the upper extremity of said discharge passage, said wall being perforated to allow the withdrawal of air from the top of said chamber into the discharge passage and means for closing said suction pipe.

5. The combination with a centrifugal pump having a discharge passage, of a suction pipe adapted to communicate with said passage, a valve controlling communication between said pipe and passage, said valve being normally open and being adapted to be closed by fluid pressure in said discharge passage, a trap disposed to receive liquid from the discharge side of said valve and a float controlled valve adapted to drain accumulations of water from said trap.

6. The combination with a centrifugal pump having a discharge passage, of a primer pipe connected with said passage, a valve controlling communication between said pipe and passage, said valve being normally open and being adapted to be closed by fluid pressure in said discharge passage, a water trap interposed between said valve and pipe and a drain valve mounted in the bottom of said trap, said drain valve being normally closed and adapted to be opened to discharge accumulations of water from said trap.

7. The combination with a centrifugal pump having a discharge passage, of a suction pipe adapted to communicate with the upper portion of said passage and a valve controlling the communication between said pipe and passage comprising a casing formed with a chamber having a vent opening and a second chamber communicating with said suction pipe, a valve head adapted to close communication between said chambers and being normally held in closed position by atmospheric pressure in said first mentioned chamber, a second valve head adapted to close communication between said second chamber and the discharge passage, said second valve head being adapted to be closed by fluid pressure in said discharge passage and means connecting said valve heads together whereby said first mentioned valve head is moved to open position upon the closing of said second valve head and the latter is urged toward open position by atmospheric pressure on the first mentioned head.

8. The combination with a centrifugal pump having a discharge passage extending to the top of the pump, of a suction priming pipe adapted to communicate with said passage and a valve controlling the communication between said passage and pipe, said valve having a spring normally retaining it in open position and having a closure member normally positioned to restrict the passage and to be closed solely by pressure upon the development of fluid pressure in said passage.

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