Nov. 5, 1929. C. A. DUNHAM 1,734,567

PRIMER FOR VACUUM PUMPS

Filed July 18, 1927 2 Sheets-Sheet 1

Fig. 1.

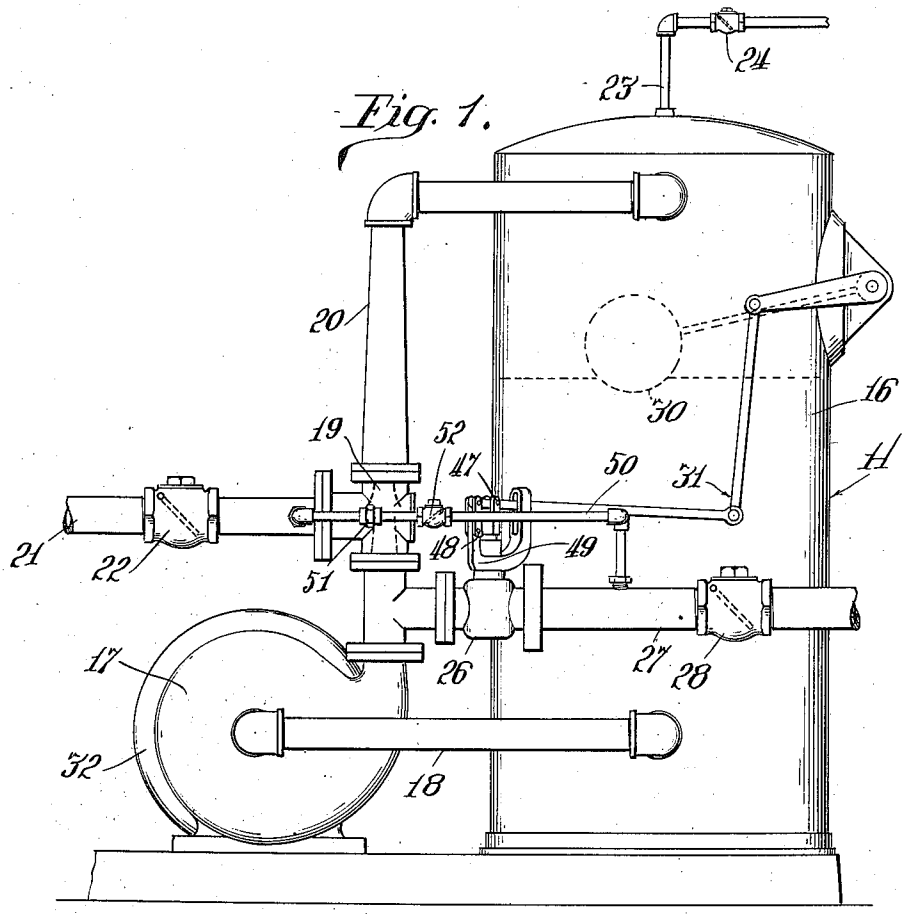


Fig. 2.

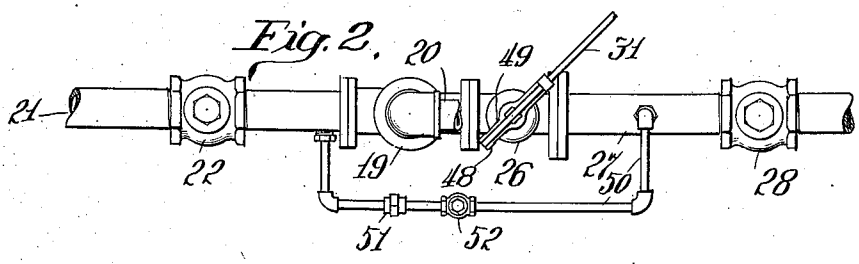
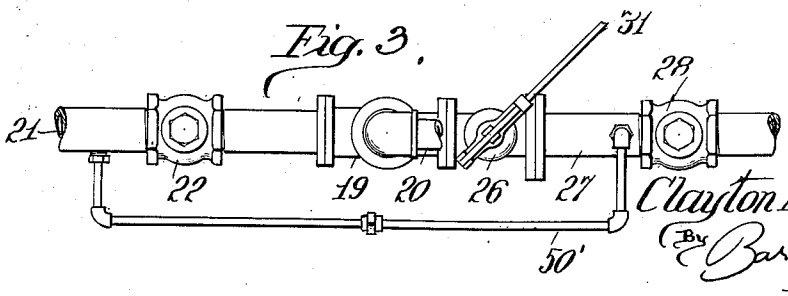


Fig. 3.



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Fig. 4

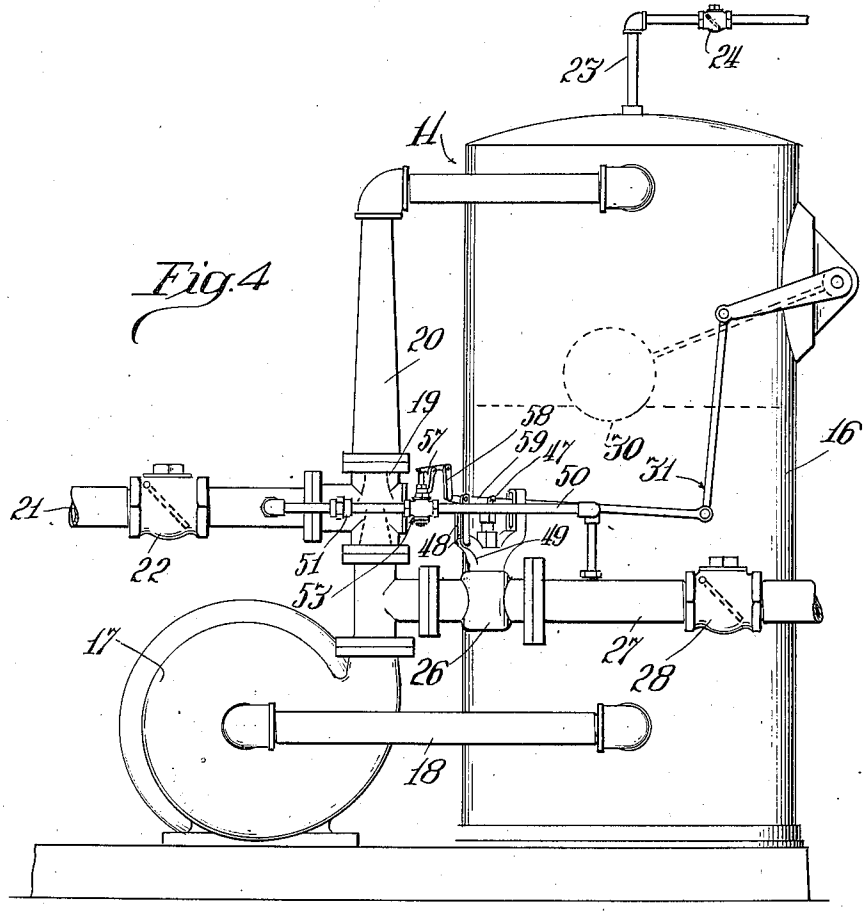


Fig. 5.

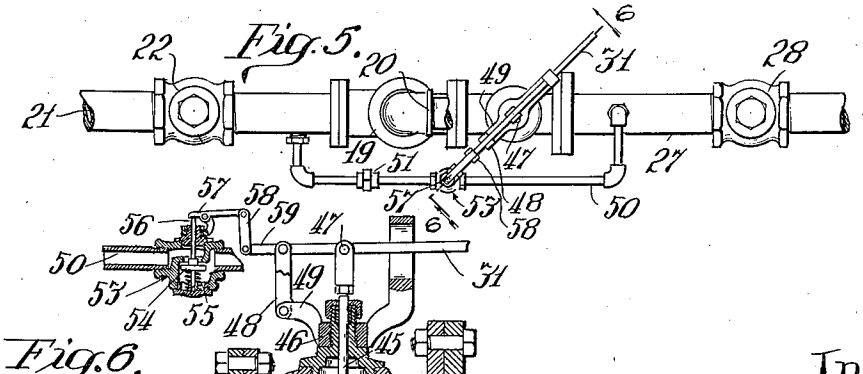


Fig. 6.

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UNITED STATES PATENT OFFICE

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PRIMER FOR VACUUM PUMPS

Application filed July 18, 1927. Serial No. 206,546.

This invention relates to a priming pipe connection for pumps, and more particularly to a pipe connection for returning to the low-pressure side of the pump and thence into the pumping system, the liquids which may leak past the closed cut-off valve in the outlet or discharge connection from the pumping system. This invention is particularly designed and adapted for use in connection with the pumping mechanism used to maintain the sub-atmospheric pressures in a vacuum steam heating system, such for example as the one shown and described in detail in my copending application Serial No. 171,616, filed Feb. 28, 1927, now Patent No. 1,644,114, granted October 4, 1927.

The pumping system comprises an inlet with which communicates the return pipe from the heating system, and an outlet through which water is forced back to the boiler or generator of the heating system. The pumping system maintains a relatively low pressure or vacuum in the return pipe so that air and condensate will be drawn into the pumping system, and a relatively high pressure is maintained in the discharge pipe so that water can be forced out against the boiler pressure. A cut-off valve in this discharge pipe is normally closed, but is opened by a float-controlled mechanism when a certain amount of water has accumulated in the pumping system so that the excess water will be forced back to the boiler. Sometimes this cut-off valve will leak, due to foreign matter lodging on the valve seat, or other failure of the valve to properly close, and in case this leakage exceeds the amount of condensate drawn in through the inlet pipe, the pumping system will eventually lose its prime and cease to be operative. According to the present invention, a relatively small conduit or pipe connection is provided between the outlet or discharge pipe beyond the cut-off valve, and the inlet or heating-system return pipe. Due to the relatively lower pressure which is normally maintained in this inlet pipe, any liquids which leak past the cut-off valve will be drawn back through this auxiliary pipe connection into the inlet pipe and thence returned to the pumping system.

Under certain conditions the pressure in the outlet pipe or boiler-feed pipe might fall below that existing in the return or inlet pipe, in which case liquid would be drawn from the pumping system through the auxiliary or primer pipe connection. To prevent this, a one-way valve opening toward the return pipe, may be provided in this primer pipe connection. In another form of the invention, a cut-off valve may be provided in the former pipe adapted to prevent flow through the pipe in either direction, this valve being connected with the operating mechanism of the main cut-off valve in such a manner that when one of these valves is closed, the other is opened, and vice versa. This arrangement of the valves will prevent the return of any portion of the water to the heating system when the main cut-off valve is opened to force water into the boiler.

The general object of this invention is to provide improvements in priming connections for pumping systems, as briefly described hereinabove and as disclosed more in detail in the specification which follows.

Other objects and advantages of the invention will be more apparent from the following detailed description of certain approved forms of apparatus designed according to the principles of this invention.

In the accompanying drawings:

Fig. 1 is an elevation, of the pumping mechanism with the improved primer means embodied therein.

Fig. 2 is a plan view of that portion of the apparatus shown in Fig. 1, which embodies the priming means.

Fig. 3 is a plan view similar to Fig. 2, but showing a modification.

Fig. 4 is an elevation, similar to Fig. 1, but showing another modification of the priming connections.

Fig. 5 is a plan view of the form of priming connections shown in Fig. 4.

Fig. 6 is an enlarged vertical section through the valves taken substantially on the line 6—6 of Fig. 5.

The suction producing mechanism H, as here shown, comprises a tank 16 partially filled with water, from the lower portion of

which a pump 17 withdraws water through intake pipe 18 and forces this water upwardly through a jet exhauster 19 and discharge pipe 20 into the upper portion of tank 16. This hurling water circuit produces a suction in the casing of ejector 19, which draws in water and air returned from a heating system, or other source, through pipe 21, these gases and condensates being carried along with the water of the hurling circuit and discharged into the tank 16. A one-way check valve 22 in pipe 21 prevents the return of these materials to the low pressure pipe 21. The gases discharged into tank 16 are vented to the atmosphere through pipe 23, provided with check valve 24. A second outlet from the centrifugal pump 17 leads through cut-off valve 26, pipe 27, and one-way check valve 28 to the generator of the heating system, or other desired point of discharge. A float 30 in tank 16 operates, when the level of accumulated liquid in the tank 16 has reached a certain height, through the link and lever connections 31 to open the valve 26 and permit the pump 17 to force water out through pipe 27 and check valve 28.

I will first refer to the form of the invention shown in Figs. 1 and 2, and also briefly to Fig. 6, which shows a cross section of the cut-off valve 26, which valve may be used in any of the modifications. In the example here shown, this is a semi-balanced valve comprising a casing having an interior web 42 provided with aligned valve openings which are simultaneously closed by the valves 43 and 44 mounted on a valve stem 45 extending out through stuffing box 46 at the top of the valve casing. Valve stem 45 is pivoted at 47 to an intermediate portion of the valve-operating lever 31, which lever is fulcrumed adjacent its end on a link 48 pivoted to a bracket 49 mounted on the valve casing. The lever connections 31 are operated by float 30 in tank 16, as already described. This valve structure is common to all of the modifications here shown. It is to be understood, however, that any other form of cut-off valve could be used at this location, and the improvements of the present invention would be equally applicable for use with such valves.

At times, for one reason or another, this valve 26 may fail to completely close. This is sometimes caused by foreign matter, which is always present in heating systems, lodging on the valve seats. This will permit the release or leakage of some water from the hurling circuit into the outlet pipe 27 during periods of operation when little or no condensate is being returned to tank 16 from the heating system. If the rate of leakage through the valve 26 should be more than the rate at which condensate is being returned through pipe 21 into the hurling circuit, there is a possibility that the water level in tank 16 will be so lowered that the vacuum pump will lose its prime, and the vacuum-producing apparatus will become inoperative. The object of this invention is to provide means for maintaining the prime in the pump in case of leakage of the cut-off valve 26. This is accomplished by returning such water as may leak through the valve when closed, back into the hurling circuit. Referring again to Figs. 1 and 2, a small return pipe connection 50 is provided for returning the leakage from the outlet pipe to the inlet pipe. One end of this connection 50 communicates with the outlet pipe 27 between valve 26 and check valve 28, and the other end communicates with the inlet pipe 21 between check valve 22 and the casing of the jet exhauster 19. The union indicated at 51 is simply for the purpose of facilitating the installation of the sections of pipe connection 50.

In heating systems where a vacuum is maintained in the return line only, the apparatus in its simplest form, as just described, will be sufficient. Since a lower pressure is normally maintained in the return or inlet pipe 21 than exists in the outlet pipe 27, any water which leaks past the cut-off valve 26 will be drawn back through the pipe connection 50 into inlet pipe 21 and thence drawn back into the hurling circuit by jet exhauster 19. Of course, at times when cut-off valve 26 is opened and water is being discharged through pipe 27 back to the generator, some of this water will be returned through pipe 50 to the hurling circuit, but this amount will be negligible compared with the amount discharged through pipe 27. The return or primer pipe 50 need only be of a size sufficient to accommodate the maximum leakage that may occur when valve 26 is closed.

In case the heating system is of such type that the boiler pressure may at times fall below the pressure in the return pipe 21, the possibility would arise of water being drawn out from the hurling circuit through pipe 21, pipe connection 50, and pipe 27, into the boiler, thus destroying the prime in the pumping system. To prevent this, a one-way check valve 52 opening toward the inlet pipe 21 may be installed at any point in the pipe connection 50.

In the modification shown in Fig. 3, the check valve 52 is omitted, but the primer pipe connection 50′ is connected into return pipe 21 back of the check valve 22, instead of between this check valve and the jet exhauster 19. By this arrangement, the check valve 22 will prevent water being drawn out from the hurling circuit through the primer pipe connection when the pressure in the boiler falls below that in the return main 21.

In the form of the invention shown in Figs. 4, 5 and 6, a spring-pressed cut-off valve 53 is provided in the return pipe 50. Connections are provided whereby this valve will always be closed when the cut-off valve 26 is

open, and will be open when the cut-off valve 26 is closed. This will prevent the return of any water through primer pipe 50 when the cut-off valve 26 is opened to permit water to be forced back to the boiler. As here shown, the valve 53 comprises a movable valve member 54 which is normally held against its seat by a spring 55. The stem 56 of valve 54 engages one end of an intermediately pivoted lever 57, which is connected by link 58 with the extended end portion 59 of the main valve operating lever 31. When the main cut-off valve 26 is closed (as shown in Fig. 6), the lever and link connections will cause the lever 57 to press down on the valve stem 56 and hold the valve member 54 off its seat, so that valve 53 will be open to permit the return of leakage through pipe connection 50. However when lever 31 is raised to open the valve 26, lever 57 will be elevated so as to permit the spring 55 to force valve member 54 upwardly against its seat and close the valve 53, thus preventing the return of any water through pipe connection 50 at this time. In addition to the automatically operated valve 53, a check valve, such as shown at 52 in Figs. 1 and 2 could be installed in the pipe connection 50, to prevent the withdrawal of water from the hurling circuit through this pipe connection when the boiler pressure falls below that in the return main. Other forms of valves than those here shown could be substituted for either of the cut-off valves 26 or 53, and any equivalent form of valve operating connections could be provided whereby one of these valves will be closed when the other is open, and vice versa. It is also apparent that the improvements of this present invention could be used in connection with other forms of exhausting apparatus than that here shown and described. It is only essential that the outlet end of the primer pipe connection communicate with an inlet portion of the exhausting apparatus which is normally at a lower pressure than the pressure existing in the pipe wherein the leakage accumulates.

The priming pipe 50 might be connected at its inlet end with the boiler feed pipe 27 beyond the one-way valve 28, or with any other water pipe or space that is normally at boiler pressure. In this form of the apparatus there would be a substantially continuous flow of water from the boiler back to the low-pressure inlet pipe 21, but since pipe 50 is of small capacity this back flow would be more than offset by the water intermittently forced to the boiler through pipe 27, and a continual priming of the pumping system would be assured. The return pipe 50 should be of small capacity but sufficient to compensate for any possible leakage through cut-off valve 26 when this valve is closed.

I claim:

1. The combination with a pumping system comprising an inlet pipe, an outlet pipe and a normally closed cut-off valve in the outlet pipe, of means for returning to the pumping system liquids that leak past the valve, comprising a pipe connection extending from the outlet pipe to the inlet pipe around the valve and pumping system.

2. The combination with a pumping system comprising an inlet pipe, an outlet pipe and a normally closed cut-off valve in the outlet pipe, of means for returning to the pumping system liquids that leak past the valve, comprising a pipe connection extending from the outlet pipe to the inlet pipe around the valve and pumping system and a one-way valve in this pipe opening toward the inlet pipe.

3. The combination with a pumping system comprising an inlet pipe, an outlet pipe and a cut-off valve in the outlet pipe, of means for returning to the pumping system liquids that leak past the valve, comprising a pipe connection extending from the outlet pipe to the inlet pipe around the valve and pumping system, a valve in this pipe and connections for automatically closing this valve when the cut-off valve is open and opening the valve when the cut-off valve is closed.

4. The combination with a pumping system comprising an outlet pipe, a relatively low pressure inlet pipe, and a normally closed cut-off valve in the outlet pipe, of means for returning to the pumping system liquids that leak past this valve, this means comprising a return pipe shunted around the pumping system and in communication at its inlet end with the outlet pipe beyond the valve, and at its outlet end with the low pressure inlet pipe.

5. The combination with a pumping system comprising an outlet pipe, a relatively low pressure inlet pipe, and a normally closed cut-off valve in the outlet pipe, of means for returning to the pumping system liquids that leak past this valve, this means comprising a return pipe shunted around the pumping system and in communication at its inlet end with the outlet pipe beyond the valve, and at its outlet end with the low pressure inlet pipe, and a one-way valve in this return pipe for preventing passage of liquids from the inlet pipe to the outlet pipe.

6. The combination with a pumping system comprising an outlet pipe, a relatively low pressure inlet pipe, and a cut-off valve in the outlet pipe, of means for returning to the pumping system liquids that leak past this valve, this means comprising a return pipe shunted around the pumping system and in communication at its inlet end with the outlet pipe beyond the valve, and at its outlet end with the low pressure inlet pipe, a valve in the return pipe, and connections for automatically closing this valve when the cut-off

valve is open and opening the valve when the cut-off valve is closed.

7. The combination with a pumping system comprising an outlet pipe, a relatively low pressure inlet pipe, a cut-off valve in the outlet pipe, and a one-way valve in the inlet pipe opening toward the pumping system, of means for returning to the pumping system liquids that leak through the cut-off valve, this means comprising a return pipe communicating at its inlet end with the outlet pipe beyond the cut-off valve, and at its outlet end with the inlet pipe at the inlet side of the one-way valve.

8. The combination with the pumping system comprising an outlet pipe, a relatively low pressure inlet pipe, a normally closed cut-off valve in the outlet pipe and a one-way valve in this pipe beyond the cut-off valve and opening away from the pumping system, of means for returning to the pumping system liquids that leak through the cut-off valve, this means comprising a return pipe leading from the outlet pipe between the cut-off valve and the one-way valve to the inlet pipe.

9. The combination with a pumping system comprising a tank, a pump, an intake pipe leading from the tank to the pump, a discharge pipe leading from the pump back to the tank, an injector in the discharge pipe, an inlet pipe leading to the injector whereby fluids are drawn into the pumping system, an outlet pipe leading from the pump whereby liquids may be forced from the system, a normally closed cut-off valve in the outlet pipe, and mechanism for opening the cut-off valve, of means for returning to the pumping system liquids that leak through the cut-off valve, this means comprising a return pipe leading from the outlet pipe beyond the cut-off valve back to the inlet pipe.

10. The combination with a pumping system comprising a tank, a pump, an intake pipe leading from the tank to the pump, a discharge pipe leading from the pump back to the tank, an injector in the discharge pipe, an inlet pipe leading to the injector whereby fluids are drawn into the pumping system, an outlet pipe leading from the pump whereby liquids may be forced from the system, a normally closed cut-off valve in the outlet pipe, and mechanism for opening the cut-off valve, of means for returning to the pumping system liquids that leak through the cut-off valve, this means comprising a return pipe leading from the outlet pipe beyond the cut-off valve back to the inlet pipe, and a one-way valve in this return pipe opening toward the inlet pipe.

11. The combination with a pumping system comprising a tank, a pump, an intake pipe leading from the tank to the pump, a discharge pipe leading from the pump back to the tank, an injector in the discharge pipe, an inlet pipe leading to the injector whereby fluids are drawn into the pumping system, an outlet pipe leading from the pump whereby liquids may be forced from the system, a normally closed cut-off valve in the outlet pipe, and mechanism for opening the cut-off valve, of means for returning to the pumping system liquids that leak through the cut-off valve, this means comprising a return pipe leading from the outlet pipe beyond the cut-off valve back to the inlet pipe, a valve in the return pipe, and connections for closing this valve when the cut-off valve is open and vice versa.

12. The combination with a pumping system comprising a tank, a pump, an intake pipe leading from the tank to the pump, a discharge pipe leading from the pump back to the tank, an injector in the discharge pipe, an inlet pipe leading to the injector whereby fluids are drawn into the pumping system, an outlet pipe leading from the pump whereby liquids may be forced from the system, a normally closed cut-off valve in the outlet pipe, and mechanism for opening the cut-off valve, of means for returning to the pumping system liquids that leak through the cut-off valve, this means comprising a return pipe leading from the outlet pipe beyond the cut-off valve back to the inlet pipe, a cut-off valve in the return pipe, a spring for closing this valve, and lever connections from this latter valve to the first mentioned valve-opening mechanism whereby the latter valve will be held open against the action of the spring while the main cut-off valve is closed, but will be permitted to close when the main valve is opened.

13. The combination with a pumping system comprising a tank, a pump, an intake pipe leading from the tank to the pump, a discharge pipe leading from the pump back to the tank, an injector in the discharge pipe, a relatively low pressure inlet pipe leading to the injector, and a relatively high pressure outlet pipe leading from the pump, of means for priming the pumping system comprising a normally open return conduit of small capacity between the high pressure outlet pipe and the low pressure inlet pipe.

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