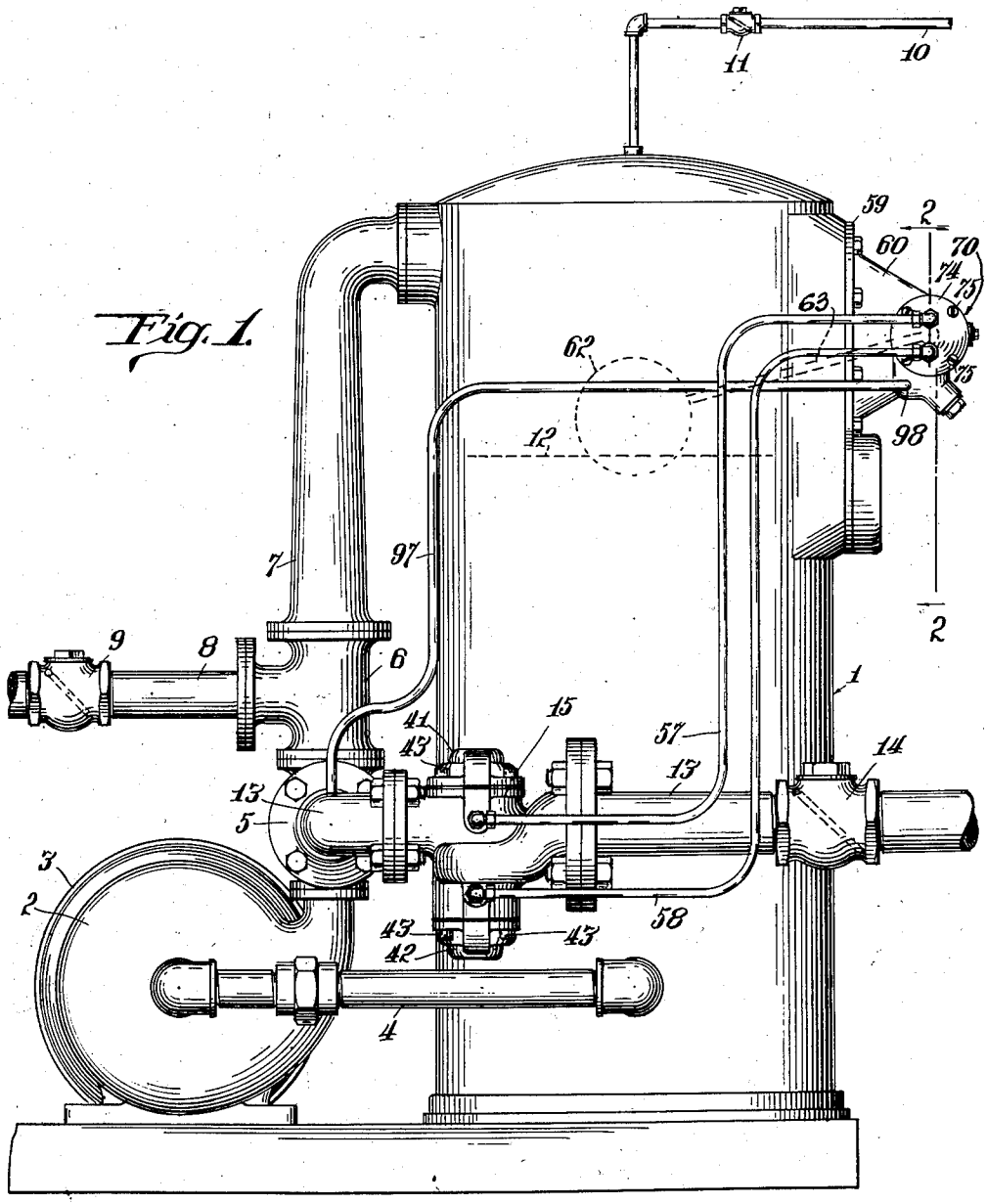
Jan. 1, 1935. C. A. DUNHAM 1,986,429

PISTON TYPE DISCHARGE VALVE

Filed June 13, 1932 2 Sheets-Sheet 1

Fig. 1.



Inventor

Clayton A. Dunham

By Barrett & Truman

Attorneys.

Jan. 1, 1935. C. A. DUNHAM 1,986,429

PISTON TYPE DISCHARGE VALVE

Filed June 13, 1932 2 Sheets-Sheet 2

Fig. 2

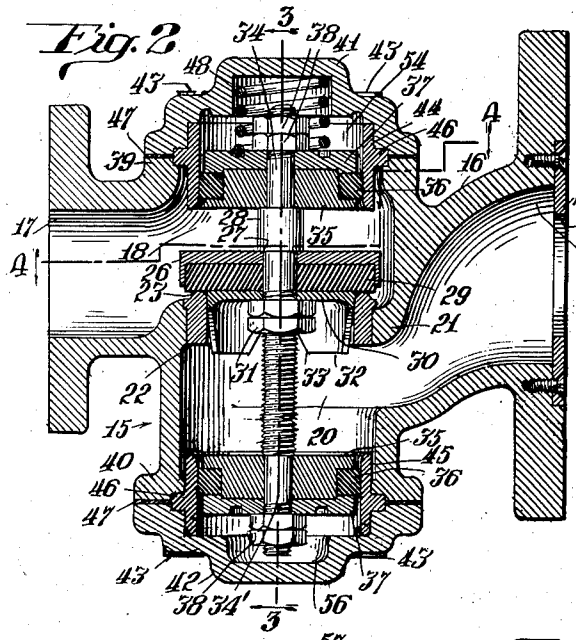


Fig. 3

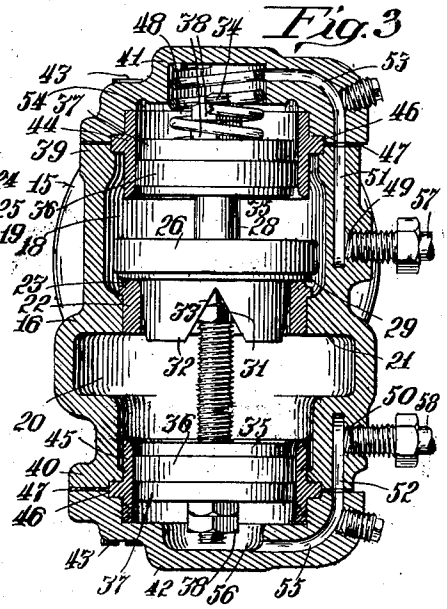


Fig. 4

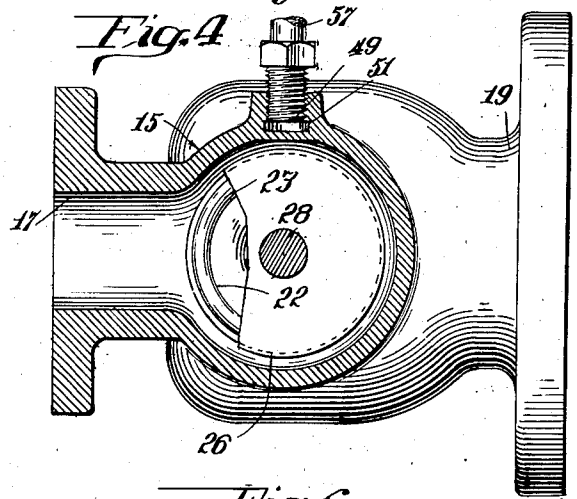


Fig. 5

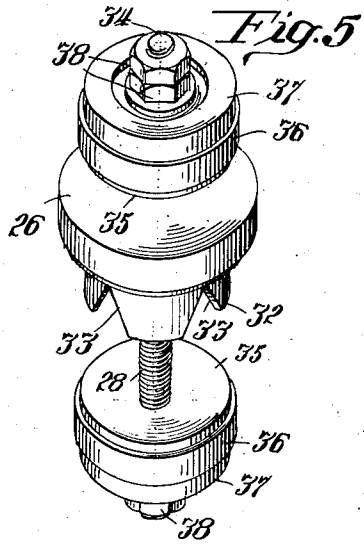
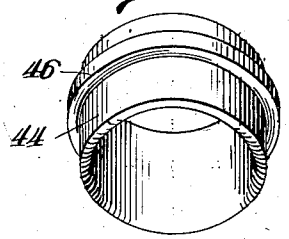


Fig. 6



Inventor

Clayton A. Dunham

By Barnett & Truman

Attorneys.

Patented Jan. 1, 1935 1,986,429

UNITED STATES PATENT OFFICE

1,986,429

PISTON TYPE DISCHARGE VALVE

Clayton A. Dunham, Glencoe, Ill., assignor to C. A. Dunham Company, Marshalltown, Iowa, a corporation of Iowa

Application June 13, 1932, Serial No. 616,967

1 Claim. (Cl. 137—139)

This invention relates to a new and improved automatic piston type discharge valve, and more particularly to a quick acting power-operating discharge valve especially designed for use in connection with the pumping mechanism used in a vacuum steam heating system of the type disclosed in the patent to Dunham 1,644,114 granted October 4, 1927.

The pumping system to which this invention is applied utilizes a hurling water circuit to produce a vacuum in the heating system and withdraw air and condensate therefrom. The pumping system has an inlet which communicates with the return pipe from the heating system, and an outlet through which water is forced to the boiler or generator of the heating system. The pumping system maintains a relatively low pressure or vacuum in the return pipe of the heating system so that air and condensate will be withdrawn therefrom, and a relatively high pressure is maintained in the discharge pipe so that water can be forced out against the boiler pressure. There is a cut-off valve in the discharge pipe which is normally closed but which is opened by a float-controlled mechanism when a certain predetermined amount of water has accumulated in the pumping system so that the excess water will be forced back to the boiler. When an ordinary type of valve is used at this point, which is directly operated from a float within the tank or reservoir in which the water accumulates, difficulties have been encountered owing to the valves becoming leaky either from the deposits of foreign matter thereon or from the valve seat being cut owing to the very low rate of speed at which the valve is lifted from its seat or returned thereto.

The present invention relates to a new and improved form of discharge valve especially designed for use in a pumping system such as briefly described hereinabove, although the valve is capable of other uses. The main cut-off valve is operated by a pair of opposed fluid-pressure operated pistons which force the valve quickly to or from its seat. The main valve disc is formed of a composition which is sufficiently hard to wear well but at the same time is soft enough to enable any solid materials to be embedded in it when the valve is moved to closed position so that the valve will make a tight contact with its seat despite the presence of foreign substances. The valve is also provided with a sleeve movable through the valve opening and provided with graduated openings in its side walls so that the rate of flow through the valve opening will be gradually increased or decreased so as not to cause water hammer when the movable valve member is opened or closed rapidly. A distributing valve directs a fluid under pressure into one or the other of the cylinders in which the operating pistons are slidable, at the same time exhausting the other cylinder so that a very quick and positive movement of the cut-off valve is obtained. The distributing valve is operated from a float within the tank or reservoir through a lost motion connection.

The principal object of this invention is to provide an improved automatic discharge valve of the type briefly referred to hereinabove and disclosed more in detail in the specifications which follow.

Another object is to provide an improved form of piston-operated cut-off valve.

Another object is to provide an improved form of movable member for the discharge valve which will seat tightly even if solid foreign matter is interposed between the valve and valve seat.

Another object is to provide a movable valve member adapted to graduate the increase or decrease of flow through the valve opening when the valve is quickly opened or closed.

Another object is to provide improved hydraulic pressure means for opening and closing the valve without the need of large float leverage.

Another object is to provide an improved valve having a high valve lift in proportion to the increase in water level within the tank. In other words, while the opening or closing of the valve is controlled by changes in water level, the valve may be fully opened or closed even though the change in water level is slight and the float-leverage is small.

Another object is to provide a valve structure in which the wearing parts are easily accessible for inspection and renewal.

Another object is to provide a valve structure that is simple and economical to manufacture, and will give long, continuous and uninterrupted service.

Other objects and advantages of this invention will be more apparent from the following detailed description of one approved form of apparatus constructed and operating according to the principles of this invention.

In the accompanying drawings:

Fig. 1 is an elevation showing the pumping mechanism with the improved discharge valve and its operating connections assembled therewith.

Fig. 2 is a longitudinal vertical central section through the discharge valve.

Fig. 3 is a vertical section taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a horizontal section taken substantially on the line 4—4 of Fig. 2.

Fig. 5 is a perspective view of the movable valve and piston assembly.

Fig. 6 is a perspective view of one of the removable cylinders.

Referring first to Fig. 1, the pumping mechanism and exhausting system to which this invention is applied comprises a tank 1 partially filled with water, from the lower portion of which a pump 2 driven by motor 3 withdraws water through intake pipe 4 and forces this water upwardly through the discharge T 5 and jet exhauster 6 into the pipe 7 leading back into the upper end of separator tank 1. This hurling water circuit produces a suction in the casing of ejector 6 which draws in water and gases through pipe 8, which may be the return pipe leading from a heating system. The gases and condensate drawn in through pipe 8 are carried along with the hurling water through discharge pipe 7 into the tank 1. A one-way check valve 9 in the pipe 8 prevents the return of any of these fluids through pipe 8 to the heating system. The gases discharged into tank 1 are vented to the atmosphere through pipe 10 provided with one-way valve 11.

It will be apparent that the amount of water in the hurling circuit will be constantly increased due to the addition of condensate from the heating system so that the water level in tank 1 (indicated at 12) will rise and it is desirable to discharge part of this water, preferably back to the boiler of the heating system. For this purpose a discharge pipe 13 leads from the T 5 of pump 2 through a check valve 14 back to the boiler. A cut-off valve 15 located in discharge pipe 13 is normally closed but is opened by a float-controlled mechanism when the water level 12 in tank 1 has risen to a predetermined location and is again closed when the excess water has been discharged from the tank. The present invention relates to an improved form of cut-off valve 15 and to the mechanism for operating this valve when the float in tank 1 has reached certain predetermined positions.

The improved discharge valve 15 will be more specifically described. The valve casing 16 is formed with an inlet port 17 leading to an upper chamber 18, and an outlet port 19 leading from a lower chamber 20, the chambers 18 and 20 being separated by a substantially horizontal partition 21 in which is formed the vertical valve opening. A cylindrical sleeve or bushing 22 fitted within this valve opening is formed with an upper rounded valve seat 23. A restriction plate 24, which may have a central aperture 25 of any desired size, is secured in the outlet port 19 so as to adapt a single size of valve to a plurality of different flow-capacities.

A valve cup or holder 26 is fitted against a shoulder 27 on the piston rod 28 which extends vertically through the valve opening and chambers 18 and 20. A disc 29 of suitable relatively soft composition material is held within the cup 26 and is adapted to engage the valve seat 23. A valve cup slidable within the bushing 22 comprises a head 30 fitted on the piston rod 28 and held in place by nuts 31 screwed on a threaded portion of the rod thereby securing in place the composition disc 29. This valve cup is formed with a cylindrical skirt portion 32 which fits slidably within bushing 22 and is formed with diverging cut-out portions or notches 33. These openings 33 are so proportioned that as the valve is raised quickly to open position the flow of liquid through the valve opening from chamber 18 to chamber 20 will be gradually increased. In a similar manner the flow will be gradually cut off instead of suddenly cut off when the valve is quickly moved to closed position. In this way water-hammer is prevented. The flow through the valve is completely cut off when the composition disc 29 is brought against the valve seat 23, and this disc is formed of sufficiently soft material so that any solid foreign matter which may become lodged on the valve seat will be embedded within the composition disc and not prevent a complete closing of the valve.

On the similar reduced end portions 34 and 34' of piston rod 28 are mounted similar upper and lower pistons each comprising a main disc 35 recessed to receive a jointless packing ring 36, a clamping disk 37 to hold the packing ring in place and nuts 38 threaded on the end portion of the rod to hold the piston assembly in place. Obviously, a solid piston could be used but in such case it would be necessary to use a split packing ring. This entire piston and valve assembly is movable up and down as a single unit and is shown in perspective in Fig. 5.

The valve casing 16 is formed with similar upwardly and downwardly projecting open-ended cylindrical neck portions 39 and 40, each of which is closed by a similar removable dished cap member, the upper cap being designated 41 and the lower one 42. These caps are held in place by bolts 43 screwed into the casing 16. It will be apparent that when these caps are in place the moving portions of the valve assembly are entirely enclosed so that no stuffing-boxes are necessary.

The similar hollow cylindrical liner members 44 and 45 have cylindrical interior open-ended bores in which the pistons are slidably fitted. Each of the cylindrical liners is provided with an exterior annular flange or collar 46 which is clamped in an annular recess formed partly in the casing neck 39 or 40 and partly in the closure cap 41 or 42. When the caps are secured in place against annular gaskets 47, the cylindrical liners are clamped in place and at the same time the assembly is sealed to prevent the escape of motive fluid between the casing and caps. A compression spring 48 confined between the top of cap 41 and the top of the upper piston serves to normally hold the movable piston and valve assembly downward with the valve closed.

Separate upper and lower inlet ports 49 and 50 for the motive fluid are formed in one side wall of casing 16, and passages 51 and 52 lead respectively from these ports upwardly and downwardly through the necks 39 and 40 respectively. The upper cap 41 is formed with a passage 53 which communicates at one end with the passage 51 in the valve casing and leads at its other end into the space 54 above the upper piston. The lower cap 42 is formed with a similar passage 55 which forms an extension of the casing passage 52 and leads into the lower chamber 56 beneath the lower piston. Supply conduits 57 and 58 connect into the ports 49 and 50 respectively.

Referring now to Fig. 1, a closure plate 59 is fitted over an opening formed in one side of the upper portion of tank 1, and this plate is formed with a hollow outwardly tapering bracket extension 60, in the outer portion of which is housed

a distributing valve 70, having a removable closure plate or head 74 secured in place by bolts 75. The float 62 which rests on the water in tank 1, is connected by stem 63 to the inner rotary element of the distributing valve.

A supply conduit 97 extends from some portion of the circulating system containing water under the high pressure developed by pump 2 and leads into a port 98 in the casing of the distributing valve 70. Conduits 57 and 58 lead from outlet ports in the valve head 74 to the inlet ports 49 and 50, respectively, of the improved discharge valve (see Fig. 3).

Let us assume now that the discharge valve 15 has just been closed after the excess liquid has been discharged from tank 1, thus lowering the float 62 to a predetermined minimum level so as to adjust the distributing valve 70 and connect high pressure supply pipe 98 with conduit 57. Water under high pressure will have passed through conduit 57 and valve passages 51 and 53 to the upper valve chamber 54, thus forcing down the piston assembly and closing the valve 29. At the same time, fluids in the lower valve chamber 56 have been discharged through valve passages 55 and 52 and conduit 58 which is now in communication through distributing valve 70 with the interior of tank 1.

As the liquid now gradually accumulates in tank 1, the water level 12 will be raised thus raising the float 62 and when a predetermined maximum liquid level is reached the distributing valve 70 will be adjusted to place supply conduit 98 in connection with conduit 58, and to connect conduit 57 with the space under atmospheric pressure in tank 1. The piston assembly will now be raised quickly to fully open the discharge valve and permit the pump 2 to discharge the surplus water from tank 1 through pipe 13.

The closing movement of the valve, as first described, will also take place quite quickly, but the flow of water through the valve will be more gradually cut off, due to the gradual closing of the tapered openings 33 in the cylindrical valve skirt 32, thus preventing water hammer.

It will be noted that the effective diameters of the upper and lower pistons and of the main valve opening are substantially equal so that the fluid pressures exerted on these members from the main valve chambers 18 and 20 will substantially balance one another. The valve is thus held closed mainly by the expansion spring 48, although a somewhat higher pressure must exist in chamber 18 than in chamber 20 since this excess pressure is necessary in order to force liquid to the boiler. This pressure differential also tends to hold the valve closed. Of course, when the space beyond one piston is exhausted and liquid under pump pressure is admitted to the space beyond the other piston, this balance of forces is destroyed so that the piston assembly will be moved quickly in the appropriate direction.

By removing one or both of the valve heads 41 and 42 of the main discharge valve, the cylinders and valve assembly can be withdrawn and all parts of the valve are readily accessible.

For convenience in identifying the parts, the discharge valve has been described as if it were positioned as shown in the drawings, the pistons, cylinders, heads, etc. being described as upper and lower with relation to this positioning of the valve. It is to be understood that the valve could be positioned sidewise or inverted without materially affecting its operation as hereinabove described.

I claim:

A piston-type discharge valve comprising a casing enclosing upper and lower chambers with which communicate inlet and outlet ports respectively and an intermediate substantially horizontal partition formed with a valve opening and a valve seat surrounding the opening at the inlet side, a piston rod projecting vertically in both directions through the valve opening, a valve member fixed to the rod intermediate its length and adapted to close the valve opening, upper and lower pistons mounted on the respective end portions of the rod, there being openings in the top and bottom of the casing coaxial with the valve opening, similar dished caps for closing these openings, duplicate upper and lower open-ended hollow cylinders in which the pistons slidably fit, each cylinder having an outstanding annular collar which is clamped in place between the casing and cap, there being ducts for a pressure fluid in the side walls of the caps and the casing which communicate when the caps are in position, the duct in each cap leading directly from the space beyond the adjacent piston to the adjacent duct in the casing, the other end of each casing duct being provided with an inlet port through which a pressure fluid is directed from outside the valve casing to open or close the valve.

CLAYTON A. DUNHAM.