

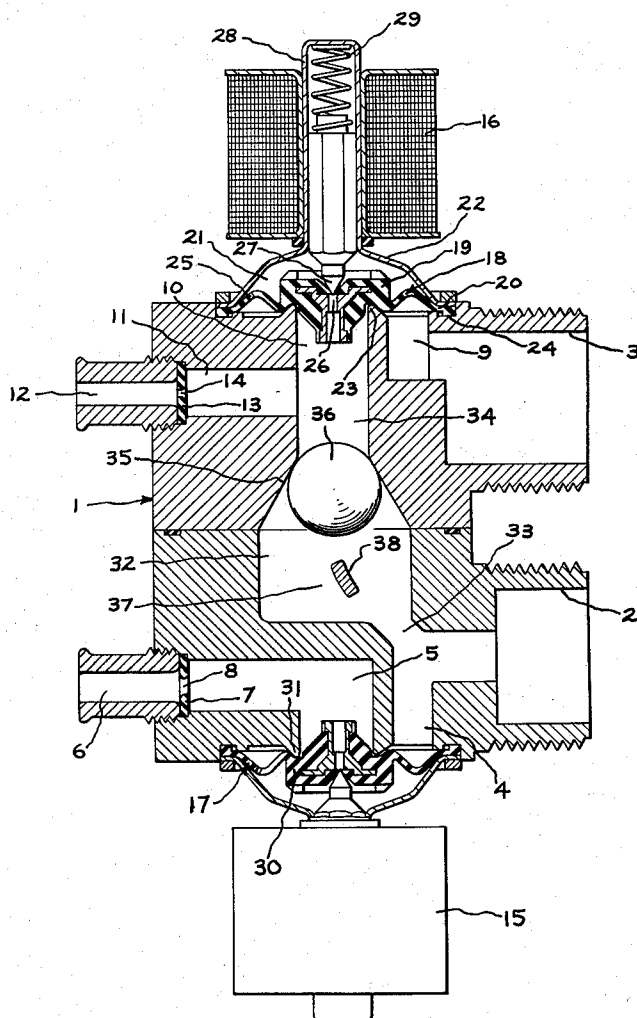
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VALVE

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VALVE

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This invention relates to valves, and more particularly to a valve for controlling the flow of liquid from two different temperature sources, and it has as its general object the provision of a single valve structure for controlling the flow from the two sources selectively to provide fluid flows having at least three different temperatures. While this invention has various applications to control fluid flow it is especially applicable for the control of the flow of washing, rinsing and condensing water in combination washing and drying machines.

Combination washing and drying machines for example, generally provide a washing cycle, a rinsing cycle, a centrifugal extraction of liquid from the clothes, and a heat drying cycle to completely dry the clothes. The washing function is generally performed with either hot or warm water depending upon the type of fabric being washed; the rinsing action is generally provided with warm water; the condensing water, used for the purpose of dehumidifying air after it has been in contact with the clothes during the drying cycle so that it can then again be heated and used to effect drying of the clothes, is of course provided cold so as to have a maximum condensing effect. In the past, one valve has been provided for the hot and warm water flow for washing and rinsing purposes, and a separate valve has been provided in connection with the cold water flow for condensing purposes. The valve provided in connection with washing and rinsing normally had one controlling device (usually of the solenoid type) for controlling the hot water flow and a second similar device for controlling the cold water flow. A third similar device normally was provided for the control of the cold water in the condenser valve.

In view of the fact that all of the water necessarily comes from two sources, the hot water source and the cold water source, it is highly desirable to decrease the total number of control units used to two, one controlling the hot water flow and the other controlling the cold water flow, and to use a single valve incorporating the two units for both washing and rinsing water on the one hand and condensing water on the other.

It is accordingly an object of this invention to provide an improved valve structure wherein the hot and warm water flow provided during washing and rinsing, and the cold water flow provided during condensing are controlled by the use of two control devices rather than the three previously used.

A further object of the invention is to consolidate the control of the washing and rinsing water supply on the one hand and of the condensing water supply on the other hand into a single valve structure.

In carrying out the invention I provide a valve which has a valve body with first and second inlets and first and second outlets respectively connecting with the inlets. First control means, such as of the solenoid actuated type, are provided for blocking the connection between the first inlet and the first outlet; similarly, second control means are provided for blocking the connection between

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the second inlet and the second outlet. A passage is formed in the valve body connected at one end to the first inlet upstream of the first control means and at its other end to the second outlet downstream of the second control means. In the passage, I provide pressure responsive means which is positioned to be movable to a position blocking the passage when the pressure at the first inlet exceeds the pressure at the second outlet, and to a position opening the passage when the pressure at the second outlet is equal to or greater than the pressure at the first inlet.

With such a construction, with hot water provided at the first inlet and cold water at the second inlet, opening of the second control means alone to allow cold water only to flow will cause the cold water to flow through the second outlet as intended, for condensing purposes, since the control means for the first inlet and outlet is closed and thus is blocking passage of the cold water to the first outlet. If hot water alone is desired, then the first control means is opened and the second control means is left closed; this causes the pressure responsive means to block the passage so that the only path for the hot water is from the first inlet to the first outlet. If warm water is desired, then both control means are opened; with approximately equal pressure on both sides of the pressure responsive means, it does not block the passage and therefore the two flows of water are free to mix together and flow out through both outlets. Since warm water is used only in the washing and rinsing process and not in the condensing process, there is no harm done by having the water flow out through both outlets since, in the usual washer-dryer structure, the water from the condenser outlet flows into the bottom of the tub after performing its cooling function in the same manner as the water provided directly to the tub.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. My invention itself, however, both as to organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawing.

In the drawing, the single figure is a side elevational view, partly in cross-section, showing the improved valve construction of my invention.

Referring now to the drawing, I have shown therein my improved valve construction which comprises a body portion, generally indicated at 1, having formed therein a first inlet 2 generally used for the provision of hot water and a second inlet 3 generally used for the provision of cold water. As shown, inlets 2 and 3 may be provided with externally formed threads to facilitate the securement of conduits from the hot and cold water sources. While it has no bearing on the operation of the valve, it is generally desirable for simplicity of manufacture to form the valve of two separate parts as shown; the valve may be formed of molded plastic material or of metal, as is well known in the art.

Inlet 2 communicates through passageways 4 and 5 with an outlet 6 which is provided with a suitable flow regulating device 7 having a relatively large opening 8 thereby to permit a relatively large flow of water through outlet 6. In similar fashion, inlet 3 communicates with passageways 9, 10 and 11 leading to an outlet 12 provided with a suitable flow regulator 13. In this case, as will be further explained below, the flow regulator has a relatively small opening 14 to provide a restricted amount of liquid flow therethrough.

Flow from inlet 2 to outlet 6 and from inlet 3 to outlet 12 is controlled by appropriate control means which includes a pair of solenoids 15 and 16 respectively as-

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sociated with the inlets 2 and 3. The solenoids control the flow by controlling respectively two diaphragms 17 and 18 which are secured to the valve body as shown by any suitable means. The diaphragms are both of the pilot-operated type, preferably identical in both construction and operation. Thus, the following description of the operation of solenoid 16 and diaphragm 18 will be understood also to apply to solenoid 15 and diaphragm 17.

Diaphragm 18 includes a center or valve portion 19 and an outer flexible portion 20, and is mounted to form a closed chamber 21 with a cap 22 of the solenoid assembly. Valve portion 19 is adapted to seat on an upstanding circular flange 23 formed around the opening of passage 10. The outer flexible portion 20 of the diaphragm is secured at its outer periphery between the cap 22 and an annular groove 24 formed in the valve body. Thus, the diaphragm, in its normal position shown, shuts off any communication between passage 10 and passage 9 by seating on flange 23.

The diaphragm includes a small bleed hole 25 through its outer flexible portion whereby the liquid under pressure in passage 9 may leak under pressure through the diaphragm into the chamber 21. The area of the surface of the diaphragm exposed to the liquid pressure in chamber 21 is greater than the area on the other side thereof exposed to the pressure in passage 9. Therefore, provided that no liquid can escape through a central aperture 26 in the diaphragm which is normally closed by a solenoid plunger 27, the diaphragm is subjected to a greater force on its outer surface than its inner surface. As a result, the center valve portion 19 of the diaphragm is held down tightly against flange 23 so as to seal the connection between passages 9 and 10.

When it is desired to pass flow from inlet 3 through passage 9 to passages 10 and 11 and outlet 12, solenoid 16 is energized. The solenoid controlled plunger 27, as shown, is arranged for longitudinal movement within a tubular extension 28 of cap 22. The inner tapered end of plunger 27 normally seats in the aperture 26 so that no leakage can occur therethrough. However, as soon as the solenoid is actuated it pulls the plunger away from the diaphragm and opens aperture 26. As a result, the liquid in chamber 21 immediately begins to leak through the aperture 26, and since the aperture is larger than the bleed hole 25, the liquid within chamber 21 decreases in quantity and the pressure on the outer side of the diaphragm becomes insufficient to hold the diaphragm seated on flange 23. The diaphragm is then forced off the flange and a direct passage is open from passage 9 to passage 10. Liquid from inlet 3 is then free to flow through from passage 9 into passage 10 as long as solenoid 16 remains energized.

To shut off the flow, solenoid 16 is de-energized and plunger 27 is returned into contact with the diaphragm by a biasing spring 29 disposed behind it. As soon as the plunger closes the aperture 26, the pressure again begins to build up in chamber 21. This force soon becomes greater than the force applied to the liquid in passage 9, and the valve portion 19 is forced to seat again on the flange 23. This closes off the flow from passage 9 to passage 10.

As stated above, the action of diaphragm 17 is identical to that of diaphragm 18, to close off or open a connection between passages 4 and 5 in response to energization or de-energization of solenoid 15. The same valve control action is supplied by the seating of the central portion 30 of diaphragm 17 on flange 31.

Formed within the valve body 1 there is a passage 32 communicating at one end 33 with passage 4 on the upstream side of the diaphragm 17 and at its other end 34 with the passage 10 on the downstream side of the diaphragm 18. The passage is formed with a generally conically shaped seat 35 which, in cooperation with a ball member 36, closes the passage 32 when the ball member

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36 is seated against the surface 35. If desired, as shown, passage 32 may be arranged with end 34 above end 33 so that there is a tendency caused by gravity for the ball member to move toward end 33. The passage 32 is relatively wide at portion 37 thereof; specifically the passage is too wide for ball 30 to perform a closing function at that point. Suitable means 38 are formed in portion 37 to retain ball 36 when the pressure conditions are such as to force ball 36 toward end 33 of passage 32.

With the arrangement described, let it be assumed that hot water is desired in the machine in which the valve of this invention is used. To effect this, solenoid 15 is energized while solenoid 16 remains de-energized. The energization of the solenoid, as has been explained in connection with solenoid 16, will cause the diaphragm 17 to be moved so that central portion 30 thereof moves away from flange 31 to effect a connection between passages 4 and 5. There is, then, a free connection from inlet 2 through passages 4 and 5 to outlet 6, and hot water will flow into the machine as is desired. Although passage 32 connects inlet 2 to outlet 12, there is no flow of the hot water through the outlet 12 because the pressure from inlet 2 forces ball 36 into engagement with surface 35 to close the passage 32.

If warm water is desired either for washing or for rinsing, both solenoids 15 and 16 are energized. The hot water pressure is less than the cold water pressure because opening 8 is larger than opening 14 and therefore ball 36 will not seat against surface 35; and even if the openings were similar in size, the hot water and cold water pressures are close enough so that there is no substantial difference between them, and the ball 36 again will not seat against surface 35. Since ball 36 does not seat against surface 35 the cold water is permitted to flow from inlet 3 through passages 9 and 10 and then out either through passage 11 and outlet 12 or through passage 32, passages 4 and 5, and outlet 6. The hot water may flow as before from inlet 2 through passages 4 and 5 to outlet 6. As has been explained before, the water used for condensing which is supplied from outlet 12 eventually finds its way into the bottom of the tub with the other water so that the passage of cold water through outlet 12 during washing or rinsing has no bearing on the effectiveness of the valve. Thus, with both solenoids 15 and 16 energized, warm water will flow from outlet 6 (and a little cold water from outlet 12) to provide the desired effect.

If only cold water flow is desired for condensing purposes, as is true during the heat drying portion of the cycle of a combination washer-dryer machine, only solenoid 16 is energized. This causes water to flow from inlet 3 through passages 9, 10 and 11 to outlet 12. Since the pressure on the cold water side of ball 36 is higher than on the hot water side thereof, it also causes the ball 36 to be moved away from seat 35. However, because solenoid 15 is maintaining the portion 30 of diaphragm 17 against flange 31, the cold water can only get to passage 4 and is then blocked from entry into passage 5 and outlet 6. Thus, the entire supply of cold water passes from the inlet 3 through to the outlet 12 as desired. It may be noted in this connection that normally the flow of condenser water is much smaller than that desired for washing and rinsing purposes, and therefore the opening 14 in flow regulator 13 is substantially smaller than the opening 8 in flow regulator 7. Relative flows, for instance, in a typical domestic combination washer dryer machine, might be on the order of five gallons per minute for the hot and warm water flow, and one half gallon per minute for the cold water flow. A further point to be noted is that the commonly encountered situation where the cold water inlet pressure is slightly higher than the hot water inlet pressure can easily be taken care of simply by providing a conventional check valve (not shown) in inlet 2.

It will be seen from the foregoing that my invention,

by the use of only two controlling valve structures, provides three entirely different types of results: I can provide either hot or warm water for washing; I can provide the warm water which is normally desired for rinsing; and I can provide through the specifically necessary outlet the cold water alone which is necessary for condensing purposes.

While in accordance with the patent statutes, I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is therefore aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A valve comprising a body portion having first and second inlets adapted to be connected to sources of fluid under pressure and first and second outlets respectively connecting with said inlets, first control means for blocking the connection between said first inlet and said first outlet, second control means for blocking the connection between said second inlet and said second outlet, means in said body portion forming a passage connected at one end to said first inlet upstream of said first control means and connected at its other end to said second outlet downstream of said second control means, pressure responsive means positioned in said passage, said passage and said pressure responsive means being formed so that said pressure responsive means blocks said passage when in a predetermined position therein, and means for providing higher pressure at said second outlet than at said first inlet when said first and second control means open their respective connections, said pressure responsive means being movable to said predetermined position blocking said passage in response to an excess of pressure at said first inlet over the pressure at said second outlet, said pressure responsive means being movable to a position opening said passage in response to an excess of pressure at said second outlet relative to the pressure at said first inlet.

2. A valve comprising a body portion having first and second inlets adapted to be connected to sources of fluid under pressure and said first and second outlets respectively connecting with said inlets, first control means for blocking the connection between said first inlet and said first outlet, second control means for blocking the connection between said second inlet and said second outlet, means in said body portion forming a passage connected at one end to said first inlet upstream of said first control means and connected at its other end to said second outlet downstream of said second control means, pressure responsive means positioned in said passage, said pressure responsive means including a ball member movable within the confines of said passage, said one end of said passage being larger than said ball and being formed with means for retaining said ball within said passage thereby to prevent said ball from blocking said one end of said passage, said other end of said passage being formed as a seat engageable with said ball to block said other end of said passage, and means for providing higher pressure at said second outlet than at said first inlet when said first and second control means open their respective connections, said ball being movable to a position in engagement with said other end of said passage to block said passage in response to an excess of pressure at said first inlet over the pressure at said second outlet, said ball being movable to said one end of said passage to open said passage in response to an excess of pressure at said second outlet relative to the pressure at said first inlet.

3. A valve comprising a body portion having first and

second inlets adapted to be connected to sources of fluid under pressure and first and second outlets respectively connecting with said inlets; first control means controlling the connection between said first inlet and said first outlet comprising a blocking member movable into and out of a position blocking connection between said first inlet and said first outlet, and a solenoid member controlling said blocking member, said solenoid member being arranged so that when de-energized it causes said blocking member to move to its blocking position and when energized it causes said blocking member to move away from its blocking position; second control means controlling the connection between said second inlet and said second outlet comprising a second blocking member movable into and out of a position blocking connection between said second inlet and said second outlet, and a second solenoid controlling said blocking member, said second solenoid being arranged so that when de-energized it causes said second blocking member to move to its blocking position and when energized it moves said blocking member away from its blocking position; means in said body portion forming a passage connected at one end to said first inlet upstream of said first blocking member and connected at its other end to said second outlet downstream of said second blocking member; pressure responsive means positioned in said passage, said passage and said pressure responsive means being formed so that said pressure responsive means blocks said passage when in a predetermined position therein, and means for providing higher pressure at said second outlet than at said first inlet when said first and second blocking members are moved away from their respective blocking positions, said pressure responsive means being movable to said predetermined position blocking said passage in response to an excess of pressure at said first inlet over the pressure at said second outlet, said pressure responsive means being movable to a position opening said passage in response to an excess of pressure at said second outlet relative to the pressure at said first inlet.

4. A valve comprising a body portion having first and second inlets adapted to be connected to sources of fluid under pressure and first and second outlets respectively connecting with said inlets, first control means for blocking the connection between said first inlet and said first outlet, second control means for blocking the connection between said second inlet and said second outlet, means in said body portion forming a passage connected at one end to said first inlet upstream of said first control means and connected at its other end to said second outlet downstream of said second control means, pressure responsive means positioned in said passage, said passage and said pressure responsive means being formed so that said pressure responsive means blocks said passage when in a predetermined position therein, said other end of said passage being arranged above said one end of said passage, and means for providing higher pressure at said second outlet than at said first inlet when said first and second control means open their respective connections, said pressure responsive means being movable to a position blocking said passage in response to an excess of pressure at said first inlet over the pressure at second outlet, said pressure responsive means being movable to a position opening said passage in response to substantial equality or to excess of pressure at said second outlet relative to the pressure at said first inlet.

5. The valve defined in claim 1 wherein said means for providing higher pressure at said second outlet than at said first inlet comprises first and second flow regulating means positioned respectively in said first and second outlets, said flow regulating means being formed to provide a large flow through said first outlet relative to the flow provided through said second outlet.

No references cited.