Feb. 20, 1951 L. A. KEMPTON 2,542,279

FLUID CONTROL DEVICE

Filed April 6, 1945 3 Sheets-Sheet 1

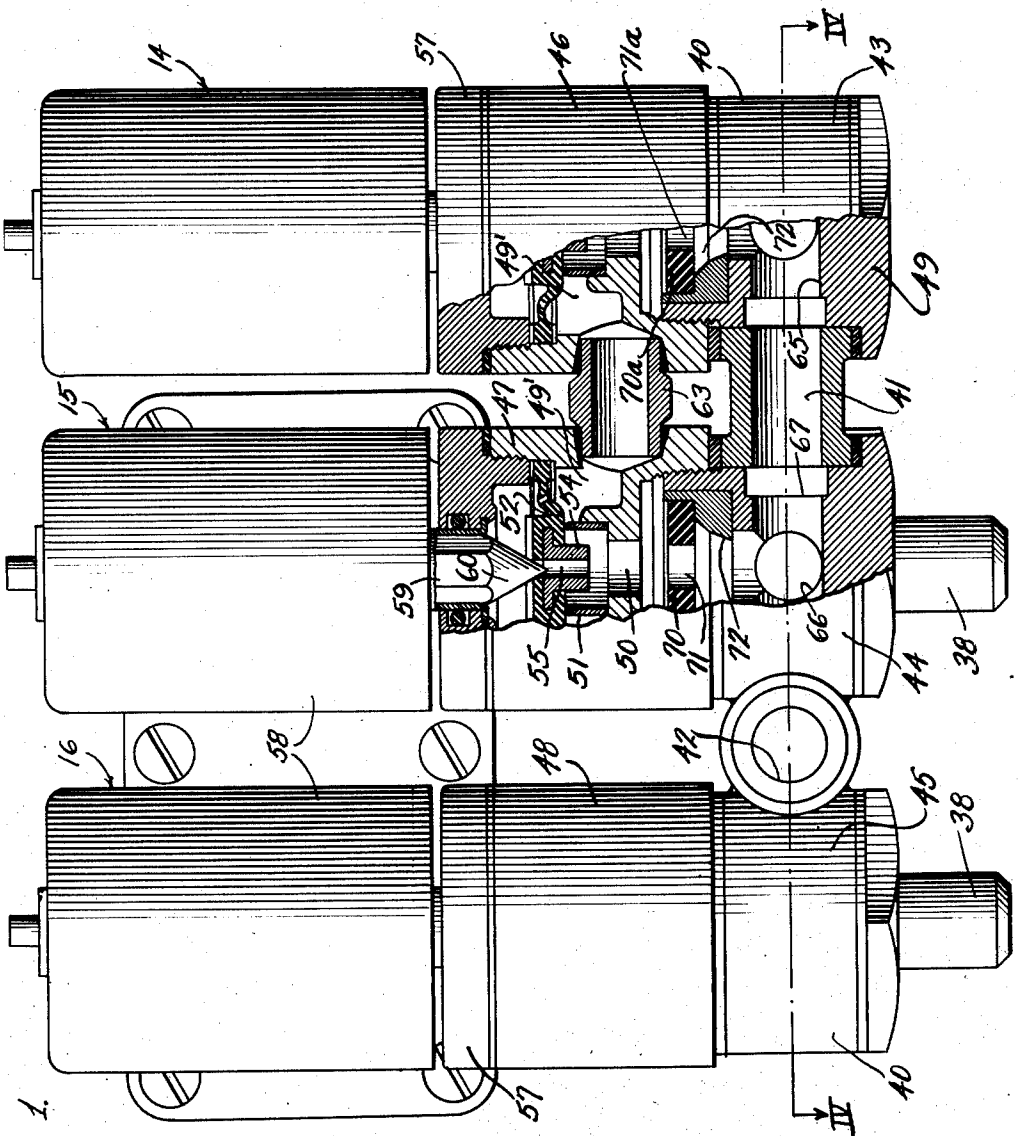

FIG. 1.

Inventor
LESLIE A. KEMPTON.

By The Firm of Charles H. Hills Attys.

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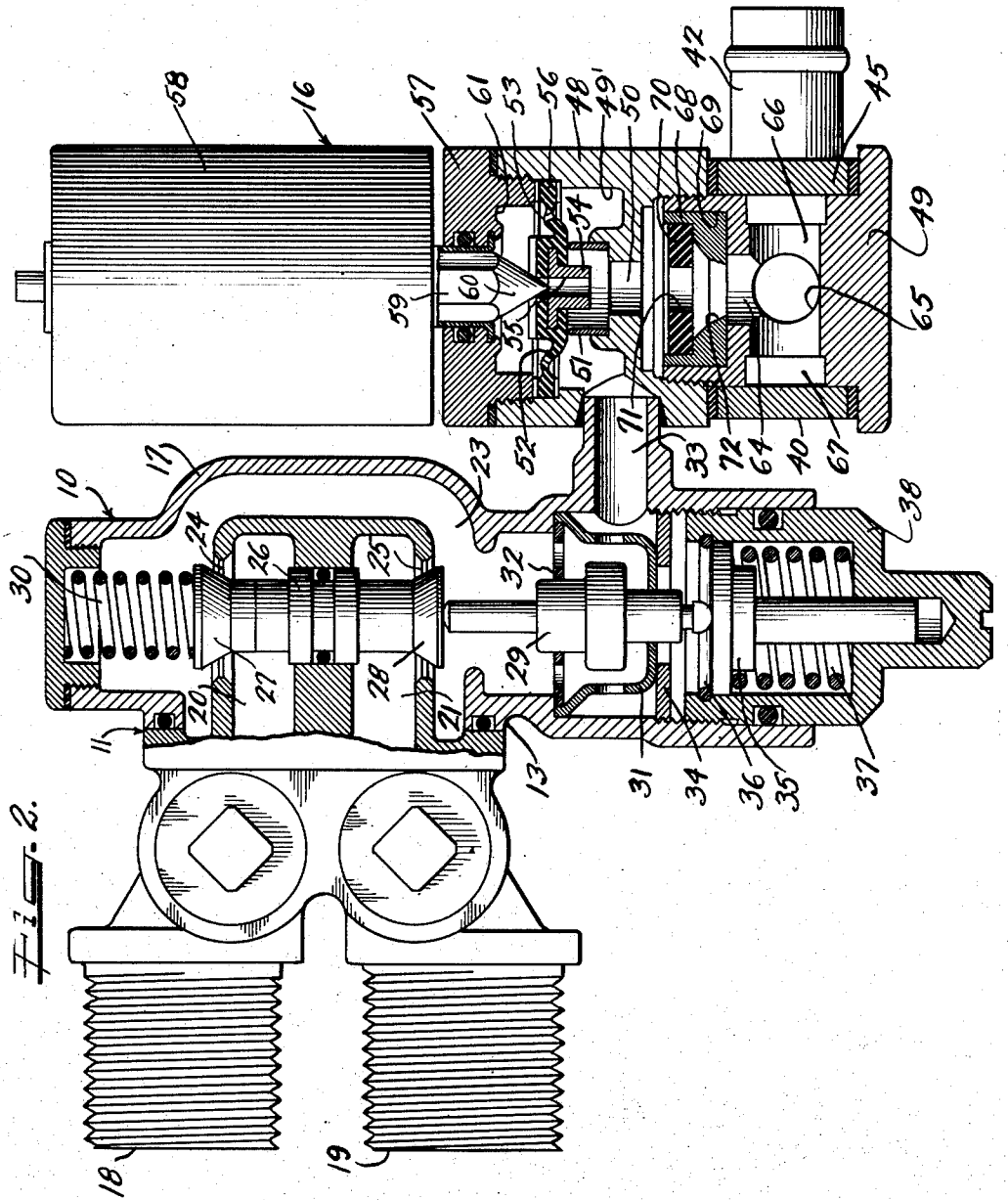

Fig. 2.

Inventor
LESLIE A. KEMPTON.

By The Firm of Charles A. Hill Attys.

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Fig. 3

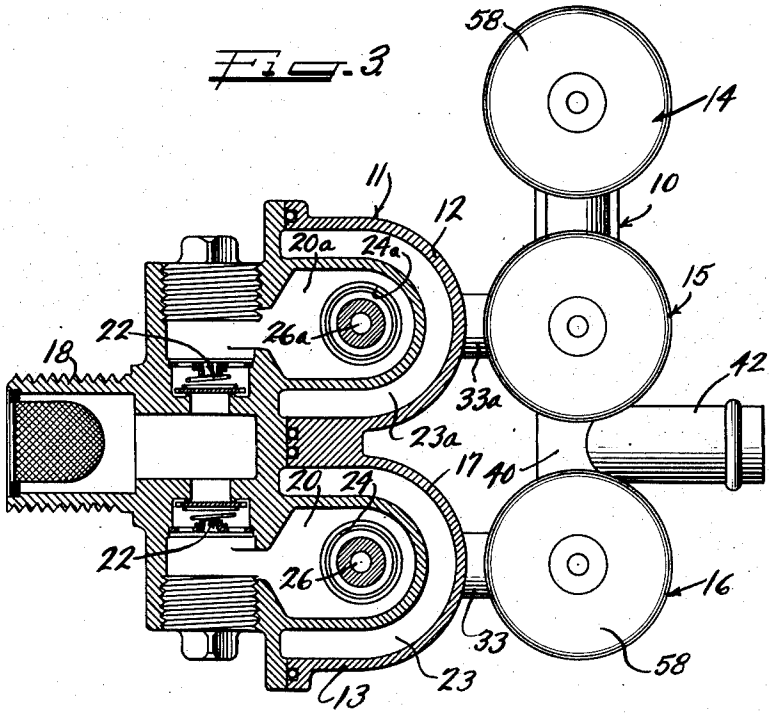
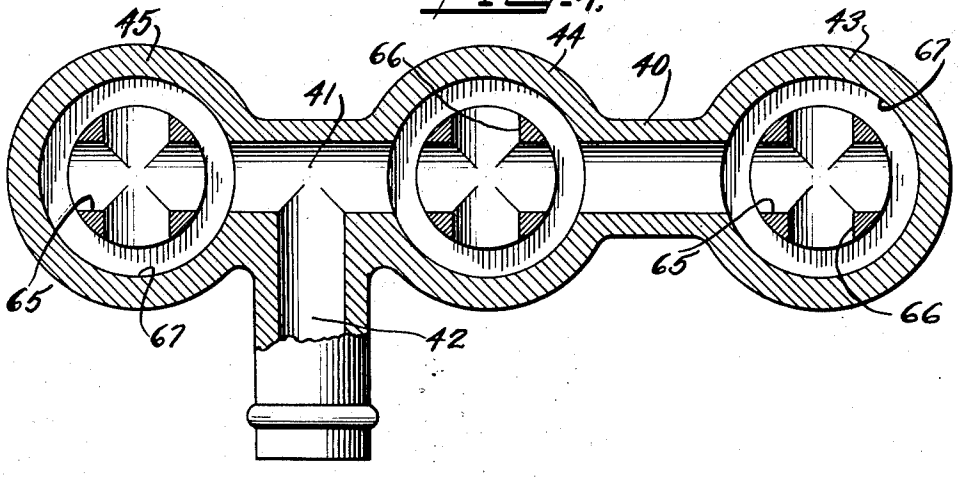


Fig. 4.



Inventor

LESLIE A. KEMPTON.

The Firm of Charles R. Hill Attys.

Patented Feb. 20, 1951 2,542,279

UNITED STATES PATENT OFFICE

2,542,279

FLUID CONTROL DEVICE

Leslie A. Kempton, Chicago, Ill., assignor to The Dole Valve Company, Chicago, Ill., a corporation of Illinois

Application April 6, 1945, Serial No. 586,997

9 Claims. (Cl. 137—144)

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The present invention relates to improvements in fluid flow control devices. More particularly, it is concerned with a form of fluid flow control device for selectively delivering a mixed fluid at a plurality of predetermined temperatures and for maintaining a uniform rate of flow through said device for each of several varying conditions.

In many fluid systems, such as the fluid system of an automatic washing machine, it is desirable to provide water of different temperatures and in different quantities for each individual stage in the cycle of operations of such machines. Thus, it is desirable to supply hot water for the washing steps and water of somewhat lower temperatures for the one or more rinsing operations and the like which follow the washing step. It is essential in such operations to conserve water and particularly hot water as much as possible.

In the course of the cycle of operations of an automatic washing machine, the tub of the machine is filled with hot water for the initial washing step to which soap or other suitable detergents are added. At the conclusion of the washing step, the washing water is drained or pumped from the tub in preparation for the rinsing step or steps to follow. The removal of the suds filled washing water from the tub frequently results in a formation of suds in the perforated basket carrying the articles to be laundered and is occasionally referred to as "suds lock."

This formation or suds lock prevents proper drainage of the water from the machine. The collection of suds can be effectively broken up and removed by the introduction of additional water to the tub and the basket of the washing machine. To accomplish this water is supplied from the mixer valve which is employed in supplying water to the tub for the several washing and rinsing steps.

Inasmuch as the introduction of water to the tub for the purpose of breaking up the suds lock takes place during the time when the drain outlet of the washing machine or the outlet pump is open and operating, the water merely flows through the machine. It will be understood that if this rinse water is put into the tub at the regular rate of flow of the valve unit supplying the wash water or rinse water to the tub a great deal of water will be employed and unnecessarily wasted.

It is, therefore, an object of the present invention to provide a form of fluid flow control

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device which is not only capable of supplying water of at least two different temperatures for use in the several stages of operation of an automatic washing machine but also to provide flow control means which will permit the introduction of a small quantity of low temperature water for a rinsing step employed in obviating the occurrence of suds lock.

More particularly, it is an object of this invention to provide a novel form of fluid flow control device capable of accomplishing the purposes hereinabove outlined.

It is a further object of the present invention to provide a single compact fluid flow control device for use with an arrangement having a pair of automatic temperature control mixing valves both of which are supplied from a common hot fluid duct and a common cold fluid duct and controlling the flow of such fluid so as to maintain a constant flow of the desired proportion for each individual operation of the device with which the unit is associated thereby effecting a material saving in the quantity of fluid required for each operation.

Another and still further object of the present invention is to provide for use with a pair of automatic temperature control mixing valves having different temperature setting, a novel fluid control unit including one shut-off valve for each mixing valve, an additional shut-off valve for controlling a by-pass from one of said mixing valves and constant flow maintaining devices for each of said shut-off valves.

Another object of the present invention is to provide valve means for handling fluid embodying a plurality of shut-off valves for controlling the admission of fluid to a common passage defining unitary casing interconnecting the several shut-off valves and a by-pass connection extending between two adjacent shut-off valves to interconnect the same independently of the common passage.

It is a still further object of the present invention to provide for use with an automatic temperature control mixer valve having an outlet, a flow control device comprising a flow control means in the outlet, a second flow control means, a by-pass from the first flow control means to the second flow control means, and a member defining a common outlet and interconnecting both of the flow control means with the common outlet.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My in-

vention itself, however, both as to its organization and manner of construction, together with further objects and advantages thereof, may best be understood by reference to the accompanying drawings, in which:

Figure 1 is an elevation of a fluid flow control device embodying the novel teachings of the present invention and having parts broken away and in section to illustrate its construction;

Figure 2 is an end view of the flow control device of Figure 1 with parts in section and broken away;

Figure 3 is a plan view of the fluid flow control device of Figure 1 with a part of the apparatus illustrated in section; and

Figure 4 is a horizontal section taken along the line IV—IV in Figure 1.

It wi'l be apparent from Figures 1 to 3, inclusive, that the fluid flow control device or valve unit 10 which best illustrates the teachings of the present invention embodies a dual automatic temperature control mixer valve 11 comprising individual units 12 and 13 together with a plurality of shut-off valves 14, 15 and 16. The valve unit 10, although it may be employed in the handling of any form of fluid, is advantageously employed in supplying mixed water of different temperatures to an automatic washing machine or the like.

The dual mixer valve 11 has a casing 17 provided with a single pair of bosses 18 and 19 to which suitable supply conduits for hot and cold water respectively may be detachably connected. The bosses 18 and 19 are connected with inlet chambers 20 and 21, respectively, of the unit 13 of the dual mixer valve 11 as seen in Figure 2 of the drawings. Suitable check valves such, for example, as the check valve assemblies 22 indicated in Figure 3 are provided to prevent cross flow of the water from one to the other of the units 12 or 13 of the dual mixer valve 11 when one of said units is delivering mixed water and the other is shut off. Substantially identical inlet chambers 20*a* and 21*a* (the latter not being shown) are found in the corresponding unit 12 of the dual mixer valve 11 as will be apparent from Figure 3.

The inlet chambers 20 and 21 of the unit 13 connect with a mixing chamber 23 through the ports 24 and 25, respectively. The flow of hot and cold water from the ports 24 and 25, respectively, is controlled by means of a piston 26 which is reciprocably mounted therebetween. The piston 26 is provided with tapered portions 27 and 28 registering generally with said ports 24 and 25, respectively, but never completely closing the ports. The piston 26 is actuated toward one extremity of its reciprocatory pass by a suitable thermostatic power element 29 which reacts to variations in the temperature of the mixed hot and cold water supplies introduced to the mixing chamber 23 in a portion of which said power element is disposed.

The piston 26 has a compression spring 30 disposed at the end thereof opposite the power element 29 to exert thereon a force which will oppose the action of the power element and keep the piston at all times in contact therewith. The power element 29 is mounted in the lower portion of the mixing chamber 23 and is supported in operating relation to the piston 26 by a cup member 31. The cup member 31 is provided with a cover 32 and both said cup member and said cover are apertured to direct the passage of the mixed water from the mixing chamber 23 along the power element 29 and thence through the outlet connection 33.

The cup member 31 is disposed internally of the casing 17 and is supported therein adjacent the bottom of the mixing chamber 23 by means of a ring 34 which is threaded or otherwise suitably fixed in place therein. An end of the power element 29 extends through the base of the cup member 31 and the ring 34 for contact with an end of the piston 35 slidably supported in the bore of a thimble or plug 38 secured in the open lowermost end of the casing 17. The piston 35 has a snap ring 36 or other suitable means for limiting the endwise movement of the piston 35 within the plug 38 and is backed by a compression spring 37. This assembly embodying the piston 35 provides a safety feature which enables the action of the power element 29 to be absorbed if for any reason it should exceed such bounds as are necessary in the actuation of the piston 26 for regulating the flow of the water through the ports 24 and 25 into the mixing chamber 32.

It will be understood that the unit 12 of the dual mixer valve 11 has corresponding parts or elements to those just described in connection with the unit 13 illustrated in detail in Figure 2 of the drawings. The corresponding parts of the unit 12 bear similar reference numerals for the purpose of simplification.

A suitable connecting means 40 preferably of one piece construction is adapted to support and connect together in operating relation a plurality of shut-off valves or other suitable means employed in the control of the delivery of mixed water from the dual mixer valve 11. In this case, the connecting means 40 supports the shut-off valves 14, 15 and 16 and defines a common passage 41 extending therethrough for directing the mixed water from the dual mixer valve 11 to a common outlet 42 as indicated in Figure 4 of the drawings. The connecting means 40 embodies the open-ended generally cylindrical portions 43, 44 and 45 for accommodating the shut-off valves 14, 15 and 16, respectively.

Each of said cylindrical portions 43, 44 and 45 has a respective wall member 46, 47, 48 mounted on one of the open ends of said cylindrical portions. The wall members 46, 47, 48 are secured in place as by means of a plurality of plug members 49 each of which is inserted in the remaining open end of the respective cylindrical portions 43, 44, 45 and is adapted to be threaded into the wall members. Suitable gaskets and sealing means are employed in sealing the several joints between the parts.

The wall member 48 as will be seen from Figure 2 of the drawings is connected to the outlet connection for the unit 12 of the dual mixer valve 11. The wall member 48 has an internal well 49' in which is disposed the port 50 having a collar like seat 51 for the flexible diaphragm 52 which serves to control the flow of fluid through the port 50. The diaphragm 52, which may be fabricated of rubber, artificial rubber, neoprene or other similar material, has a plurality of apertures 53 extending therethrough and surrounding the centrally disposed insert 54 defining a passage 55 which is adapted to extend into the end of the port 50 adjacent the seat 51.

The diaphragm 52 is provided with a peripheral bead 56 which is secured in place as by means of the cap 57 threaded into the uppermost end of the wall member 48 against a suitable shoulder or the like cut into or formed on the wall of the well 49'. A suitable solenoid 58 is mounted

externally of the wall member 48 on the cap 57 in such fashion that its reciprocable core 59 which is provided with a tapered or cone-shaped end portion 60 thereon will upon energizing and deenergizing of said solenoid open and close the passage 55 to interconnect the chamber 61 formed above the flexible diaphragm 52 with the port 50.

It will be understood from Figure 2 of the drawings that when mixed water is passed through the outlet connection 33 into the well 49' of the wall member 48, a portion will pass through the apertures 53 to the upper side of the diaphragm 52 when the tapered end portion 60 of the core 59 closes the passage 55 through said diaphragm or when the solenoid 58 is deenergized. The diaphragm 52 will thus be in contact with the seat 51 and the port 50 will be closed to the passage of the mixed water introduced to the well 49'. When the solenoid 58 is energized and the core 59 is retracted the tapered portion 60 is removed from contact with the passage 55 through the diaphragm 52 and permits the water entrapped in the chamber 61 to flow through the passage 55 and the port 50 into the cylindrical portion of the connecting member 40. In so doing, a pressure differential is set up across the diaphragm 52 and thereafter the mixed water entering the well 49' will be enabled to raise the diaphragm 52 off the seat 51 to permit said water to pass through the port 50.

The shut-off valve units 14 and 15 are generally similar in their construction to the unit 16 hereinabove described in detail. Thus, corresponding parts of the shut-off valve units 14 and 15 bear corresponding reference numerals to those applied to the same parts in the shut-off valve unit 16. The only difference in the several shut-off valve units of the fluid flow control device 10 of the present invention lies in the fact that the wall member 46 associated with shut-off valve 14 and the wall member 47 of the shut-off valve 15 are provided with a by-pass coupling 63 which interconnects the respective wells 49' of said wall members 46 and 47 so as to communicate the well 49' of the wall member 46 with the mixer valve 12 of the dual mixer valve unit 11. Thus, mixed water from the unit 12 of the dual mixer valve 11 may be supplied to the shut-off valve unit 14 irrespective of whether or not the shut-off valve 15 is open.

Each of the plug members 49 employed in securing the wall members 46, 47 and 48 in place on their respective cylindrical portions 43, 44 and 45 on the connecting means 40 is provided with an axially extending bore 64 therein connecting with cross bores 65 and 66 which register with the interior of each of said cylindrical portions. The cross bores 65 and 66 are interconnected at their ends by the annular passage 67 extending above the outer periphery of the plug 49. A generally cylindrical insert 68 is press-fit or otherwise suitably secured in the counterbore 69 adjacent the end of the plug member 49 which engages the wall member 48 as seen in Figure 2 of the drawings.

The insert 68 forms adjacent one end thereof a support for a flexible washer 70. The centrally disposed aperture 71 extending to the washer 70 is preferably of a cross-sectional diameter which is smaller than that of the port 50 adjacent which it is disposed. On the opposite side of the washer 70 from the port 50 there is provided a tapered or substantially funnel-shaped opening of considerably larger cross-section even at its smallest end than that of the aperture 71 in the washer 70. The washer 70 which is fabricated of rubber, artificial rubber or other suitable flexible material is adapted to flex with respect to the tapered outlet 72 to automatically control or adjust the size of the aperture 71 with changes in the pressure of the mixed water passed through the port 50 in the wall member 48 to maintain a constant flow of the mixed water through the bore 64 and into the connecting cross bores 65 and 66 in the annular passage 67.

The fluid flow control device 10 is particularly advantageously adapted to use with an automatic washing machine in which a suitable timer or other sequential operating means is employed to energize and deenergize the several solenoids 58 associated with the shut-off valves 14, 15 and 16 so as to control the delivery of mixed water of varying temperatures and quantities to the tub or container in which the washing operations are to be performed. For example, the unit 13 of the dual mixer valve 11 may be adjusted by the provision of the proper temperature setting of the power element 29 to provide mixed water at a temperature of 140° F. such as is commonly employed in the washing operation performed in the conventional washing machine. The unit 12 of the dual mixer valve 11 may, on the other hand, be set to provide mixed water at a temperature of 100° F. such as may be employed in the rinsing operation performed as one of the steps of the washing cycle of an automatic washing machine or to be used in certain washing operations as well. As indicated in Figure 3 of the drawings the shut-off valve 15 is interconnected with the unit 12 of the mixer valve 11 as by means of the outlet connection 33a while the shut-off valve 16 is connected with unit 13 through the connection 33.

It will be understood, therefore, that in the operation of the automatic washing machine, as determined by the timer or other control means employed, mixed water of the desired temperature will be delivered from the common outlet connection 42 by the operation of the proper shut-off valves 15 or 16 depending upon the temperature of the water required for the given operation. The washer 70 employed in connection with the shut-off valves 15 and 16 will have the same size aperture 71 so that both units 12 and 13 of the dual mixer valve 11 will deliver the same quantity of mixed water through the outlet connection 42 in the same interval of time.

At certain times in the operation of the ordinary automatic washing machine, however, it is desired to provide a somewhat lesser quantity of water than will be provided by the operation of the shut-off valve 15, for example. Thus, when the diaphragm 52 is in contact with the seat 51 in the shut-off valve unit 15 mixed water from the unit 12 of the dual mixer valve 11 may pass through the outlet connection 33a into the well 49' in the wall member 47 of the shut-off valve 15, thence through the by-pass connection 63 and into the well 49' of the wall member 46 associated with the shut-off valve 14. The washer 17a associated with the shut-off valve 14 has an aperture 71a which is of considerably smaller cross-section than the washers 70 of the shut-off valves 15 and 16 so as to deliver a constant quantity of mixed water at a somewhat lesser constant rate of flow from the shut-off valve 14 to the common outlet 42 of the connecting means 40.

The structure of the fluid flow control device 10 of the present invention embodying the auxiliary shut-off valve and by-pass connection is

particularly advantageous in that it provides an opportunity to introduce a smaller quantity of mixed water from one of the units of the dual mixer valve 11 to the container of the automatic washing machine, for example, for the performance of a spray rinsing operation immediately following the washing step and preceding the final rinsing step.

It will, of course, be understood that any combination of the component units may be employed to provide different quantities and temperatures of mixed water afforded by each of the shut-off valve units employed singly or in different combinations. Such combined operations, however, depend upon the setting of the timer or control means which is employed for energizing and deenergizing the solenoid 58 of the several shut-off valves 14, 15 and 16.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. Valve means for handling fluid comprising a unitary casing having a plurality of open-ended chambers joined together to form a common passage with a single outlet therefor, a shut-off valve having an inlet and an outlet and a well portion therein mounted on one end of each chamber, said well portion being in communication with the inlet, a plug member inserted in the opposite end of each chamber arranged to secure each shut-off valve to each chamber with the outlet of the shut-off vlave in communication with the chamber, flow control means in said plug member for coacting with the shut-off valve to maintain a uniform flow of fluid into the chamber and thence to the common passage with which it is connected, and by-pass means interconnecting the inlet side of the well portion of one of the shut-off valves with the inlet of another of the shut-off valves independently of the common passage.

2. Valve means for handling fluid comprising a unitary casing having a plurality of open-ended chambers joined together to form a common passage with a single outlet therefor, a shut-off valve having an inlet and outlet therein mounted on one end of each chamber, a plug member inserted in the opposite end of each chamber arranged to secure each shut-off valve to each chamber with the outlet of the shut-off valve in commuication with the chamber, flow control means in said plug member for coacting with the shut-off valve to maintain a uniform flow of fluid into the chamber and thence to the common passage with which it is connected, and a by-pass connection between the inlet of one of the shut-off valves and the inlet of another of the shut-off valves independent of the common passage.

3. Valve means for handling fluid comprising a unitary casing having a plurality of open-ended chamber portions joined together by integrally formed connecting means to form a common passage having a single outlet, a well member having an inlet and an outlet and a valve seat therein mounted on an end of each chamber, a separate plug member for each chamber and arranged to secure each well member to each chamber, said plug members each having an opening extending therethrough interconnecting the chamber and the outlet of the well member, means in the opening in each plug member for maintaining a constant flow of fluid therethrough, automatically operable valve means in each well member for engaging the seat therein, and means interconnecting the inlet side of the well associated with one of said chambers with the inlet of an adjacent well independently of their connections through the passage in the casing.

4. Valve means for handling fluid comprising a unitary casing having a plurality of open-ended chamber portions joined together by integrally formed connecting means to form a common passage having a single outlet, a well member having an inlet and an outlet and a valve seat therein mounted on an end of each chamber, a flexible diaphragm valve in each well member for contact with the seat therein to open and close the passage of fluid through said well member, a pilot valve for controlling the operation of the diaphragm, a solenoid for selectively operating the pilot valve, a plug member inserted in the other end of each chamber arranged to secure the outlet of each well member to each chamber, said plug member having an opening therein interconnecting the chamber and the outlet of the well member, means in the opening in each plug member for maintaining a constant flow of fluid therethrough, and a by-pass connection between the inlet side of the well associated with one of said chambers with the inlet of an adjacent well.

5. Connecting means for a fluid flow control device embodying a plurality of flow control units, said connecting means comprising means defining a common enclosed passage, a plurality of open-ended generally cylindrical portions arranged at spaced intervals along the passage defining means, a common outlet connecting with the passage-defining means, a well member having an inlet and an outlet mounted at one of the open ends of each cylindrical portion, and a plug member disposed at the other open end of each cylindrical portion having a part extending through the cylindrical portion and arranged to secure the outlet of each well member to an associated cylindrical portion in communication therewith.

6. Connecting means for a fluid flow control device embodying a plurality of flow control units, said connecting means comprising means defining a common enclosed passage, a plurality of open-ended generally cylindrical portions arranged at spaced intervals along the passage defining means, a common outlet connecting with the passage-defining means, a well member having an inlet and an outlet mounted at one of the open ends of each cylindrical portion, a plug member disposed at the other open end of each cylindrical portion having a part extending through the cylindrical portion and arranged to secure the outlet of the well member to said cylindrical portion in communication therewith, and fluid passage means interconnecting the inlet of one well member with the inlet of another well member independently of the passage defining means.

7. Valve means for handling fluid comprising a unitary casing having at least three open ended chambers joined together to form a common passage with a single outlet therefor, a shut-off valve having a well having an inlet and an outlet, said valve being mounted on one end of each chamber, a plug member inserted in the opposite end of each chamber arranged to secure the shut-off valve to said chamber with the outlet of the well in communication therewith, means in said plug member for coacting with the shut-off valve to

maintain a uniform flow of fluid into the chamber and then to the common passage with which it is connected, and means interconnecting the inlet side of the well of one of the shut-off valves with the inlet side of the well of another of the shut-off valves independently of the common passage.

8. In a fluid control device, a plurality of automatically operated shut-off valves each having a well with an inlet and an outlet, a fluid connecting means for said valves comprising a unitary fluid passage defining means having a generally cylindrical portion at each end thereof and at least one such portion disposed between said end portions, all of said cylindrical portions being open-ended, a common outlet from said passage defining means, each well of said valves being mounted at one of the open ends of each cylindrical portion in communication therewith, a plug member inserted in the other open end of each cylindrical portion arranged to secure each shut-off valve thereto, a metering device in each plug member for controlling the volume of fluid introduced to the passage defining means from the well member, each well member having a valve seat, each shut-off valve having a valve element registering with an associated valve seat in each well, and a separate solenoid operated pilot valve for controlling operation of each valve element.

9. In a fluid control device, a plurality of automatically operated shut-off valves, each having a well with an inlet and an outlet, fluid coupling means for said valve and comprising an open ended generally cylindrical shaped mounting portion for each shut-off valve, coupling portions formed integrally with and interconnecting said mounting portions and forming a single passage therebetween, a common outlet from one of said coupling portions, each well member having communication with a mounting portion, a separate plug member extending through each mounting portion and arranged to secure a shut-off valve to each mounting portion, means in each plug member for controlling the flow of fluid from the shut-off valve associated therewith through the passage defined by the coupling portions, and fluid passage means interconnecting the inlets of at least two of the well members independently of said coupling portions.

LESLIE A. KEMPTON.

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