The mixing valve used in the water fill system of a washing machine is moved from being located inside the washing machine to the water source, eliminating hoses, reducing manufacturing cost, and improving reliability.
Fig 1. Prior Art
Fig. 4
WASHING MACHINE WATER FILL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

BACKGROUND—FIELD OF INVENTION

[0002] This invention relates to washing machines, specifically, to the water fill system.

BACKGROUND—DESCRIPTION OF PRIOR ART

[0003] The prior art is shown in FIG. 1. A washing machine has a mixing valve 20 to independently control the flow of hot and cold water from hot and cold water sources 12. The mixing valve 20 is located within the washing machine housing 30. Water is fed to the mixing valve by two hoses 14. These hoses are shipped with the washing machine, and the hoses have female swivel connectors on each end. The mixing valve has two inlets 22 with male threads, so the hoses connect directly to it. The water source lines 12 usually have either a single throw valve 10 or two faucets to open or close both hot and cold water supplies. The single throw valve 10 or faucets usually have male threads, so the hoses 14 connect directly to them. If the single throw valve 10 or faucets do not have appropriate threads, appropriate connectors are obtained from a plumbing parts supplier to complete the installation of the washing machine.

[0004] The mixing valve 20 is composed of a plastic housing with two inlets 22 and an outlet 28, and two electrically controlled plug elements 24 for preventing or allowing water to flow. Electrical control comes to contacts 26 via wires 34 from a controller 32. For cost reasons, the water streams, after passing through the plugs 24, are normally combined into a single stream inside the mixing valve 20 and then the stream flows through an outlet 28. Water flows from the outlet 28 through a low pressure hose 36 which carries the water to the washing machine tub 38.

[0005] This system has one major problem. The hoses 14 between the single throw valve 10 or faucets and the mixing valve inlets 22 are constantly under the full high pressure of the water source. Although the hoses 14 supplied with the washing machines are intended for this high pressure, the hoses 14 occasionally rupture. The rupture rate is very low, but the cost of the resulting flooding damage is often very high. Washing machine manufacturers could supply stronger hoses, but this would increase their cost. Washing machine owners could replace the hoses with stronger hoses available from many plumbing parts suppliers, but most owners do not do so. Owners of washing machines also could turn off the water at the source by shutting the single throw valve 10 or faucets, but most owners rarely do so.

[0006] U.S. Pat. Nos. 5,713,222, 5,560,231, 5,375,438, 4,899,524, 4,754,622, 3,566,006, 3,605,455, 2,871,871, 2,552,398, 2,523,801, and 2,498,179 all deal with water fill systems, but are concerned with water flow after the mixing valve. U.S. Pat. No. 3,020,731 relates to protection against backflow. None of these patents claim means of eliminating the hose rupture problem.

[0007] U.S. Pat. No. 5,425,255 claims a method of improving isolation between the electrical contacts of the mixing valve plug 26 and the washing machine water moisture. The intent of the patent is to improve reliability by reducing the chance of moisture induced corrosion of the electrical contacts. The disadvantage of the patent is that the improved isolation is accomplished by the addition of a physical barrier in the washing machine housing 30, at added cost to the washing machine manufacturer.

SUMMARY

[0008] In accordance with the current invention, the mixing valve is moved from being located inside the washing machine to being attached directly to the water source. Only minor modifications are needed to the mixing valve. The outlet of the mixing valve and the electrical power to it can use the same connections and materials as in the prior art.

OBJECTS AND ADVANTAGES

[0009] Accordingly, several objects and advantages of this invention are:

(a) to eliminate hoses that sustain continuous high water pressure, thereby reducing washing machine manufacturing cost;

(b) to eliminate hoses that sustain continuous high water pressure and occasionally fail, often causing extensive and costly damage, thereby improving reliability;

(c) to use the same connections and materials on the washing machine side of the mixing valve as is currently used, thereby saving re-tooling costs;

(d) to have a system that, if electrical power is lost, places a closed water valve at the water source, thereby improving reliability; and

(e) to move the electrical contacts to the mixing valve far from the washing machine tub so that corrosion due to proximity to water moisture is reduced without any added cost to the washing machine manufacturer.

DRAWING FIGURES

[0015] FIG. 1 shows the prior art using a single throw valve to control both hot and cold water supplies.

[0016] FIG. 2 shows the improved water fill system using female threads on the mixing valve inlet and a three piece mixing valve.

[0017] FIG. 3 shows details of the female threads arrangement on the mixing valve inlet with swivel cross sectioned.

[0018] FIG. 4 shows the improved water fill system using male threads on the mixing valve inlet and a one piece mixing valve.

[0019] FIG. 5 shows the improved water fill system using female threads on the mixing valve inlet, a two piece mixing valve, and a Y-type outlet tube.

DESCRIPTION—FIGS. 2 AND 3—PREFERRED EMBODIMENT

[0020] A preferred embodiment of the improved washing machine filling system is shown in FIGS. 2 and 3.

[0021] In FIG. 2, the mixing valve is composed of two separate valve elements 40, 41 each having its own inlet 42 from the water source, and a hose 46. The outlet 44 of one
valve 40 is connected to a second inlet 46 of the other valve 41 by a short connection hose 46. Hose 46 can be made of the same material as prior art outlet hose 36. Water flows from the second valve 41 through its outlet hose 44, via a second outlet hose 48 to the tub 38. Connection hose 46 and outlet hose 48 are connected to the mixing valves in the same way as outlet hose 30 is connected to the mixing valve outlet 28 in the prior art. The mixing valves 40, 41 differ on the outlet side of the plugs 24 in that valve 40 has only an outlet 44 and valve 41 has both an outlet 44 and an additional inlet 46. There is no requirement as to which valve 40, 41 carries hot water or cold water. Valve 40 could be replaced by a valve identical to valve 41, as long as a means of closing off the unused inlet is employed. Many well known methods could be employed for this closure. Mixing valve elements 40, 41 are attached to and electrically controlled by wiring 50 and controller 32 as in the prior art. Outlet hose 48 and wiring 50 can be the same as outlet hose 36 and wiring 34 of the prior art, except for length.

Because the electrical contacts 26 to the mixing valve 40, 41 are now outside the washing machine housing 30, the chance for degradation of the contacts due to proximity to the washing machine water moisture is reduced.

Re-tooling is needed to make the new mixing valve. Only the plastic housing of the prior art mixing valve 20 needs to be changed. The parts associated with the plugs 24 and electrical contacts 26 are unchanged.

The mixing valve inlets 42 may have male or female threads. In the prior art the inlets 22 use male threads. In the preferred embodiment of FIG. 2, the threading is female, as shown in more detail in FIG. 3. Swivel 42A, shown cross sectioned, contains female threads needed to connect to the single throw valve 10 or faucets. A washer 45 is placed on the end of the shaft 43 to obtain a conventional water tight connection to the single throw valve 10 or faucets when the swivel 42A is tightened. The female swivel 42A, washer 45, and shaft 43 are a well known arrangement found in many low cost products. This ensures that the preferred embodiment can be manufactured at a low cost. By connecting the mixing valves directly to the single throw valve 10 or faucets, the prior art hose 14 are eliminated, saving cost. By eliminating hoses 14, hose rupture is no longer possible, improving reliability.

The plugs 24 within the various mixing valves 20, 40, 41 are all operated electrically. The electrical signals involved are low dc or ac voltages, so placing the electrical connections external to the washing machine housing 30 does not pose a danger of electrical shock. In the absence of electrical power, the plugs 24 are in a closed position. Therefore, even if electrical power is lost, the high pressure water is terminated immediately at the outlet of the single throw valve 10 or faucets, adding to protection against major water damage.

A gasket 52 applied to the opening in the washing machine housing 30 through which the wires 50 and low pressure outlet hose 48 enter the washing machine housing 30. This protects both wires 50 and hose 48 from chaffing.

Alternative Embodiments—FIGS. 4 and 5

FIGS. 4 and 5 show two alternative embodiments of this invention.

In FIG. 4, the structure of the prior art mixing valve 10 as a single unit is retained for the new mixing valve 60. Female-to-female swivel connectors 64 obtainable from many plumbing parts suppliers connect the mixing valve 60 inlets 62 to the single throw valve 10 or faucets, which will require re-tooling the plastic. The spacing between the two inlets 62 needs to match that of the outlets of the single throw valve 10 or faucets. Matching spacing of the two inlets 62 to the outlets of the single throw valve 10 has some margin for manufacturing variations because the axis of the swivel 64 and the axis of the inlet 62 do not need to be perfectly aligned during the tightening. This approach requires less re-tooling than is needed in the preferred embodiment since the prior art male thread inlet 22 is retained for inlet 62 rather than the preferred embodiment FIG. 2 female inlet 42. However, miss-matches in temperature coefficients and the effects of other mechanical movement may make maintenance of a good water tight seal a difficult engineering task. A second disadvantage of this embodiment is that, when faucets are used, the spacing of faucets is much less well controlled than on the single throw valve 10. Additional plumbing connector parts may then be needed for installation. By using short pieces of high pressure hose in this arrangement, reliability comparable to the prior art would be improved, but the arrangement is not as compact or as esthetically pleasing as the preferred embodiment. This arrangement is also expected to be more expensive than the preferred embodiment. Detailed analysis by those skilled in the art should be done to verify which approach should be used.

It will be obvious to the reader that instead of the male treads on the one piece mixing valve inlets 62 in FIG. 4, female threads as shown in the preferred embodiment in FIGS. 2 and 3 could be used.

It will also be obvious to the reader that in the preferred embodiment, swivels 42 could be replaced by male threaded inlets 62 and swivel valve connectors 64. The arrangement of FIG. 3 is preferred over the alternate embodiment because the cost of the female threading arrangement 42 as an integral part of the mixing valve system is expected to be lower cost than the cost of female-to-female connectors 64. Detailed analysis by those skilled in the art should be done to verify which approach should be used.

Another alternative embodiment is shown in FIG. 5. For an arrangement using two separate but identical valves 40, the outlet 44 from each mixing valve goes to a Y-type outlet hose 66. The arrangement of FIG. 2 is preferred over the arrangement of FIG. 5 because the cost of two different valves 40, 41 in FIG. 2, including both added tooling and added inventory control cost, is expected to be lower than the cost of the Y-type hose connection 50. Detailed analysis by those skilled in the art should be done to verify which approach should be used.

Those skilled in the art will understand that any features incorporated in the hoses 14 or mixing valve 20 of the prior art which are not specifically described here can be applied directly to this invention. One example is the use of a washer with a screen filter in the hoses 14. These can be used in place of the washer 45 or can be placed in the connectors 64. Another example is that any backflow protection incorporated in mixing valve 20 can be incorporated in mixing valves 40, 41, 60 or in the Y-type outlet hose 66.
Advantages

From the description above, a number of advantages of this improved washing machine filling system become evident:

- (f) hoses that sustain continuous high water pressure have been eliminated, thereby reducing washing machine manufacturing cost;
- (g) by eliminating hoses that sustain continuous high water pressure and occasionally fail, often causing extensive and costly damage, reliability is improved;
- (h) by using the same connections and materials on the washing machine side of the mixing valve as is currently used, re-tooling costs are kept low;
- (i) the new system is such that, if electrical power is lost, a closed water valve is placed directly on the water source, improving reliability; and
- (j) by moving the electrical contacts between the washing machine and the mixing value outside the washing machine, the possibility of corrosion due to proximity to the water moisture in the washing machine is reduced, improving reliability.

Conclusions, Ramifications, and Scope

Accordingly, it is evident that, by eliminating hoses currently supplied with the washing machines, the invention reduces manufacturing costs of washing machines and eliminates a reliability problem that can be a major cost to owners of washing machines. Retooling costs for washing machine manufacturers can be limited to the plastic part of the mixing valve.

We claim:

1. A method of improving the reliability of and reducing the cost of a washing machine having independent control of the hot and cold water flow located at the water source outside the washing machine housing whereby hoses subject to failure are eliminated, saving cost and improving reliability compared to existing washing machine water fill systems.

2. The method of claim 1 providing said independent controls as a single unit comprising inlets, electrically operated plugs, and an outlet, whereby the electrical contacts for operation are physically far from the corrosion producing water moisture within the washing machine improving reliability.

3. The method of claim 1 providing said independent controls as separate units comprising an inlet, an electrically operated plugs, and an outlet, whereby the electrical contacts for operation are physically far from the corrosion producing water moisture within the washing machine improving reliability.

4. An arrangement of claim 2 providing the water inlet sides of said independent controls connected to the hot and cold water sources by any well known means having higher reliability and lower cost compared to hoses used in existing washing machine water fill systems.

5. An arrangement of claim 3 providing the water inlet sides of said independent controls connected to the hot and cold water sources by any well known means having higher reliability and lower cost compared to hoses used in existing washing machine water fill systems.

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