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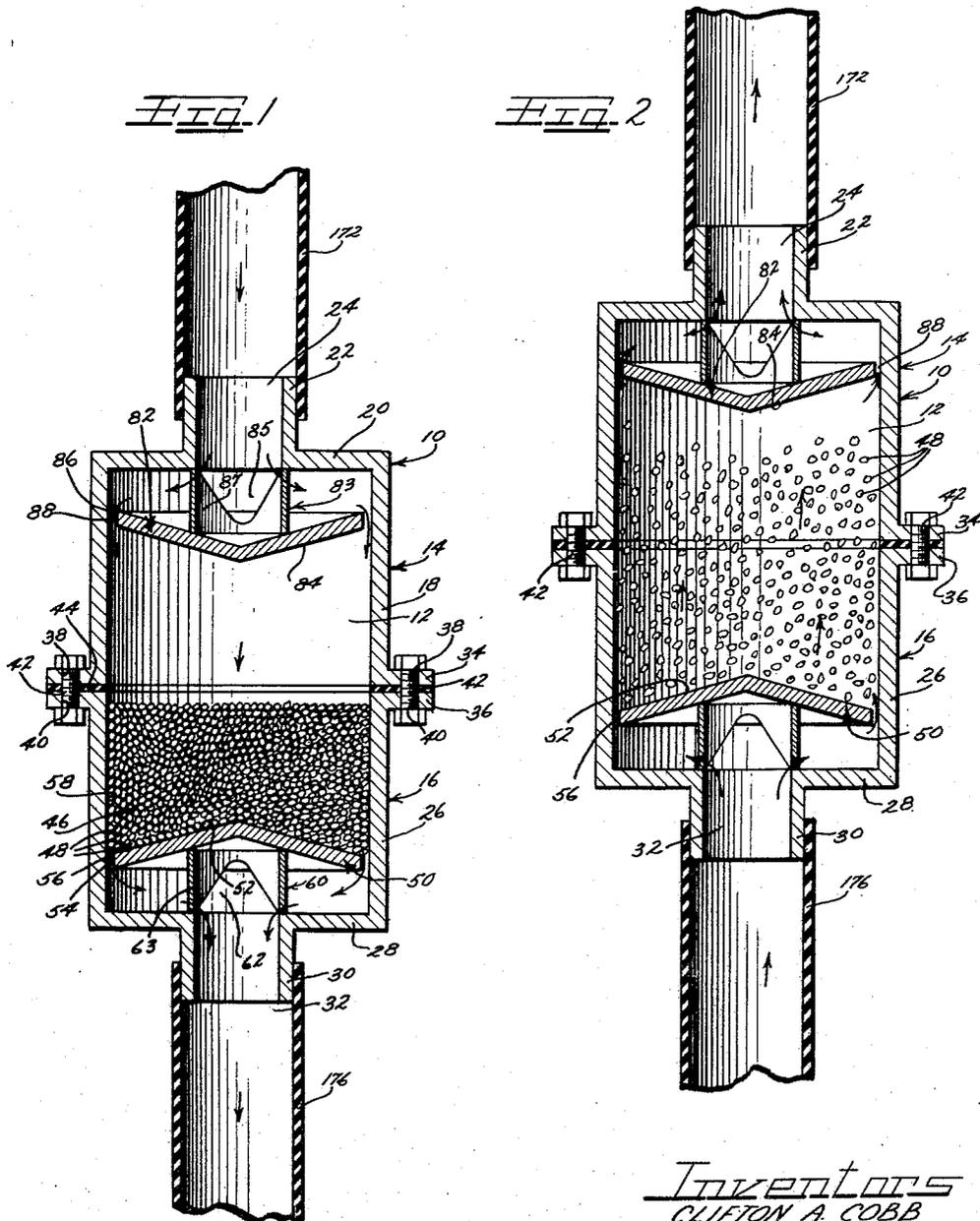
C. A. COBB ETAL

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SELF-CLEANING FILTER FOR LAUNDRY MACHINE

Filed March 13, 1957

3 Sheets-Sheet 1



Inventors

CLIFTON A. COBB
EDWARD E. WIESSNER
CARROL A. ORR

Hell Sherman Meroni Gross & Simpson

Attys

BU

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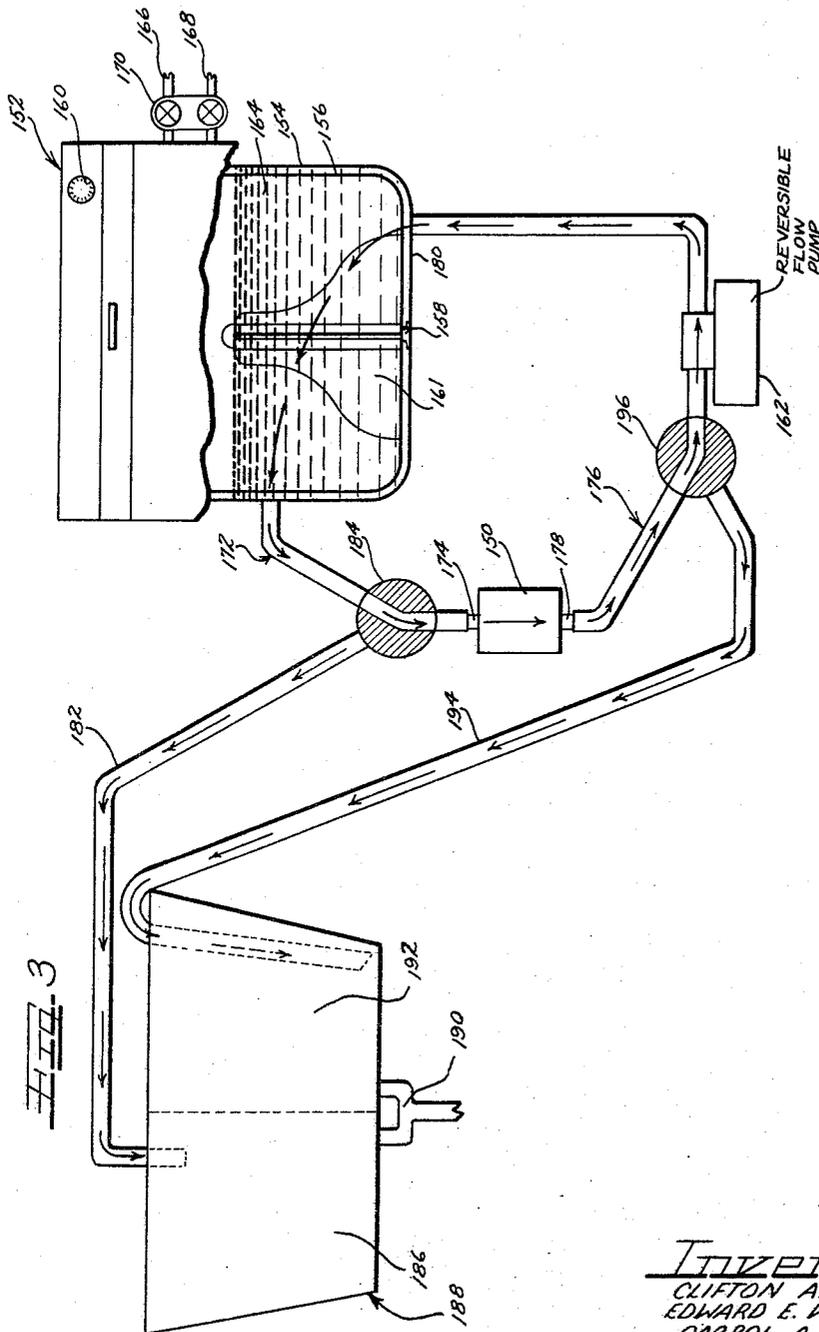
C. A. COBB ETAL

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Inventors
CLIFTON A. COBB
EDWARD E. WIESSNER
CARROL A. ORR
Will Sherman Meroni Gross & Simpson
Attys

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C. A. COBB ETAL

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FIG. 4

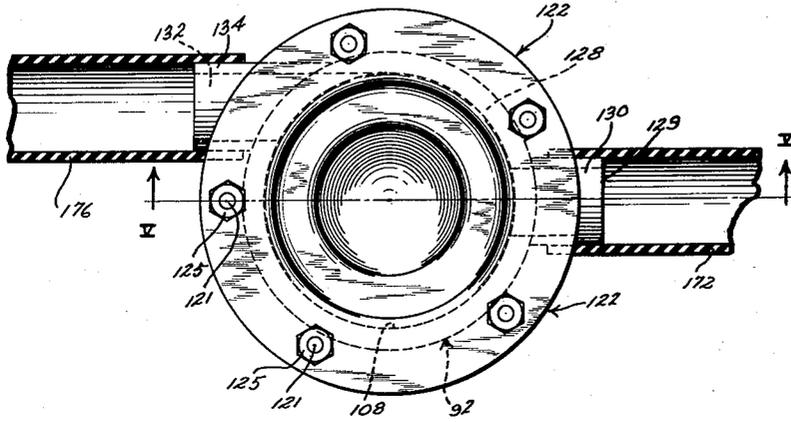
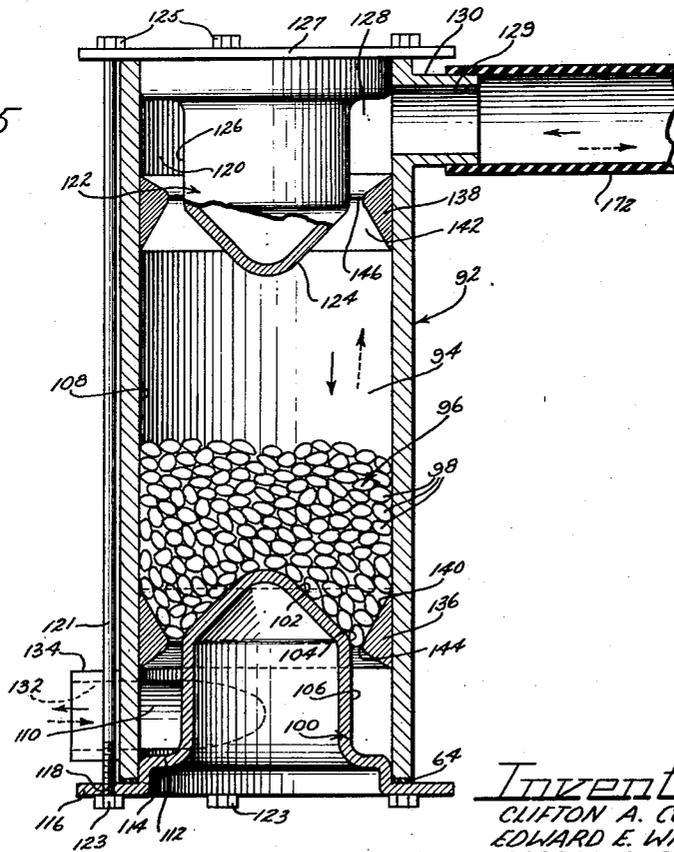


FIG. 5



Inventors
CLIFTON A. COBB
EDWARD E. WIESSNER
CARROL A. ORR

Bill Sherman Merwin Gross & Simpson

Attys

Bu

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**SELF-CLEANING FILTER FOR LAUNDRY
MACHINE**

Clifton A. Cobb, Edward E. Wiessner, and Carrol A. Orr, St. Joseph, Mich., assignors to Whirlpool Corporation, a corporation of Delaware
Filed Mar. 13, 1957, Ser. No. 645,765
5 Claims. (Cl. 210-275)

The present invention relates to an improved self-cleaning filter for removing lint and foreign materials from the water of a domestic type washing machine, and to an improved fluid system for cleaning the filter and for transferring the washing and rinsing water to various locations in connection with the automatic operation of the washer.

In domestic washing machines, of the type used in automatic operation, clothes are placed within a basket or tub which is contained in an outer fluid-containing tub. Means such as an agitator or the like are used for agitating the washing fluid to wash the clothes and carry away the materials which have soiled the clothes. At the end of the washing operation, the washing fluid is drained whereupon a series of rinses may be employed and the clothes thereafter may be spun dry by high speed rotation of the basket.

During the washing process, the washing fluid becomes laden with foreign material which has soiled the clothes and with particles of lint or the like which are loosened and removed from the fabrics by the fluid. This foreign material and lint deters the efficient action of the water, and some of the lint and particles of soil will remain on the clothes when the wash water is drained away. This is undesirable for a number of reasons and especially inasmuch as the lint will attach itself to the surface of the clothes when they are spun dry, and will remain on the fabric surface when the clothes are removed from the tub.

It is, therefore, highly desirable to provide a means for cleaning the lint and foreign particles from the water during the washing operation. Filters have been provided, but have not been wholly effective and have required manual attention and cleaning for continued operation.

The present invention contemplates as one of its objects the provision of an improved filter for removing lint and foreign particles from the wash water of a domestic type washing machine during the washing operation, which will be self cleaning and require no manual attention.

Another object of the invention is to provide an improved fluid conduit and pump system whereby the washing and rinse water is effectively handled and wherein the system is combined with the improved self-cleaning filter to avoid disadvantages heretofore encountered.

Another object of the invention is to provide an improved self-cleaning filter in which the flow of fluid can be reversed for self-cleaning, and wherein water from the washing tub is used for the self-cleaning and preferably relatively clean rinse water.

Another object of the invention is to provide a self-cleaning filter in combination with a fluid handling system for an automatic washing machine in which the functions of filtering the fluid, cleaning the filter, draining the washing and rinsing fluid, conducting the fluid into a suds saving system and returning the sudsy fluid to the washer, all accomplished with a minimum amount of equipment to thereby obtain a machine which is inexpensive to manufacture and simple to produce, operate and maintain.

A further object of the invention is to provide an improved filter construction which is capable of effectively filtering fluids such as those used in an automatic washing machine, and wherein the flow of fluid can be reversed for effective self-cleaning.

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Other objects and advantages will become more apparent in the teaching of the principles of the invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a vertical section view taken through a form of filter embodying the principles of the present invention;

FIGURE 2 is a vertical sectional view taken through the filter and illustrating the apparatus as FIGURE 1, but showing its operation during the self-cleaning action;

FIGURE 3 is a somewhat diagrammatic view of the filter employed in combination with a washing machine and illustrating the arrangement constituting the fluid handling system for use with the filter;

FIGURE 4 is a plan view of another form of the self-cleaning filter; and,

FIGURE 5 is a vertical sectional view taken along line V-V of FIGURE 4.

The filter embodying certain principles of the invention and showing one form as illustrated in FIGURES 1 and 2 and the filter is combined in the fluid handling system of a domestic type washing machine as illustrated in FIGURE 4. A preferred form of the filter is illustrated in FIGURES 4 and 5. While the filter, as illustrated in the forms described, finds particular utility in the combination of the automatic washer and fluid handling and control system illustrated in FIGURE 4, it will be understood that the inherent advantages of the invention may find utility in other environments and the features and elements are not to be restricted to the particular form shown.

The filter, as illustrated in FIGURES 1 and 2 comprises a casing 10 or housing which is cylindrical in shape and which defines a cylindrical filter chamber 12 therein. The casing is formed of an upper cylindrical section 14 and a lower section 16. The upper section 14 has a cylindrical body wall 18 carrying an integral end wall 20. The end wall is provided with an annular boss 22, which defines the inlet opening 24 leading into the filter chamber 12.

The lower portion 16 of the casing 10 likewise is provided with a cylindrical wall 26, which has an integral end wall 28. The end wall carries an integral annular boss 30, which provides an outlet opening 32 communicating with the filter chamber 12.

The two sections 14 and 16 of the filter casing carry annular outwardly extending flanges 34 and 36, respectively. These flanges are provided with a series of spaced openings 38 and 40 for receiving bolts 42, which clamp the sections 14 and 16 of the casing together. A gasket 44 is located between the flanges to provide a fluid tight coupling between the sections 14 and 16.

Within the filter chamber 12 is a filter bed 46, which is formed of a multitude of particles 48 of filtering material. The filter material or filter particles may be formed of materials such as glass, ceramic, thermosetting plastics, aluminum, gravel, stone or other aggregate, or other non-corrosive substances that are not chemically attacked by washing powders, bleaches or other chemicals used in home laundry operations.

The filter particles are of substantially uniform size and are preferably non-symmetrical in shape so that they will wobble or tumble when lifted off their supports and suspended in a reverse flow of fluid through the filter chamber 12. It is important that the filter particles do not have sharp edges or contours that would permanently entrap lint or other foreign matter. Round, oval or cone shaped particles have been found to operate with advantage. Round glass balls of a size on the order of one-fourth inch in diameter have been found to be very operative in the combination illustrated.

In their normal operation, the filter particles 48 will settle down to form the filter bed 46 and will be supported by the support plate 50. This plate is preferably conical in shape with an upper surface 52 inclined upwardly from the outer edge 54. The plate is circular in plan view and defines an annular flow passageway 56 between the edge 54 of the plate and the inner cylindrical wall 58 of the filter chamber 12. This passageway is uniform in width and of a size slightly smaller than the diameter of the filter particles 48, so that they will not escape through the passageway 56.

The support plate 50 is held in its location within the filter chamber 12 supported on a tubular base 60. The plate 50 may be cemented to the base 60, and the base cemented to the inner face of the end wall 28 by conventional moisture resistant adhesive. This tubular base 60 has portions cut away to obtain maximum flow passageways or openings 62 which are in communication with outlet opening 32. The legs 63, formed by cutting the openings 62 in the base 60, support the plate 50.

At the upper end of the filter chamber 12, a retaining plate 82 is provided. This plate is conical in shape and has an upper surface 84 inclined from its outer edge 86 to a point. The outer edge is circular so as to define an annular passageway 88 between it and the inner cylindrical surface 58 of the filter chamber 12. The plate 82 is of the same or similar construction as the plate 50 at the lower end of the filter chamber.

The retaining plate 82 is carried on a tubular support 83 which is secured to the plate 82 and the filter end wall 20, such as by waterproof cement or adhesive. Flow passageways 85 are cut in the support 83 with legs 87 left between the passageways.

It will be noted that there is a space between the bed 46 of the filter material and the surface of the upper retaining plate so that the aggregate particles can float upwardly when the flow of fluid is reversed for cleaning purposes.

It will also be noted that the filter housing 10 is symmetrical and that it can be operated in an inverted position, and care need not be taken in assembly as to which end is placed up. This construction will reduce the cost of manufacture, since the parts are interchangeable.

In the form of the filter shown in FIGURES 4 and 5, a filter casing or housing 92 is provided which is cylindrical in shape and which has a cylindrical interior forming a filter chamber 94.

Within the filter chamber is the filter bed 96 comprising the filter particles 98, which may be the same as the filter particles provided in the filter bed 46 in the embodiment of FIGURES 1 and 2.

The filter bed is supported at the lower end of the filter housing 92 in part by a filter cap 100, which is inserted into the open lower end of the cylindrical filter housing 92. The filter cap may be made of pressed or drawn sheet metal and has a hollow interior. The upper surface 102 supports the filter bed and is conical in shape tapering upwardly from the outer edge 104. The edge 104 extends downwardly in the cylindrical body and the cylindrical outer surface 106 of the body, combined with the lower end of the inner cylindrical wall 108 of the housing form an annular chamber 110. This annular chamber permits the fluid to circulate in a rotary motion as it enters the casing 92 when the fluid is reversed in direction for cleaning the filter, as will later be described.

The filter cap is flared outwardly at 112 in an annular flange and then turned downwardly at 114 to fit tightly against the inner cylindrical wall 108. From the downwardly turned flange 114, the metal is turned outwardly to form a flange 116, which projects outwardly beyond the cylindrical wall of the casing 92 and a gasket 64 between the flange 116 and end of the casing 92. This flange 116 has a series of spaced holes 118 which receive elongated rods 121 threaded at the lower end to receive nuts 123 and at the upper end to receive similar nuts

125, for holding the lower filter cap 100 in place and also holding the upper filter cap 122 in place. The upper filter cap is of the same construction as the lower and is provided with a conically shaped surface 124 which faces downwardly toward the filter bed 96. A space exists between the surface 124 and the filter bed so that the filter particles 98 may flow upwardly for the self-cleaning action when the flow of fluid is reversed.

Adjacent the conical surface 124 of the upper filter cap 122 is a cylindrical surface 126, which, in combination with the inner cylindrical wall 108 of the casing 92, defines an annular chamber 128 receiving the fluid as it enters through the inlet opening 129 leading into the casing. This inlet opening is formed by an annular boss 130, and the outlet opening 132 at the lower end of the casing 92 is formed by an annular boss 134. The cap 122 is flanged outwardly at its edge to form a flange 127 which receives the ends of the holding bolts 121.

Annular retainer rings 136 and 138 are secured to the inner wall 108 at the lower and upper ends of the casing 92, respectively. These rings are provided with inner surfaces 140 and 142 formed in the shape of a bulge to define flow passageways 144 and 146 between the bulge and the outer cylindrical walls 106 and 126 of the filter caps 100 and 122.

In normal filter operation, the fluid enters the filter through the inlet opening 129 following the flow indicated by the solid line arrows. The fluid moves down through the filter bed wherein the lint and foreign materials, gathered by the washing fluid during the washing operation, are removed. The fluid leaves through the outlet opening 132.

When the filter is to be flushed, the fluid flows in a reverse direction, as indicated by the dotted line arrows. It is to be noted that the annular boss 134, which defines the outlet opening 132, is located tangentially with respect to the filter chamber 94. Thus, as the fluid is reversed in the self-cleaning action, it swirls around the annular chamber 110, passes up through the passageway 144 to individually loosen the filter particles 98 and agitate them so that they will change positions and freely release the particles which have been filtered from the fluid in the filtering action.

The filter is shown at 150 in FIGURE 3 in combination with a domestic washer 152 of the automatic type and a fluid handling system. The washer includes a tub 154 with a basket 156 therein which may be perforated and mounted on a supporting hub 158 for rotation about a vertical axis.

The washing machine is provided with a control dial 160 which is connected to suitable electrical controls for operating a timer motor, which in turn operates a control switch for a motor for driving an agitator 161 or washing means provided within the basket 156, for driving a pump 162, and for operating electric valves, which will be described later. Fresh water is admitted to the tub as shown at 164 through hot and cold water lines 166 and 168 controlled by a valve means 170, which is electrically operated and which may be in the form of a mixing valve to proportion the hot and cold water in the ratios desired.

A first conduit 172 is connected between the inlet port 174 of the filter 150 and the tub 154 at a location beneath the normal level of the washing fluid 164 in the tub. A second conduit 176 is connected between the outlet port 178 of the filter 150 and the tub 154 at a location also beneath the normal level of the washing fluid 164 therein. Preferably, the second conduit is connected at the base of the tub 154 and the first conduit connected at a location spaced above the base. Since the fluid, during filtering action, is normally circulated in the direction indicated by the solid line arrows, fluid will be drawn from the tub at a location above bottom 180, and when the second conduit 176 is used to evacuate the tub after the washing action, the fluid will be drawn from the bottom 180.

For circulating the washing fluid during the washing

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operation, the pump 162 is connected in the second conduit 176. It will be understood, of course, that for certain purposes and with different conduit arrangements the pump 162 could be located in the first conduit 172.

The pump preferably is a uni-directional pump of the multi-flow type wherein the rotor is driven in a single direction, but control means are provided to cause the pump to pump in either direction. A reversible pump, however, could be utilized, as well as a plurality of pumps.

The pump 162 is reversed in pumping operation when the self-cleaning operation of the filter 150 is to be performed. This will use the washing fluid which is in the tub for the filter cleaning operation. Preferably, the fluid is filtered during the washing operation and the deep rinse operation, and the filter is cleaned with the relatively clean water used in the subsequent rinsing operations.

The reverse flow of fluid for cleaning the filter 150 is directed to a suitable drain through a drain conduit 182. This conduit connects to the first conduit 172 between the tub 154 and the filter inlet 174. At the juncture between the conduits 182 and 172 is a two-way valve 184. When fluid is flowing through the filter in a filtering direction, the two-way valve 184 is adjusted so that communication is afforded between first conduit 172 and the entrance port 174 to the filter. When the filter is being cleaned, the two-way valve 184 is set so that communication is afforded between the inlet opening 174 for the filter and the drain conduit 182 to permit the fluid to be carried through a suitable drain such as provided by the section 186 of a laundry sink 188 having a Y-shaped drain 190.

The other section 192, of the laundry tub 188 is used as a suds storage chamber with the suds saver conduit 194 leading thereto.

The suds saver conduit is connected to the second conduit 176 between the pump 162 and the outlet opening 178 of the filter. At the juncture of these two conduits 194 and 176 is a two-way valve 196. During filtering operation this two-way valve 196 is set so that fluid will flow from the filter 150 through the pump 162 and back into the tub 154. The valve is maintained in the same setting when the filter is self-cleaned by reverse flow. However, when the tub 154 is to be drained of sudsy water to be pumped to the suds saving section 192 of the laundry tub 188, the two-way valve 196 is set in the opposite position so that the pump will direct the fluid along the conduit 194 rather than up into the filter 150. The two-way valves 184 and 196, as well as the fresh water control valve 170, may be of the solenoid type and electrically operated or may be directly cam operated. In any event, the valves are preferably time controlled in the usual manner from a time control mechanism, such as the type having a cam shaft with a series of switch operating cams arranged therealong operated by a timer motor set and controlled by the dial 160.

In the preferred sequence of operation, the time control mechanism will cause the fresh water control valve 170 to admit wash water to the tub 154. The washing means within the tub will then be operated for the washing operation and the pump 162 will be operated to continuously circulate the wash water through the filter 150. The two-way valves 184 and 196 will, of course, be set to permit the water to circulate from the first conduit 172 through the filter 150 and the second conduit 176.

At the end of the washing operation, the pump 162 will be controlled to reverse its pumping direction and the position of the valve 196 will be changed so that the hot sudsy water will be pumped into the suds saver conduit 194 to be stored in the suds saver sink chamber 192.

When the tub is emptied of wash water, the fresh water control valve 170 will admit rinse water. The position of valve 196 will be changed and the pump 162 will be reversed to filter the rinse water. At the end of the rinsing operation, the position of valve 184 will be changed and the operational direction of pump 162 will be changed so as to pump the relatively clean rinse water through the

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second conduit 176, through the filter 150, and up through the drain conduit 182, thereby causing a reverse flow of fluid through the filter 150, cleaning the filter material therein.

Subsequent rinsing operations can be performed with the addition of further fresh water with operation of the valve 170, and this fresh rinse water will further clean the filter by being pumped therethrough in a reverse direction.

For subsequent washing operation, the position of two-way valve 196 will again be changed and the direction of operation of pump 162 will also be changed. The sudsy water will then be returned through the suds saver conduit 194 back to the tub for a succeeding washing operation. As soon as the washing operation begins, the position of valves 184 and 196 will be set so that the pump 162 will continuously circulate the wash water through the filter 150.

Thus, it will be seen that we have provided an improved filter for use with a washing machine and an improved fluid handling and control system for operation with the self-cleaning filter, which meets the objectives and advantages hereinbefore set forth. The system, as will be noted from the description above, is exceedingly simple and requires the provision of a single pump with a minimum number of valves and relatively few fluid conducting lines. Each of the fluid control elements serves multi purposes and the arrangement is well adapted to reliable and simple operation without adjustment, and is also inexpensive to manufacture and assemble.

The filter is extremely durable and capable of an operating life equal to that of the other elements of the machine. The filter may be located within the cabinet housing of the washer in an unused space and will not require attention, and yet will retain its efficient operation for succeeding cycles of operation inasmuch as it is thoroughly and completely cleaned with each cycle. This self-cleaning action not only improves the effectiveness of the washing operation, but enables the provision of a washing machine provided with a filter which is completely automatic in operation and requires no attention from the operator other than the setting of the starting controls.

We have, in the drawings and specification, presented a detailed disclosure of the preferred embodiments of our invention, but it is to be understood that we do not intend to limit the invention to the specific forms disclosed, but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by our invention.

We claim as our invention:

1. A self-cleaning washing fluid filter for use in a washing machine comprising a cylindrically shaped filter container having a filter chamber therein, a plurality of particles of filter material within the chamber having a smooth outer surface and being of non-symmetrical shape, a filter cap having a cylindrical outer surface and insertible into the base of the filter container, a second filter cap for the opposite end of the container and insertible into the end thereof, an annular retainer ring located within the cylindrical filter chamber and annularly surrounding said first filter cap, a second annular retainer ring located within the cylindrical filter chamber and annularly surrounding the second filter cap, said filter caps and retainer rings each defining an annular flow passageway therebetween of a width smaller than the size of the filter particles, an inlet conduit connected to the filter container and communicating with the filter chamber through the said annular passageway, and a discharge conduit connected to the filter container and communicating with the filter chamber through said annular outlet passageway, the flow of washing fluid normally passing through the filter from the inlet to the outlet conduit but reversible to dislodge the individual filter particles from their supported

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position on the first filter cap to carry filtered foreign materials out through the inlet opening.

2. A self-cleaning lint filter assembly for filtering lint and suspended foreign particles from fluid by directional flow of said fluid through said assembly and for automatically flushing accumulated lint and foreign particles from said assembly by reverse flow of said fluid through said assembly comprising, a housing defining a chamber and provided with a plurality of fluid ports accommodating bidirectional fluid flow through said chamber, retaining means extending axially inwardly into said chamber from opposite end walls of the housing and defining with the housing side walls annular constricted fluid flow passages, and a bed of filter pellets normally massed within a portion of said chamber upon one of said retaining means for filtering lint and foreign particles from said fluid during directional fluid flow through voids formed between said filter pellets, said filter pellets having smooth surfaces promoting ready separation from each other by hydraulic forces during reverse fluid flow through said chamber and said pellets being dispersible in response to said reverse flow to flush accumulated lint and foreign particles from said bed of filter pellets and said chamber during said reverse fluid flow.

3. A self-cleaning filter assembly as defined in claim 2 including conduits communicating with said ports and including therein two-way valve means for controlling the normal and reverse flow through said chamber.

4. A self-cleaning lint filter assembly as defined in claim 2 in which at least one of said ports is positioned

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tangentially to said chamber to promote a swirling action to fluid entering said chamber.

5. A self-cleaning lint filter assembly as defined in claim 2, wherein said retaining means comprises a cap member spaced axially inwardly from the opposite end walls of said housing to form an annular recess axially outwardly of said annular fluid flow passage, said flow ports communicating tangentially with said recess, thereby to circulate fluid into said annular recess and into said filter chamber with a swirling action.

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