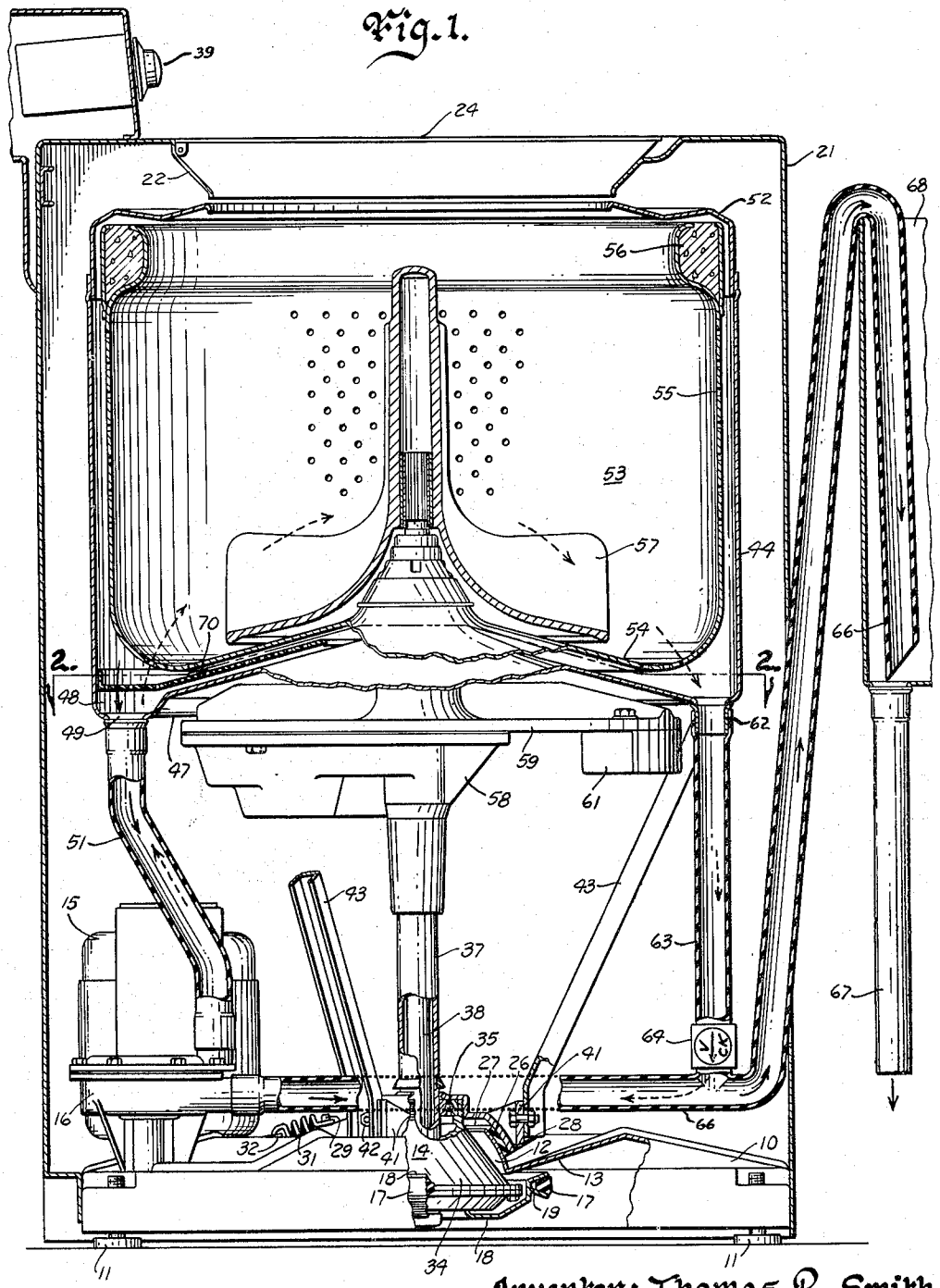
Nov. 29, 1960 T. R. SMITH 2,961,862

SELF CLEANING FILTER SYSTEM

Filed Jan. 3, 1957 2 Sheets-Sheet 1

Fig. 1.



Inventor: Thomas R. Smith

by James S. Wallace

Attorney

Nov. 29, 1960 T. R. SMITH 2,961,862

SELF CLEANING FILTER SYSTEM

Filed Jan. 3, 1957 2 Sheets-Sheet 2

Fig. 2.

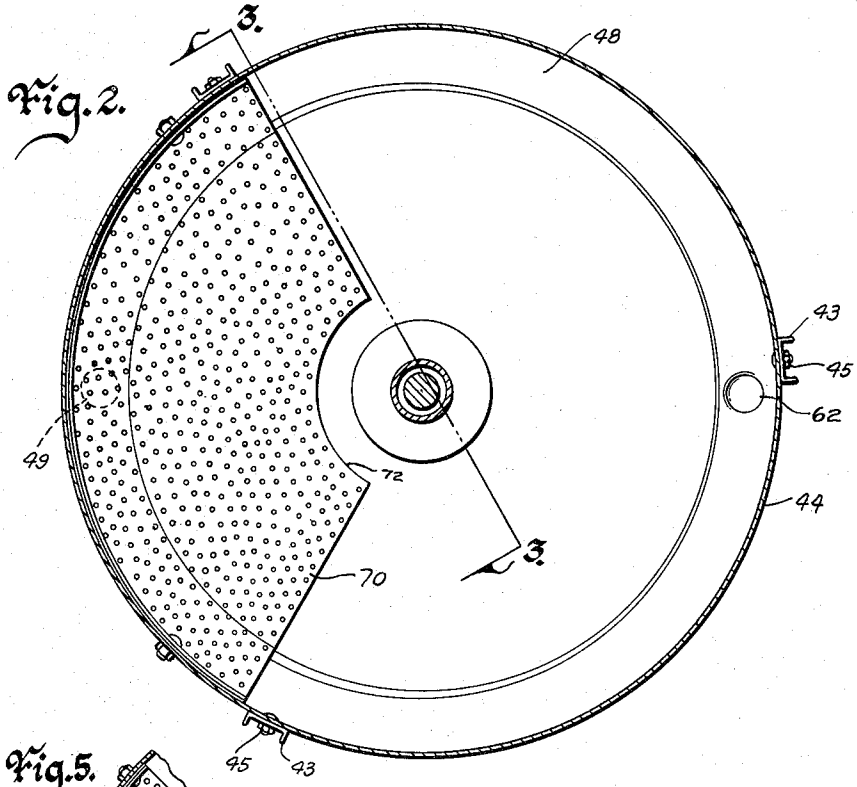


Fig. 5.

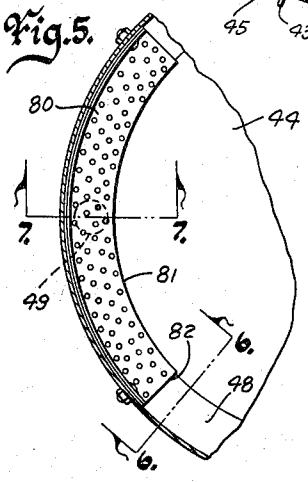


Fig. 3.

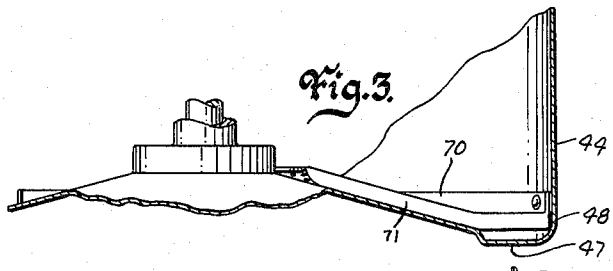


Fig. 8.

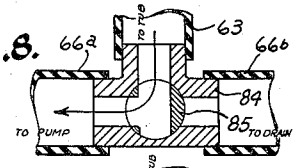


Fig. 4.

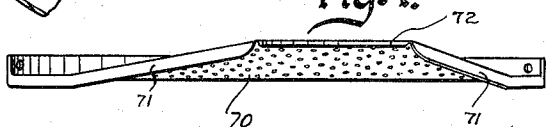


Fig. 6.

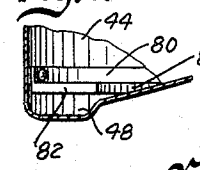


Fig. 7.

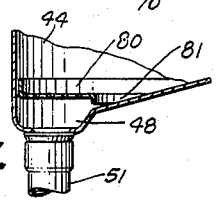
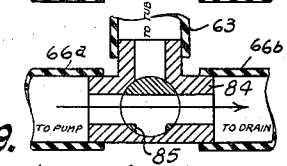


Fig. 9.



Inventor
Thomas R. Smith
by James L. Nettleton
Attorney

United States Patent Office 2,961,862 Patented Nov. 29, 1960

2,961,862

SELF CLEANING FILTER SYSTEM

Thomas R. Smith, Newton, Iowa, assignor to The Maytag Company, Newton, Iowa, a corporation of Delaware

Filed Jan. 3, 1957, Ser. No. 632,383

8 Claims. (Cl. 68—18)

This invention relates to a self-cleaning filter system for a washing machine capable of being automatically controlled throughout a sequential cycle of washing and fluid extraction operations.

It relates specifically to that type machine in which a pump controlling the removal of fluids from the washing machine pumps in one direction during the agitation operation and then reverses its direction of rotation to pump in the opposite direction during the centrifugal extraction or drain operation.

In the embodiments of my invention disclosed hereinafter the coordination of the reversal of this pump with the reversal of the drive mechanism controlling the washing and extraction operations is utilized to automatically control the fluid flow through a self-cleaning filter during these respective operations so that a filtering of the washing fluid takes place during the agitation of the clothes within the machine while the back flushing of the self-cleaning filter is automatically accomplished during the fluid extraction or drain operation.

Briefly, my invention incorporates an imperforate tub member capable of retaining fluids during the agitation period. A drain hose is attached to this tub and to a reversible fluid pump having its opposite side leading to an external drain. A filter is provided near the junction of the connection between this drain hose and the tub. A fluid circulation second hose provided with a check valve permitting fluid flow in a single direction only is then attached between another portion of the tub and this opposite side of the fluid pump leading to the external drain. By coordinating the operation of the pump with that of the drive mechanism controlling the machine, it is possible during the agitation period to circulate fluids from the tub down through the circulation hose and its check valve, through the pump and then up the drain hose and through the filter before the fluid is returned to the tub during the agitation of the clothes in this fluid.

When the tub is drained during the extraction period, the pump is reversed with a reversal of the drive mechanism controlling the machine allowing the fluid in the tube to be pumped from the tub through the filter in a reverse direction to back flush that filter as the fluid is pumped to the external drain.

In the accompanying drawings:

Figure 1 is a side elevation, partially broken away, showing a washing machine incorporating my invention;

Figure 2 is a sectional view taken on line 2—2 of Figure 1 showing the positioning of the self-cleaning filter at the lower portion of the outer tub;

Figure 3 is a fragmentary sectional view taken on line 3—3 of Figure 2;

Figure 4 is a perspective view of the self-cleaning filter shown in Figure 1;

Figure 5 is a fragmentary view similar to that of Figure 2 showing a second embodiment of my invention;

Figure 6 is a fragmentary sectional view taken on line 6—6 of Figure 5;

Figure 7 is a fragmentary sectional view taken on line 7—7 of Figure 5;

Figure 8 is a sectional view of a modified valve construction for my fluid circulation system; and,

Figure 9 is a view similar to Figure 8 showing a second position of the diverter valve shown in Figure 8.

In the accompanying drawings, there is shown a base frame 10 mounted on adjustable feet 11 and provided with a supporting dome 12 rising out of a centrally located depression 13 in base frame 10. Dome 12 serves as a mounting for a drive assembly 14 such as that disclosed in the John D. Goodlaxson application, Serial No. 505,231, filed May 2, 1955, and assigned to the same assignee as that of the instant application.

Base frame member 10 also supports the up-ended reversible motor 15 and the water pump 16 which, like a drive assembly 14, is driven by motor 15 through belt 17 on the under side of the base frame 10. Numeral 19 designates the groove of pulley 18 which serves as the input member for the drive assembly 14.

Cabinet 21, attached to and enclosing base frame 10 together with the drive and tub assemblies supported thereby, is provided at its upper end with a depending annular flange 22 defining an access opening into the washing machine apparatus which is normally covered by access door 24.

In Figure 1, it can be seen that dome 12 in base frame 10 is provided with friction pads 26 at its periphery adjacent the opening 27 formed by the uppermost portion of the truncated dome 12. An umbrella-like support member 28 rests on these friction pads 26 and is provided with three equally spaced ears 29 for three centering springs 31 which are fastened to brackets 32 on base frame 10. This arrangement centers support member 28 on dome 12 and restrains it from rotation relative to base frame 10.

Threaded into the umbrella support member 28 is a member 34 of substantially frusto-conical configuration which serves as a housing for drive assembly 14 of the previously identified Goodlaxson application, Serial No. 505,231. Housing member 34 cooperates with umbrella support member 28 by gripping the outer race of a thrust bearing 35 which is provided with a tapered inner race. Mating with and seated in this tapered inner race of bearing 35 is the spin tube or shaft 37 which journals a power shaft 38 also extending into the drive assembly 14. With this construction all weight placed on the spin tube 37, housing 34 and on umbrella member 28 may be used to an advantage to provide ample frictional forces between umbrella member 28 and the friction pads 26 for damping nutational movements of the shafts 37 and 38 relative to dome 12 while permitting rotational movement of spin tube 37 in thrust bearing 35.

While the details of the Goodlaxson assembly forming the basis of the previously identified application Serial No. 505,231 are not essential to the construction of the instant invention, its operation can be briefly explained for environmental purposes. Upon energization of motor 15 in a direction to rotate pulley 18 in a counterclockwise direction as viewed from the bottom of Figure 1, power shaft 38 is rotated in this same direction while spin shaft 37 is held against rotation by appropriate braking mechanism within housing 34. Upon reversal of motor 15, spin shaft 37 is released for rotation to allow shafts 37 and 38 to be spun in unison in a clockwise direction.

The direction of rotation of motor 15 is dependent upon the programmed sequence determined and controlled by the timer mechanism 39 through a control circuit the precise details of which form no part of this invention.

With the drive and support construction set forth above, it can be seen that the shafts 37 and 38 may be selectively

rotated as determined by the direction of rotation imparted to pulley 18 while permitting their nutation about a vertical axis at all times. In the washing machine illustrated in the accompanying drawings, shafts 37 and 38 nutate on a point determined by the intersection of the vertical axis of rotation with a horizontal plane bisecting groove 19 of pulley 18.

Now with reference to the tub assembly, it will be noted that umbrella support member 28 is provided with three recessed upstanding lugs 41 spaced equally from each other and alternately around member 28 with respect to the three ears 29. While not entirely obvious from Figure 1, it will be apparent from this description that there are three lugs 41 spaced 120° from each other, each of which is 60° removed from an adjacent ear 29.

Fastened within the recessed lugs 41 by connectors 42 are the three tub brace members 43 which are, in this embodiment, of channel-like cross section. Brace members 43 extend outwardly and upwardly from the umbrella support member 28 to join the nonrotatable imperforate outer tub 44 through tub connectors 45 to form an inverted tripod support for tub 44. The tub 44 is provided with a bottom wall 47 in which is formed a C-shaped gutter 48 having its lowest portion converging into the drain outlet 49 which in turn communicates with the water pump 16 through the flexible hose 51.

The nonrotatable outer tub 44 is provided with a removable crown 52 which permits removal of the rotatable inner clothes receptacle or basket 53 nested within tub 44. The clothes receptacle 53 has a perforate bottom wall 54 and a perforate cylindrical side wall 55 which carries a concrete inertia ring 56 at its uppermost end. A conventional oscillating type agitator 57 is mounted within the inner tub or basket 53 to provide the proper agitation of fabrics placed within the tub assembly thus formed.

In order to drive agitator 57 during the agitation period and rotate receptacle 53 during the fluid extraction cycle, the following connections to the drive assembly 14 are provided. Spin tube 37, extending into drive assembly 14, carries at its upper end the lowest gear case cover 58 which in turn is bolted to the upper gear case cover 59 carrying counterweight 61 which balances the conventional motion unit housed by covers 58 and 59 and driven by power shaft 38. While not shown in the accompanying figures in detail, upper gear case cover 59 extends upwardly through a fluid tight bearing formed in the tub bottom wall 47 and is rigidly attached to the basket bottom wall 54 by appropriate connections the detail of which is not necessary for the understanding of the instant invention.

From an inspection of the accompanying drawings it can be seen that tub 44 is connected to a second hose member 63. This hose 63 serves as a fluid circulation hose and is, in this modification, attached to the circulation outlet 62 provided in bottom wall 47 and located diametrically opposite drain outlet 49. Circulation hose 63 is provided with a check valve 64 which opens easily under fluid pressure from above to permit unidirectional fluid flow in a downward direction through hose 63 but which closes once pressure is applied from the lower side of that check valve.

Circulation hose 63 forms a T-connection with the drain hose 66 which is connected between pump 16 and an elevated drain 67 provided by an adjacent reservoir 68. While the reservoir 68 is desirable for suds saving purposes, it serves only as an elevated drain in this illustrative embodiment and would not be necessary if an additional valve were used in the drain hose 66 at a point beyond the T intersection formed with the circulation hose 63 in order to control the drainage of fluids from tub 44. In order to clarify the hose connection details for this illustrative machine, hose 66 has been shown as projecting through the front panel rather than through the back panel of the machine as is done in actual practice.

To filter fluids circulated through the illustrative machine, a self-cleaning filter plate 70 is provided in tub 44 near the junction of drain hose 51 with the tub bottom wall 47. Filter member 70 is rigidly attached to tub 44 in a spaced relationship to basket 53 and the tub bottom wall 47 in order to allow relative rotation to take place between basket 53 and tub 44. Filter 70, in the embodiment shown in Figures 1 to 4, is sector shaped and is provided with down-turned sides 71 and a slightly down-turned throat portion 72 to aid in the retention of lint and thread particles filtered from the fluids pumped through filter 70.

Filter 70, as shown in Figure 2, is perforate and is positioned above the drain outlet 49 to assure that all liquids passing through hose 51 will flow through or around filter 70. It is preferable in the construction of this filter arrangement that a portion of the fluid be bypassed around filter member 70 so that it will not be possible to prevent water from passing through hose 51 due to a clogged filter caused by improper loading or operation of this machine. In the embodiment of Figures 1 to 4, space is therefore provided between gutter 48 and down-turned edges 71 as well as between bottom wall 47 and the depending edge 72 to allow some fluid to bypass filter 70.

In operation during the agitation period, rotation of drive assembly pulley 18 by motor 15 in a counterclockwise direction as viewed from the bottom of Figure 1 causes spin shaft 37 to be braked by mechanism within assembly 14 while power shaft 38 causes agitator 57 to oscillate within tub 53 in a conventional manner to cleanse the clothes. During this agitation period, the rotation of pump 16 is such that it tends to pump fluid upwardly through drain hose 51 into tub 44 as the washing fluid passes downwardly through check valve 64 and fills the horizontal portion of drain hose 66 between pump 16 and check valve 64 in the direction of the dotted arrows of Figure 1. This fluid is pumped upwardly through drain hose 51 by pump 16 and passes through and around filter member 70 which filters from the washing fluid a portion of the lint, ravelings or thread particles separated from the clothing during the agitation process. The filtered water leaving filter 70 passes through and around basket 53 and mixes with the washing fluid within tub 44 before passing again into the circulation hose 63 to repeat its circulatory path through filter 70.

Upon reversal of motor 15 during the centrifugal extraction periods, the spin tube 37 is released from its braked position and is rotated in unison with shaft 38 by pulley 18 to rotate basket 53 and effect an extraction of fluids from the wet fabrics retained within that revoluble clothes receptacle. During this spin period, the rotation of pump 16 is also reversed with the result that water flow through that pump reverses causing fluids to be pumped from tub 44 through hoses 51 and 66 to drain 67 by way of reservoir 68 as shown by the solid arrows in those hoses in Figure 1.

In this drainage process washing fluids passing from tub 44 reverse their flow through filter 70 and flush that filter free of collected lint and thread particles placing it in a cleansed condition preparatory to the next agitation cycle. It will be noted that as the washing fluids pass from pump 16 and into drain hose 66 no fluid will be returned to tub 44 through circulation hose 63 by reason of that hose being closed by check valve 64.

By shaping the filter plate 70 in the manner shown in Figure 2, the fluid pumped from tub 44 during the centrifuging operation not only flushes that filter free of lint but also scours the bottom of the tub area free of accumulated sand and dirt deposits as described and claimed in my co-pending application, Serial No. 587,718, filed May 28, 1956, now Patent No. 2,900,812, of August 25, 1959, and assigned to the assignee of the instant invention.

Figures 5, 6 and 7 illustrate a second embodiment of my invention which differs from the first described embodiment primarily by the degree of its radial projection toward the center of tub **44**. Figure 5 shows the modified filter **80** as being fastened to tub **44** in a manner similar to the connection of filter **70** to that tub in Figure 2. Filter **80** extends across drain opening **49** and bridges the gutter **48** before terminating in a depending flange **81** which projects practically to tub bottom wall **47**. Filter **80** is also provided with end flanges **82** which approach bottom wall **47** but do not completely close gutter **48**. This provides a filter for fluid passing into tub through hose **51** without unduly impeding fluid flow from the tub during the drainage process. While the fluid patterns produced by fluid flow through filter **80** of this embodiment differ from those of filter **70** of the first embodiment, the basic function and operation of filtering particles of lint and thread particles from fluid circulated by pump **16** through the respective outlets **62** and **49** remains the same in both embodiments.

While both filters **70** and **80** have been shown to permit some fluid to bypass each of these filters, it is also within the spirit of this invention to filter all fluids passing through hose **51** either by placing a filter completely over drain outlet **49** or within the hose portions through which water is both circulated and back flushed by the drainage process.

In addition, while both illustrative embodiments of my invention have shown a stationary fluid pump capable of pumping in one direction during the agitation period and in an opposite direction during the centrifugal extraction period by controlling the direction of rotation of the main driving motor, it is also considered to be within the scope of this invention to use a unidirectional drive motor in conjunction with a pump capable of being shifted between two oppositely driven sheaves or belt surfaces to accomplish this same desired reversal of fluid flow during the agitation and drain periods.

It is also considered to be within the scope of this invention to utilize two oppositely driven pumps in conjunction with a diverter valve controlling fluid flow into these pumps to control reversal of fluid flow through the filter system in a similar manner.

Figures 8 and 9 illustrate a positive diverter valve assembly which may be substituted for the check valve construction shown in Figure 1. The diagrammatic Figures 8 and 9 show a valve body **84** as being inserted in between the two-piece hose having one portion leading to pump **16** and designated by reference character 66_a and a second portion leading to an external drain and designated by the reference character 66_b. Circulation hose **63** connects to valve body **84** in a T connection similar to its connection to hose **66** in Figure 1.

Mounted within valve body **84** and movable between the positions shown in Figures 8 and 9 is the valve element **85** which may be controlled by a crank-link-solenoid construction, etc. (not shown). With this actuator system valve element **85** may be moved into either of its positions whenever fluid flow through pump **16** is reversed.

For example, during the agitation period when fluid is flowing in the direction of the dotted arrows of Figure 1, valve element **85** will be positioned as shown in Figure 8 to provide that desired flow path. In that position communication is established between circulation hose **63** and hose portion 66_a while all fluid flow through hose portions 66_b is terminated.

During the centrifugal extraction period or drain operations when fluid flow follows the pattern of the solid arrows in Figure 1, valve element **85** is moved into the position shown in Figure 9 to prevent fluid flow into hose **63** while allowing hose portion 66_a to communicate directly with hose portion 66_b.

This modification, which may be duplicated by other diverter valve constructions, positively prevents air from

entering hose portion 66_a from hose portion 66_b during the agitation period while positively preventing fluid flow into hose **63** during the drain operations. In addition, this construction eliminates the necessity for the high drain through reservoir **68** as shown in Figure 1 since all fluid flow through hose portion 66_b is terminated during the agitation period with valve element positioned as shown in Figure 8.

This modification, like that of Figure 1, permits the filter for filtering lint and foreign particles from the washing fluid to be placed either in tub **44** as shown in Figure 1 or in either of hoses **51** or 66_a which provide the two-way flow necessary for back flushing the filter.

I claim:

1. A self-cleaning filtering system for a washing machine operable through an agitation period and a drain period for cleansing fabrics comprising, a tub adapted to contain fluid during said agitation period, a fluid conduit connected to and communicating with said tub, a reversible fluid pump having one side connected to and communicating with said fluid conduit, a drain hose, said pump having an opposite side connected to said drain hose, a circulation conduit connected to and communicating with said tub at a point diametrically opposite the point of connection between said tub and said fluid conduit, said circulation conduit being further connected to and communicating with said drain hose, a check valve in said circulation conduit providing unidirectional fluid flow therethrough, a filter located within said tub and positioned over the point of connection between said fluid conduit and said tub to filter fluid passing through said fluid conduit, means for rotating said pump in a first direction during said agitation period to circulate fluid through said circulation conduit and said check valve and said filter to filter said fluid of lint and thread particles separated from said fabrics during said agitation period, said means reversing the direction of rotation of said pump during drain period to discharge fluid from said tub through said filter in a reverse direction to back flush said filter.

2. A self-cleaning filtering system for a washing machine operable through an agitation period and a centrifugal extraction period for cleansing fabrics comprising, a tub adapted to contain fluid during said agitation period, a revoluble clothes basket within said tub, a fluid conduit connected to and communicating with said tub, a reversible fluid pump having one side connected to and communicating with said fluid conduit, a drain conduit, said fluid pump having an opposite side connected to and communicating with said drain conduit, a circulation conduit connected to and communicating with both said tub and said opposite side of said pump, a filter located within said tub and positioned between said tub and said basket over the point of connection between said fluid conduit and said tub to filter fluid passing through said fluid conduit, means for rotating said pump in a first direction during said agitation period to circulate the fluid from said tub through said circulation conduit and said fluid conduit and back into said tub through said filter to filter said fluid of lint and thread particles separated from said fabrics during said agitation period, said means reversing the direction of rotation of said pump during said centrifugal extraction period to discharge fluid from said tub through said filter in a reverse direction to back flush said filter.

3. A self-cleaning filtering system for a washing machine operable through an agitation period and a centrifugal extraction period for cleansing fabrics comprising, a tub adapted to contain fluid during said agitation period a revoluble clothes basket nested within said tub and having a bottom wall spaced from said tub, a fluid conduit connected to and communicating with said tub, a reversible fluid pump having one side connected to and communicating with said fluid conduit, means defining an elevated drain elevated above said fluid, a

drain hose communicating with said elevated drain, said fluid pump having an opposite side connected to and communicating with said drain hose, a circulation conduit connected to and communicating with both said tub and said drain hose, a valve within said circulation conduit controlling fluid flow therethrough, a filter mounted within said tub over the point of connection between said fluid conduit and said tub and projecting from the periphery of said tub into the space between said tub and said basket bottom wall to filter fluid passing through said fluid conduit, means for rotating said pump in a first direction during said agitation period to circulate fluid through said circulation conduit and said fluid conduit to filter said fluid of lint and thread particles separated from said fabrics during said agitation period, said means reversing the direction of rotation of said pump during said centrifugal extraction period to discharge fluid from said tub through said filter in a reverse direction to back flush said filter during said centrifugal extraction period.

4. A self-cleaning filtering system for a washing machine for receiving fabrics to be washed and operable through an agitation period and a drain period comprising, a tub adapted to contain fluid during said agitation period, a clothes basket within said tub, first and second fluid outlets in said tub, conduit means interconnecting said outlets, a valve in said conduit means, a drain hose communicating with said conduit means, a fluid filter positioned within said tub between said tub and said basket to filter fluid passing from said conduit means into said tub through said first outlet, pump means in said conduit means for pumping fluid from said tub through said second outlet and into said tub through said first outlet and said filter during said agitation period to filter from said fluid those lint and thread particles separated from said fabrics and suspended in said fluid, and control means controlling said pump means for reversing fluid flow through said filter and said first outlet to back flush said filter through said drain hose during said drain period.

5. A self-cleaning filter system for a washing machine for receiving fabrics to be washed and operable through an agitation period and a centrifugal extraction period comprising, a tub adapted to contain fluid during said agitation period, a clothes basket revolubly mounted within said tub, first and second fluid outlets in said tub, conduit means interconnecting said outlets, a valve in said conduit means, a drain hose communicating with said conduit means, a fluid filter covering said first outlet and positioned within said tub in spaced relationship to said tub and to said basket to filter fluid passing into said tub through said first outlet, pump means in said conduit means for pumping fluid from said tub through said second outlet and into said tub through said first outlet and said filter during said agitation period to filter from said fluid those lint and thread particles separated from said fabrics and suspended in said fluid, and control means controlling the rotation of said basket and operation of said pump means for rotating said basket and reversing fluid flow through said filter and said first outlet to back flush said filter through said drain hose during said centrifugal extraction period.

6. A self-cleaning filter system for a washing machine for receiving fabrics to be washed and operable through an agitation period and a centrifugal extraction period comprising a tub adapted to contain fluid during said agitation period, a clothes basket revolubly mounted within said tub, first and second fluid outlets in said tub, conduit means interconnecting said outlets, a valve in said conduit means, a drain hose communicating with said conduit means, a fluid filter covering said first outlet and positioned within said tub between said tub and said basket to filter fluid passing into said tub through said first outlet, said filter having at least a portion of its periphery flanged toward said tub to retain lint and thread particles within said filter, pump means in said conduit means for pumping fluid from said tub through said second outlet and into said tub through said first outlet and said filter during said agitation period to filter from said fluid those lint and thread particles separated from said fabrics and suspended in said fluid, and control means controlling the rotation of said basket and the operation of said pump means for rotating said basket and reversing the fluid flow through said filter and said first outlet to back flush said filter through said drain hose during said centrifugal extraction period.

7. A self-cleaning filter system for a washing machine for receiving fabrics to be washed and operable through an agitation period and a centrifugal extraction period comprising, a tub adapted to contain fluid during said agitation period, a clothes basket revolubly mounted within said tub, first and second fluid outlets in said tub, conduit means interconnecting said outlets, a diverter valve in said conduit means having a drain port therein and regulating communication between said first and second outlets and between said first outlet and said drain port, filter means positioned adjacent said first outlet and between said tub and said basket for filtering foreign particles from fluid passing through said conduit means, pump means in said conduit means for pumping fluid from said second outlet through said first outlet and said filter means during said agitation period to filter foreign particles from said fluid, and control means controlling the rotation of said basket and operation of said pump means for rotating said basket and reversing fluid flow through said filter means and said first outlet to back flush said filter means through said drain port during said centrifugal extraction period.

8. A washing machine operable through an agitation period and a centrifugal extraction and drain period for cleansing fabrics comprising, a tub adapted to contain fluid during said agitation period, a revoluble clothes basket within said tub, an agitation member within said basket, first and second fluid outlets in said tub, conduit means interconnecting said first and second outlets, a drain conduit connected to said conduit means, filter means for filtering said fluid passing through said conduit means, pump means in said conduit means for circulating said fluid from said second outlet through said filter means and to said tub during said agitation period to filter from said fluid the lint and thread particles separated from said fabrics and suspended in said fluid, drive means to drive said agitation member during said agitation period and said revoluble clothes basket in said centrifugal extraction period, and control means for reversing fluid flow through said filter means and said first outlet to back flush said filter means during said drain period.

References Cited in the file of this patent

UNITED STATES PATENTS

796,383	Willard	Aug. 1, 1905
1,382,992	Lombard	June 28, 1921
1,799,421	Hornbuckle	Apr. 7, 1931
1,969,176	Kirby	Aug. 7, 1934
2,287,628	McMahan	June 23, 1942
2,482,319	Casse	Sept. 20, 1949
2,761,303	Shelton	Sept. 4, 1956
2,823,534	Loehle	Feb. 18, 1958